ICU

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How to improve Patient safety in the OR anaesthesia work area?

Symposium on Monday, June 3rd 2019

12:15 – 13:45 in Strauss 1 Room

Chairman: **Prof. Xavier CAPDEVILA** *(Montpellier, France)*

Medication errors in the OR: causes and epidemiology
Dr. Sven STAENDER
(Männedorf, Switzerland)

Medication safety: insights from an expert pharmacist
Dr. Edith DUFAY
(Lunéville, France)

Medication errors: how to prevent?
Prof. Joyce WAHR
(Minneapolis, USA)

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PAEDIATRICS

It is never easy when children are in the hospital. And it is even more stressful when they're in the Paediatric Intensive Care Unit (PICU). When a child is admitted to the PICU, it means that they require the highest level of medical care. Children in the PICU present with different symptoms and conditions - from serious infections to heart conditions; from asthma to diabetes; from a traumatic injury to a drowning accident. In other words, children in the PICU are acutely ill and require highly-skilled, minute-to-minute care, and attention.

Our cover story Paediatrics discusses the treatment and management of the critically ill child. Managing a child in the PICU requires specific and consistent care and continuous monitoring. Many times, there is a need to use treatment modalities that are not available in other parts of the hospital. And these modalities often involve the use of ventilators and certain medicines (sedatives and opioids) that can only be given while keeping the child under close supervision.

Our contributors talk about these challenges and discuss clinical practices that can improve care. Nilesh Mehta talks about quality improvement tools that can help transform the paediatric intensive care unit into a highly reliable and safe environment that nurtures continuous learning and delivery of high-quality care.

Sapna Kudchadkar presents an overview of the 'PICU Up!' mobility programme at Johns Hopkins University School of Medicine, which integrates sleep promotion, delirium prevention, and sedation optimisation to increase mobilisation in critically ill children.

Karen Choong discusses PICU-acquired complications and the fact that they continue to be under-recognised amongst PICU clinicians. She highlights the importance of early recognition and the introduction of ICU based rehabilitation strategies to improve patient outcomes.

Elisabeth Esteban, Iolnda Jordan, and Francisco José Cambra discuss the challenges and opportunities to improve care and practice in the PICU and talk about the family-centred model and how it is essential to provide the best care for children.

Marcelo Malakooti talks about the use of virtual reality and how critically ill children at all developmental levels can benefit from interactive experiences that provide positive stimulation that otherwise are absent from the ICU environment.

In our Informatics and Technology section, Dr. Theodorus Kyprianou outlines seven steps to design, procure, implement and maintain a Clinical Information System for the intensive care unit and how such a system needs to be adapted and customised to fit local healthcare professionals' and patients' needs.

In our Matrix section, Vittoria Comellini, Stefano Nava, and Antonio Artigas talk about respiratory physiotherapy in critically ill patients and how it represents a fundamental part of the standard practice in ICU. They provide an overview of the physiotherapeutic tools and strategies that can be applied to critically ill patients. Tim Frenzel, Lisanne Roesthuis and Johannes G van der Hoeven talk about a structural approach for diagnosing weaning failure and highlight the importance of prescribing an individualised treatment plan. Gennaro Martucci, Karin Amrein, and Julia Ney provide a review on the role of vitamin D in critically ill patients and the potential benefit of vitamin D supplementation.

In our Management section, Julie Darbyshire presents practical measures and interventions to reduce noise levels in the ICU and to improve the patient experience. She highlights the importance of a wider understanding of the types of noise that can be most disturbing and the consequences of constant disturbance on patients. Mark P. Abrams highlights the importance of Person in Personalised Medicine and why it is crucial to maintain a focus on the patient-doctor relationship in order to more fully optimise patient care.

Our interview section features Rolf Rossaint, Professor of Anaesthesiology, RWTH University Aachen, Germany. Prof. Rossaint has published several high-quality studies dealing with the treatment of severe acute respiratory distress syndrome (ARDS) and has also been actively involved in research on the pathophysiology of trauma associated coagulopathy and possible treatments. He discusses these new guidelines with ICU Management & Practice.

Managing the critically ill child is no small feat, especially when we are in the midst of a paradigm shift from a culture of sedation and immobility to a culture of mobilisation and early recovery. PICU teams need to work together to implement this change and to provide high-quality care using advanced treatment strategies that are safe and effective for children. ■

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Use of sedation and controlled paralysis in ICU patients with ARDS

According to a National Institutes of Health sponsored clinical trial that was conducted at several North American hospitals and was led by clinician-scientists at the University of Pittsburgh and University of Colorado schools of medicine, reversibly paralysing and sedating hospitalised patients with severe breathing problems does not prove improve patient outcomes in a large majority of cases. Findings were presented at the American Thoracic Society's Annual Meeting and are published in the New England Journal of Medicine.

This trial was conducted to settle an ongoing debate within the critical care medicine community as to whether it is better to paralyse and sedate patients in acute respiratory distress or to avoid heavy sedation to improve the patient's recovery. According to senior author Derek Angus, Chair of PITT's Department of Critical Care Medicine, this issue has always been a dilemma for clinicians since many well-done clinical studies show that temporarily paralysing patients to improve mechanical breathing could save lives. But it is not possible to paralyse a patient without heavy sedation. As per the findings of the trial, sedation results in worse recovery, hence providing the answer to this long-standing debate that sedation with intermittent short-term paralysis is as good as deep sedation with continuous paralysis.

The trial - Re-evaluation Of Systemic Early neuromuscular blockade (ROSE) is the first of the National Heart, Lung, and Blood Institute's (NHLBI) Prevention & Early Treatment of Acute Lung Injury (PETAL) Network. The network conducts clinical trials designed to prevent diseases or treat patients who are at risk for acute lung injury or acute respiratory distress syndrome (ARDS). One of the key areas of emphasis for the PETAL Network is early detection, and that is why every member institute of this network is required to include critical care, emergency medicine, acute care or trauma principal investigators. This is to ensure that critical issues are recognised and triaged, and the odds of patient recovery are improved before they even get to the intensive care unit.

> **"sedation with intermittent short-term paralysis is as good as deep sedation with continuous paralysis"**

The ROSE trial has already enrolled 1006 patients in 48 US and Canadian hospitals. The patients were enrolled within hours after the onset of moderate to severe ARDS. Half of the patient population was given a 48-hour continuous neuromuscular blockade and heavy sedation while the other half was given light sedation. Study clinicians had the option of giving a small dose of neuromuscular blockade that would wear off within an hour to ease respiratory intubation.

James Kiley, Director of the Division of Lung Diseases at the NHLBI, explains that the PETAL network wants to conduct trials that would help answer these important questions. The results of these trials can help clinicians make decisions early on so that they can provide better care for patients with ARDS.

The idea for the ROSE trial originated because of findings from another trial in 2010 that reported reduced mortality with neuromuscular blockade. All participants in that French trial were heavy sedated, whether they received the neuromuscular blockade or not. But in North America, clinicians have been trying to stay away from heavy sedation as it is associated with cardiovascular complications, delirium, and increased difficulty weaning patients from mechanical ventilation.

Findings from the ROSE trial show that patients who received the neuromuscular blockade and were highly sedated developed more cardiovascular issues while in the hospital. However, no significant difference was found in mortality between the two groups at three months, six months, or 12 months follow-up.

The study has completed enrolment ahead of schedule, and it is believed that findings will soon be available for healthcare providers, which could result in rapid implementation of enhanced care for ARDS patients. Derek Angus has said that so far, the results suggest that avoiding paralysis and deep sedation is the best practice for most patients who are hospitalised for breathing problems. But future trials will have to test whether there is a subpopulation of patients with ARDS who could still benefit from neuromuscular blockade. ■

Reference

Early Neuromuscular Blockade in the Acute Respiratory Distress Syndrome. The National Heart, Lung, and Blood Institute PETAL Clinical Trials Network. New England Journal of Medicine.

New recommendations for stroke systems of care - American Stroke Association policy statement

Approximately 7.2 million Americans 20 years or older have had a stroke. Nearly 800,000 people in the U.S. have a new or recurrent stroke each year. A stroke occurs every 40 seconds in the U.S., and someone dies of a stroke every four minutes.

According to a policy statement published by the American Stroke Association, and published in the journal Stroke, improvements in stroke systems of care are imperative to ensure advancement in the treatment and care of stroke patients and to improve patient outcomes. The statement was released during the National Emergency Medical Services (EMS) Week. Over the last decade, stroke systems have seen vast improvements in the availability of endovascular therapy, neurocritical care, and stroke centre certification. The use of telestroke and mobile stroke units have further improved access for stroke patients to alteplase, a lifesaving, clot-busting drug.

As Opeolu Adeoye, the chair of the writing group for the statement and associate professor of emergency medicine and neurosurgery at the University of Cincinnati points out, there have been monumental advancements in acute stroke care over the last 14 years. The concept of a comprehensive stroke system of care has evolved. This new policy statement reflects the progress that has been made so far and highlights what still needs to be done to maximise patient outcomes.

As per the statement, if more than one intravenous alteplase-capable hospital is within reach, EMS should consider additional travel time of up to 15 minutes to reach a hospital that is capable of performing endovascular thrombectomy for patients who have had a severe stroke. Both these treatments, intravenous alteplase, and endovascular thrombectomy, should be administered as soon as possible to be effective. However, not every hospital can deliver these services. As Adeoye points out, getting to the hospital quickly is important for patients with a large vessel blockade, but so is getting to the right hospital.

The new policy statement from the American Stroke Association also addresses disparities in care among racial and ethnical minorities, who are less likely to use EMS and who also have the lowest awareness of the causes and symptoms of stroke.

> "getting to the hospital quickly is important for patients, but so is getting to the right hospital"

This lack of knowledge, especially among the Hispanic and black population, can hamper timely stroke care. That is why the American Stroke Association has emphasised on the importance of implementing public education programmes that focus on stroke systems and highlights the importance of seeking emergency care by calling 9-1-1 if stroke symptoms are observed.

Other recommendations include:

- Implementation of local and regional public education initiatives to increase awareness of symptoms with an emphasis on high-risk populations.
- The need for EMS leaders, governmental agencies, medical authorities, and local experts to work together and to adopt consistent and standardised triage protocols to rapidly identify patients with a known or suspected stroke.
- For certified stroke centres to provide help to stroke survivors to reduce the risk of subsequent strokes, as per the guidelines for secondary prevention.
- To design a stroke system that provides comprehensive post-stroke care, including primary care and specialised stroke services including physical, occupational, speech, and/or other therapies needed at time of discharge.
- To enact policies to standardise the organisation of stroke care, to lower barriers to seeking emergency care for stroke, to ensure that stroke patients receive care at the right hospital at the right time, and to facilitate access to secondary prevention of rehabilitation and recovery resources after stroke.

Overall, the goal of these recommendations is to create optimised stroke systems of care. The American Heart Association's Get With The Guidelines - Stroke at U.S. Hospitals have been associated with an 8% reduction in mortality at one year and improved functional outcome at the time of discharge.

Reference

Adeoye, O et al. (2019) Recommendations for the establishment of stroke systems of care: a 2019 update: a policy statement from the American Stroke Association. Stroke.

Cocoon bed aims to lower ICU delirium

The intensive care unit environment can be extremely stressful, even if they provide some of the best care in the world. It is believed that a patient in the ICU has their sleep interrupted approximately every three minutes either through noise, lights, or medical intervention. Up to 80% of patients in the ICU suffer from some form of delirium, and nearly 30% develop post-traumatic stress disorder.

In order to improve the treatment of patients in the ICU and to lower the rates of delirium, Brisbane's Prince Charles Hospital Foundation has designed the world's first hospital bed that is being called the "Intensive Care Cocoon." The cocoon features noise-cancelling technology that removes the incessant beeping of monitoring equipment from the patient's head. It also stimulates day and night, and allows patients to view a live video of their home so that they can talk to their family members and their pets.

As Prof. John Fraser, the director of the Critical Care Research Group at Prince Charles Hospital in Brisbane points out, a stay in the ICU can seem like the worst jet-lag ever, and while patients with critical conditions are treated in the ICU, there are environmental factors that often worsen mortality, increase time in hospital and overall frighten people. He highlights the fact that the risk of mortality at six months increases by 300% in patients with delirium.

Patients have been known to suffer from anxiety during their ICU stay and from PTSD after. For some, the ICU can be the scariest place they've ever seen. It is thus evident that there is a need to address this issue and to focus on improving the patient experience in the ICU.

The Prince Charles Hospital Foundation plans to build two prototypes of the beds if it is able to raise $1 million in donation. These beds might be expensive to build, but if rolled out across hospitals, it is believed that they can make intensive care cheaper in the long run and can reduce the length of time patients stay in the ICU.

Reference

The Common Good. People Powering Medical Discoveries. An initiative of the Prince Charles Hospital Foundation.

Big Data and subtypes of sepsis

Results of a study conducted by the University of Pittsburgh School of Medicine suggests that sepsis is not one condition, but many conditions that could benefit from different treatments. The findings are published in JAMA and were presented at the American Thoracic Society's Annual Meeting.

Sepsis is the number one killer of hospitalised patients and is a life-threatening condition that arises when the body's response to infection begins to injure its own tissues and organs. It has been over a decade, and no major breakthroughs have happened in the treatment of sepsis. The only improvement observed so far is the enforcement of the "one-size-fits-all" approach for prompt treatment, highlights Christopher Seymour, associate professor in Pitt's Department of Critical Care Medicine and member of Pitt's Clinical Research Investigation and Systems Modeling of Acute Illness Center. But as he explains, these protocols ignore the fact that all sepsis patients are not the same. It is a condition that kills nearly 6 million people annually, and using a one-size-fits-all approach is unacceptable for such a huge threat to patients.

By seeing sepsis as several different conditions, and with varying clinical characteristics, it may be possible to discover and test therapies that are tailored to treat the different subtypes of sepsis.

The "Sepsis ENdotyping in Emergency Care" (SENECA) project, funded by the National Institutes of Health (NIH), has used computer algorithms to analyse 29 clinical variables found in the electronic health records of more than 20,000 patients who had sepsis within six hours of hospital arrival. Patients were clustered into four distinct sepsis types, which include:

1. Alpha - found to be the most common (33%) and with the least organ dysfunction and lowest in-hospital death rate at 2%.
2. Beta - found in approximately 27% of patients; mostly elderly patients with the most chronic illness and kidney dysfunction.
3. Gamma - almost the same frequency as beta; but associated with greater inflammation and pulmonary dysfunction.
4. Delta - least common at around 13%; most deadly type, often associated with liver dysfunction and shock; showed highest in-hospital death rate at 32%.

After studying another 43,000 sepsis patients, the UPMC team confirmed these findings. These findings were then applied to recently completed international clinical trials that tested different therapies for sepsis. None of these trials had anything significant to report. However, results might have been different if the trial participants had been classified on the basis of these four subtypes. For example, early goal-directed therapy (EGDT) was not found to have any benefit following a five-year study, but when the UPMC team re-examined the results, they found that it could have benefitted the Alpha type of sepsis patients but would result in worse outcomes for the Delta subtype.

If you think about it logically, the theory of sepsis subtypes makes perfect sense. Just like all breast cancer patients do not receive the same treatment (as some breast cancers can be more invasive and require aggressive treatment), the same is true for sepsis. There is thus a need to find therapies that apply to specific types of sepsis and then design clinical trials to test those therapies.

Reference

Seymour CW et al. (2019) Derivation, Validation, and Potential Treatment Implications of Novel Clinical Phenotypes for Sepsis. JAMA.

Sedation with dexmedetomidine in critically ill patients

Dexmedetomidine is used to sedate patients while maintaining a certain degree of sustainability. The use of dexmedetomidine is known to reduce the duration of mechanical ventilation and delirium among patients in the intensive care unit (ICU). However, its use as the sole sedative agent in patients undergoing mechanical ventilation has not been studied extensively.

An open-label, randomised trial was conducted with 4000 critically ill adults who had been undergoing ventilation for less than 12 hours in the ICU. These patients were expected to receive ventilator support for longer than the next calendar day. Patients either received dexmedetomidine as the sole sedative or usual care with propofol, midazolam, or other sedatives. The primary outcome of the trial was the rate of death from any cause at 90 days and the target range of sedation-scores on the Richmond Agitation and Sedation Scale was -2 to +1 (lightly sedated to restless).

As per the results of the trial, the primary outcome event occurred in 566 of 1948 patients in the dexmedetomidine group, and in 569 of 1956 patients in the usual-care group. In order to achieve the required level of sedation, patients in the dexmedetomidine group received supplemental propofol, midazolam, or both during the first two days after randomisation, while the same drugs were administered as primary sedatives in the usual-care group. It was observed that the incidence of bradycardia and hypotension was more common in the dexmedetomidine group.

> **"patients undergoing mechanical ventilation in the ICU and who received dexmedetomidine for sedation had a similar rate of death at 90 days compared to the usual-care group"**

Findings from this trial suggest that patients undergoing mechanical ventilation in the ICU and who received dexmedetomidine for sedation had a similar rate of death at 90 days compared to the usual-care group. The dexmedetomidine group needed supplemental sedatives to achieve the required level of sedation. Overall, the dexmedetomidine group reported more adverse events compared to the usual-care group.

Reference

Shehabi Y et al. (2019) Early Sedation with Dexmedetomidine in Critically Ill Patients. New England Journal of Medicine.

Use of opioids in the ICU not linked to continued prescriptions

According to a new study, opioids prescribed in the intensive care unit (ICU) do not drive risks for continued use or prescriptions. The findings were presented at the American Thoracic Society (ATS) 2019 International Meeting in Dallas, TX.

Opiate abuse is a major healthcare issue. In the U.S., opioid-related deaths have increased more than three-fold from 2000 to 2016. The use of opioids in the ICU have to follow guidelines that are adjusted to a standard based on necessary opiate exposure only. This applies to parenteral opioids and oral opioids.

The study was conducted with 3102 opiate-naive patients admitted from 2016-2017. 45% of these patients received opioids in the ICU and were exposed according to their prescription. As a general profile, opioid-receiving patients were younger, with greater weight, height, APACHE scores, and greater lengths of stay in both the hospital and the ICU. The primary outcome of the study was opioid prescriptions within 1-year post-discharge.

Study investigators from the Cleveland Clinic and Duke University Medical Center shared the findings that patients who were prescribed opioids in the ICU did not report an increase in the risk of continued opioid prescription at 1 year after discharge. These findings thus support the guideline set by the Society of Critical Care Medicine regarding the management of pain, agitation, and delirium.

Healthcare providers should continue to address pain optimally and should manage patients in the ICU by using the comprehensive bundle to provide comfort as well as prevent delirium.

Reference

Chen A et al. (2019) Use of Opioids in the Medical Intensive Care Unit Is Not Associated with Outpatient Opiate Use. ATS International Conference. Available from abstractsonline.com/pp8/#!/5789/presentation/26085

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Quality improvement in the PICU – a primer for intensivists

Quality improvement provides tools that help the transformation of an intensive care unit into a highly reliable and safe environment, that nurtures continuous learning and delivery of high-quality care that improves patient experience and outcomes.

Despite advances in healthcare and dramatic improvements in survival across the spectrum of disease states, there exists a chasm between ideal care and actual healthcare delivery globally (NASEM 2018). In the U.S., consistent high-quality health care remains elusive in the increasingly complex and subspecialised healthcare system (IOM 2001). Quality improvement (QI) has emerged as a strategy to address the defects in the healthcare system, to achieve the best care that improves patient experience and outcomes. We will discuss some of the concepts of the QI process, with particular emphasis on the paediatric intensive care unit (PICU) environment.

Definition

High-quality care is consistent with evidence base and professional knowledge, and it is characterised by an increased likelihood of achieving desired outcomes (IOM 2001). The IOM report outlined six dimensions of quality in healthcare: i) safety (avoiding patient harm), ii) effectiveness (avoiding overuse and underuse), iii) patient-centredness (focused on patient needs), iv) timeliness (avoiding harmful delays), v) efficiency (avoiding waste, affordability to system), and vi) equity (IOM 2001; NASEM 2008). Avedis Donabedian described a model with three main areas for assessment of quality; structure, process, and outcome – the SPO framework – this model guides the practical application of QI concepts. The patient perspective is central to this framework, and QI efforts must be focused on the patient experience and outcomes during illness.

Challenges to quality improvement in the PICU

The PICU environment is characterised by complexity of care, therapeutic choices, time sensitivity for interventions, constantly changing workflow, competing priorities and a complicated interaction between the provider, patient and the healthcare environment (**Figure 1**). Large amounts of visual real-time data that need to be interpreted in the context of changing patient status and the interface with devices, create opportunities for unpredictable errors and harm. Healthcare-associated infections, medication errors, device-related safety issues, and failure to provide timely therapies are some of the events seen in this environment. Human behavioural factors, such as knowledge gap, fixation, alarm fatigue and failure to effectively communicate and collaborate are often deemed as causal factors for errors. In addition, lack of engagement from the frontline providers, disruption of autonomy and competing priorities in the unit result in a perception of QI efforts as a burden, time constraint and top-down mandates that are not deemed worthwhile. Lack of leadership buy-in can be a major factor in the failure to sustain QI efforts in the PICU. The PICU environment (structure, devices, workflow) and its interaction with providers is a critical factor in preventable harm, with faulty systems design often the root cause. A highly reliable ICU must incorporate a thoughtful and intelligent design and structure that facilitates the delivery of high-quality care.

> **PICU leaders must embrace a culture of safety, continuous improvement and ensure a safer environment for patients and providers**

High-reliability organisations/systems

In order to successfully mobilise change and ensure high-quality care delivery, the PICU must embrace the culture of high reliability (Hines AHRQ 2008). Highly reliable organisations (HRO) are characterised by extended periods without catastrophic accidents or serious failures, despite operating in a highly complex and hazardous domain. A highly reliable PICU nurtures a culture of continuous quality improvement, has strong, engaged and motivating leaders who cultivate resilience in the system by prioritising safety over other performance demands. The five characteristics of an HRO are: i) preoccupation with failure; ii) reluctance to simplify explanations for operations, successes, and failures; iii) sensitivity to operations (situational awareness); iv) deference to frontline expertise, and v) commitment to resilience.

Smart PICU design

Preferably conceived at its inception, a strategic PICU design creates an environment (workspace and workflow) that is suitable for

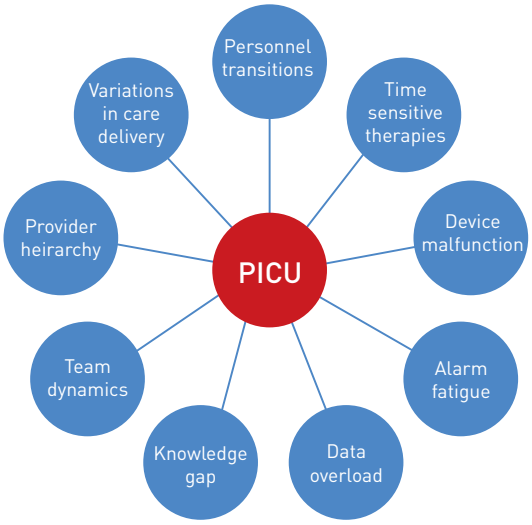

Figure 1. Challenges in the PICU environment that may impede its transformation into a high reliability system.

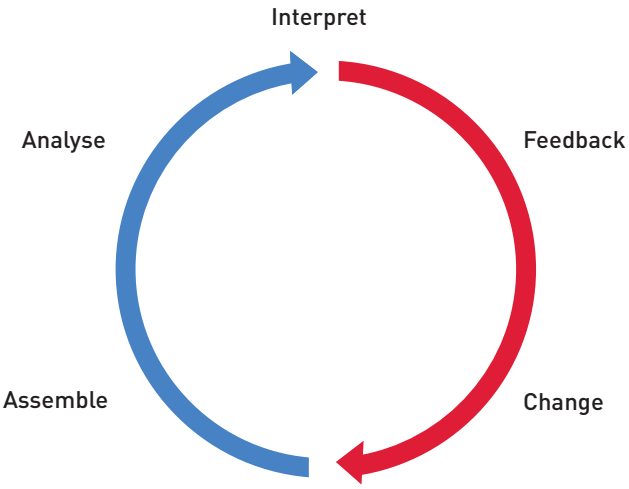

Figure 2. The Learning Healthcare System Cycle (Friedman 2014)

safe and effective care provision by committed providers, while also optimising patient and provider experiences. Patient rooms are designed to promote infection control procedures, early mobility, and patient comfort. A smart ICU room may also monitor and track changes in light, noise and other environmental hazards. Intelligent summarisation of data, smart alarm management, and patient privacy are other key aspects of the ICU design (Halpern 2014).

Optimising PICU workflow

Thoughtfully developed and standardised key processes such as patient rounds, handoffs during admission, transfers and discharges, medication reconciliation and safety huddles have become an integral part of daily workflow in the PICU. The use of a checklist or a more robust decision support tool that integrates patient data in real time facilitates some of these processes during rounds in many PICUs. Protected space for undisturbed performance of high-risk tasks, such as medication check, structured assessment tools for sedation and pain, tracking the evolution of illness severity using early warning scores are examples of nursing QI and safety processes aimed at improving patient safety in the PICU. In a highly reliable PICU, providers continue to explore the environment for potential disasters, are willing to speak up for safety, and strive for prevention or early detection and mitigation of harm.

Culture of continuous QI and Learning healthcare systems

A highly reliable PICU invests in data gathering. Patient level data are analysed in the context of existing knowledge base to develop best practices using the concepts of implementation science, an important tool that completes the cycle of a Learning healthcare system, depicted in **Figure 2**. The commitment to learn from every event or data stream is at the core of this cycle. The lessons learnt from this interpretation and past experience, are immediately made available for clinical decision support (Friedman 2014).

A just culture is critical to promoting a learning environment in which the providers report hazards, errors, and defects in care, without fear of blame or punishment. At our institution, providers are encouraged to check each other, be attentive to details and look for latent defects, speak up if concerned for safety, communicate clearly, escalate concerns along the chain of command if necessary, and maintain a questioning attitude. Such a culture breaks barriers such as hierarchy, interdisciplinary team dynamics, and fear of blame in the PICU. A just culture does not absolve individuals of any accountability but ensures that individuals are not blamed for systemic flaws that make it more likely for highly trained and dedicated providers to fail.

ICU informatics and quality improvement

Figure 3 illustrates a smart ICU model, where patient level data at the bedside are integrated and intelligently displayed, transforming them into actionable data for decision support. Modern informatics concepts must aim to utilise patient level data to ensure high quality care, continuous learning and quality improvement to impact patient outcomes. Such continuous bedside data allow learning from invaluable dynamic trends during illness course in the ICU, in context to therapies being applied. Automatic aggregation of data from a large number of patients, from multiple sites and via a variety of data sources has allowed the creation of large ICU databases such as the Multiparameter Intelligent Monitoring in Intensive Care II (MIMIC-II) research database (Saeed 2011). Examples of group learning using automatic or manually submitted data in small or large registries in the PICU population include the Virtual PICU systems (VPS), Pediatric Research Database (PRD Pivot) with rich de-identified data elements from the electronic health record, Pediatric Heart Network (PHN) collaborative learning model, Pediatric Cardiac Critical Care Consortium (PC4) clinical registry for infants and children in North American cardiac ICUs, Pediatric International Nutrition Study (PINS, I, II & III) database of nutritional intake and outcomes in mechanically ventilated

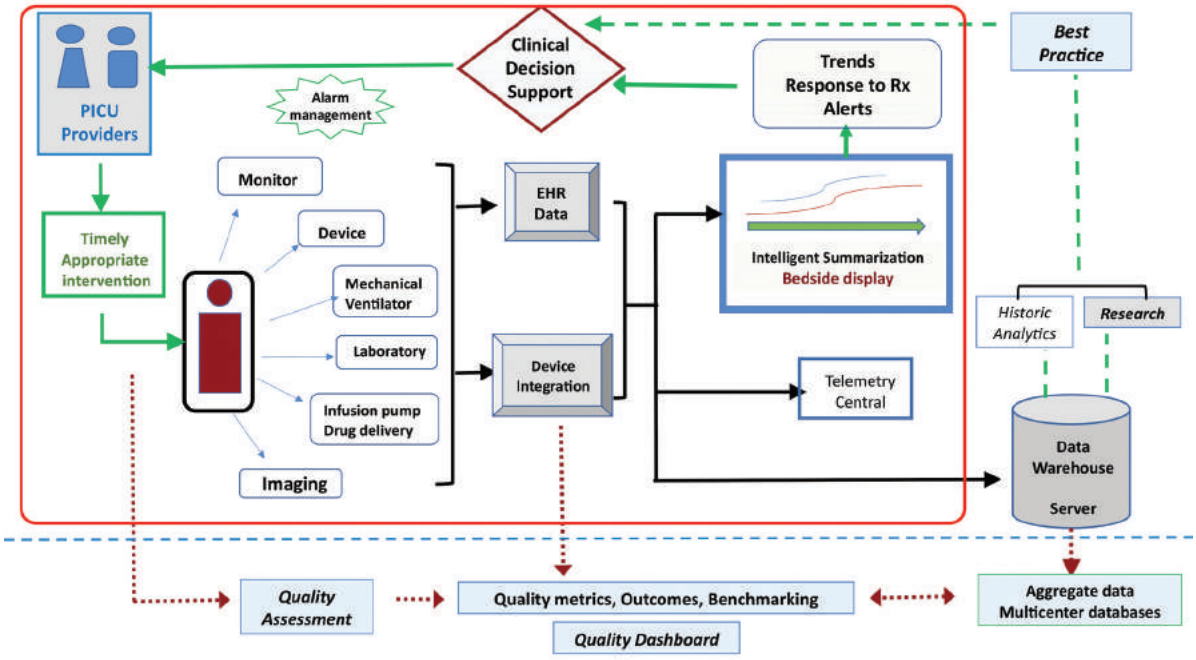

Figure 3. A Smart ICU model – leveraging patient-level and aggregate data for high quality care

children, Collaborative Pediatric Critical Care Research Network (CPCCRN) and Pediatric Emergency Care Applied Research Network (PECARN) databases, Society of Thoracic Surgeons Congenital Heart Surgery Database (STS-CHSD), Extracorporeal Life Support Organization (ELSO), Australia New Zealand Pediatric Intensive Care (ANZPIC) registry and the PICU International Collaborative Learning through Outcomes Data sharing (PICU-CLOUD) network.

Large patient-level datasets that can be leveraged for hypothesis generation, comparative effectiveness research, tracking, trending and benchmarking of ICU quality metrics, and a novel approach of collaborative learning. Attention to the accuracy, quality, and rigorous analyses of these data must be ensured, and data privacy, security, management, and governance are important considerations when sharing data across institutions on these digital platforms. Optimisation of electronic note writing, data input by nurses, alarm management to prevent fatigue, efficient storage, and analyses of data for research, intelligent data summarisation to provide decision support, are some of the benefits of healthcare IT advances. In order to benefit from these platforms, their development must take into account the unintended data overload, documentation burden, human behaviour expertise, and user interface in the PICU.

Collaborative learning

Best practices at the institutional level can be rapidly disseminated for wider adoption leading to improved patient outcomes. This concept is the central theme of collaborative learning, in which participating centres in a network share data and benchmark performances along key metrics. Potential target areas are explored for best practices using a collaborative multistep approach that involves site visits. Best practices are translated into clinical practice guidelines that are systematically applied across the network to examine their impact on clinical outcomes (Wolf 2016). The Pediatric Heart Network used a stepwise collaborative model that included data sharing, site visits to identify best practice, developing standards by consensus, and implementation of practice change across the network. They successfully decreased the time to extubation after paediatric cardiac surgery (Mahle 2016). Other examples of successful networks that leverage data for collaborative learning include the Children's Oncology Group, Cystic Fibrosis Foundation, and the Vermont-Oxford Collaborative.

QI Toolkit

A variety of tools have been developed to undertake systematic QI studies. Paediatric intensivists must become familiar with the methodologies and interpretation of the essential QI tools such as the i) Cause and effect (fishbone) diagram – to determine root causes of the event, ii) Failure Modes and Effects Analysis – to identify potential risks and their impact, iii) Flowcharts, Pareto charts, Run Charts and Control Charts – help visualisation of variation in performance over time, iv) Plan-Do-Study-Act rapid-cycle testing sheet to assess the impact of short iterative interventions. Details of these and other such tools are well described in the Institute for Healthcare Improvement (IHI) website (**ihi.org/resources/Pages/Tools/Quality-Improvement-Essentials-Toolkit.aspx**).

Quality metrics

Measurement is an important component of the healthcare transformation journey. Quality metrics are indicators that help measure PICU performance along agreed areas of importance to patient outcomes. These metrics allow serial examination of the unit performance over time, in the context of interventions, and are compared to internal goals or external (other PICU or group) benchmarks. QI metrics can

be process variables, outcome metrics or structural indicators. Characteristics of an ideal QI metric include a clear definition, measurable, show a degree of variability across sites such that good and poor performers can be differentiated, preferably an outcome measure or have a plausible link to the outcome of interest, not sensitive to severity of illness and reflect provider or unit performance. **Table 1** shows some examples of QI metrics in a PICU

Table 1. Examples of QI metrics in a PICU

Type	Metric
Outcome	Standardised Mortality Ratio (SMR) (Lower is better)
	MSICU Cardiac Arrest Rate (Lower is better)
	Survival to Hospital Discharge after Cardiac Arrest in the MSICU (Higher is better)
	Central Line-associated Bloodstream Infection (CLABSI) Rate (Lower is better)
	Catheter-associated Urinary Tract Infection (CA-UTI) Rate (Lower is better)
	Preventable Medication Error Rate (Lower is better)
Structure	Serious adverse event reporting system
	Vital equipment checks
	Nurse-patient ratio
	Infusion pumps – quality assessment and alarm management
Process	Hand Hygiene Compliance Rate (Higher is better)
	Medication Reconciliation Compliance (Higher is better)
	Daily rounding checklist compliance
	Extubation readiness testing
	Monitoring for delirium and sedation assessment
Patient/Family experience	Parent satisfaction around ICU cares
	Parent satisfaction around daily communication with providers

Safety culture in the ICU

The Michigan Keystone Project is a landmark effort that demonstrated the benefits of a collaborative QI approach to improve ICU outcomes. Over a 10-year period, sustained reductions in the rate of central line-associated bloodstream infections (CLABSI) were observed in over 100 ICUs across Michigan (Pronovost 2016). In addition to incorporating simplified best practices proven to reduce CLABSI, the investigators launched a systematic QI framework for preventing harm in the unit, embraced a strong safety culture, including checklists for safe central line insertion bundles, workflow re-design and empowering of providers to speak up for compliance to best practices. PICU leaders must encourage reporting of near misses and latent defect in the system without fear of reprisal. Near misses must be viewed as opportunities to learn about systems issues and potential improvements, rather than as evidence of safety. Vigilance for and anticipation of potential failures is a hallmark of a high reliability organisation.

Conclusions

Quality improvement in the ICU includes a spectrum of efforts aimed at improving individual patient experience and outcomes, leveraging smart technology and informatics to provide bedside decision support to deliver high-quality care, and the use of specialised tools to examine the impact of QI interventions on process and outcomes. PICU leaders must strive to transform their unit into a high reliability system by embracing a culture of safety, promoting continuous improvement, and investing in engineering a safer environemnt for patients and providers. A strategic quality management plan with broad stakeholder buy-in allows QI efforts in the PICU to be focused. Measurement, benchmarking and dissemination of performance metrics are essential to maintain provider engagement and sustain the improvements in processes and patient outcomes. ■

Conflicts of interest

None

Key points

- Paediatric intensive care unit is a highly complex environment with likelihood of for unintended patient harm.
- Quality improvement strategies aimed at improving patient outcomes must be firmly embedded in the PICU culture.
- PICU leaders must embrace the culture of high reliability and continuous quality improvement where every event or data point is considered an opportunity for learning. Providers in such units are preoccupied with failure, looking for defects in the system to prevent or mitigate harm
- Smart PICU designs allow providers to work in a safe and efficient environment, minimising harmful events and optimising patient comfort and experience
- Data management and intelligent summarisation facilitate bedside decision support in such units.
- Quality improvement tools allow gathering and intepretation of data, highlight opportunities for improvement, and facilitate collaborative learning that promotes high quality and value care in the ICU.

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Can Goal-Directed Therapy solve the economic burden of postsurgical complications?

How effective are less invasive or even noninvasive methods?

The clinical and economic burden of postsurgical complications and the economic impact of Goal-Directed Fluid Therapy (GDFT) implementation.

Improving the quality of care by reducing post-surgical complications, decreasing mortality, and decreasing hospital length-of-stay for surgical patients while also reducing cost, is a widespread goal of health services and healthcare professionals all around the world.

In recent years, innovative concepts, approaches, and technologies have been evaluated and recommended by renowned International Societies to achieve this goal. Among these concepts are Goal Directed Fluid Therapy (GDFT) strategies, which are defined as "*targeted haemodynamic and fluid management therapies using parameters such as stroke volume, cardiac output and oxygen delivery in conjunction with standard vital signs in managing patients during and immediately after surgery.*"[1]

While there are still debates going on about the best use, many clinical studies confirm the positive effect of GDFT on patient outcome after major surgery. The reduction of the most common complications, such as wound infection, sepsis or pneumonia, have been reported to result in a decrease of morbidity and even mortality in high-risk and intermediate-risk surgeries.[1,2,3] Nevertheless, the implementation of this approach in the clinical routine very often fails due to the perceived high cost for initial equipment.[1,2]

> **"with cost savings up to 77% on disposables, the noninvasive CNAP® technology can even be used in intermediate and low-risk surgeries"**

To obtain objective data, Manecke et al. "*assessed the clinical and economic burden of postsurgical complications in the American University Health System Consortium (UHC) in order to predict the economic impact of GDFT implementation.*" By comparing patients with and without postsurgical complications, they showed that out of 75,140 patients 8,421 developed one or more post-surgical complications, resulting in a morbidity rate of 11.2%.[1] "*In 2011 the UHC spent a total of $252 M to treat postsurgical complications in the study population.*"[1]

Apart from showing the dramatic impact of postsurgical complications on cost, the authors also calculated the savings potential of GDFT: "*After implementation of GDFT, projected gross savings would be $569-$970 per patient and $43-73 M for the entire UHC study population.*"[1] This implies savings of up to 29%, which easily compensate for the initial costs of the required equipment assuming approximately $300/patient.[1]

Patient benefit can be further expanded by using less invasive tools, which allow for the use of GDFT in a much wider patient population, including intermediate risk surgeries.[3] Less invasive or even noninvasive solutions are not only associated with less risks, but also with fewer complications for the patient than invasive methods. "*All of these issues are highly relevant for potential economic decision making.*"[2]

Using the noninvasive CNAP® Monitor in intermediate risk patients undergoing hip or knee replacement, Benes et al. showed that Goal-Directed Therapy based

on pulse pressure variation reduced postoperative wound infection, which is the number one complication and essential cost driver in surgical patients[1], by 61%.[3]

"The CNAP® Monitor was found to be comparable to its invasively assessing counterparts. Given these positive factors, the CNAP® device is already widely and routinely used in many clinical institutions; therefore our study could serve as a proof of concept for this praxis."[3] With cost savings up to 77% on disposables, CNAP® is definitely a promising solution to meet the demand for improved healthcare quality at low cost. ■

Key points

- Goal-Directed Fluid Therapy (GDFT) is defined as "targeted haemodynamic and fluid management therapies using parameters such as stroke volume, cardiac output and oxygen delivery in conjunction with standard vital signs in managing patients during and immediately after surgery."
- Many clinical studies confirm the positive effect of GDFT on patient outcome after major surgery.
- The implementation of this approach in the clinical routine very often fails due to the perceived high cost for initial equipment
- After the implementation of GDFT, gross savings easily compensate for the initial costs of the required equipment.
- With cost savings up to 77% on disposables, CNAP® is definitely a promising solution to meet the demand for improved healthcare quality at low cost.

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PICU Up! A multicomponent early mobility intervention for critically ill children

An overview of the 'PICU Up!' mobility programme at Johns Hopkins Children's Center, which integrates sleep promotion, delirium prevention, and sedation optimisation to increase mobilisation in critically ill children.

What is the PICU Up! Programme?

Paediatric intensive units traditionally have had a culture where critically ill children are intubated and mechanically ventilated, immobilised, and highly sedated. This practice is primarily driven by a focus on safety and keeping children comfortable, along with the perception that bed rest provides greater haemodynamic stability. There is also the feeling that keeping children deeply sedated may ensure that the child does not remember their ICU stay, thus promoting the creation of a culture of immobility, which could have negative short and long-term implications for critically ill children.

The Paediatric Intensive Care Unit at Johns Hopkins is a 40-bed, tertiary care medical surgical unit that cares for children between the ages of 0 to 22 years. In 2011, our PICU team at Johns Hopkins began to think about how we were using the terms "sleep" and "sedation" interchangeably. For example, if a child already on an opioid and a benzodiazepine was agitated, we were giving them more medicine so that they would "sleep better." We know that sleep and sedation are very different states and can have an impact on the child's developing brain, but we weren't addressing the issue of restorative sleep in our patients whose brains are actively developing of children. A common misperception is that children in the PICU are older, but data from a recent multicentre study has demonstrated that more than half of our longer stay patients are under the age of two (park.web.jhu.edu). Therefore, we have an opportunity to positively impact neurocognitive development during a time that is most critical in a child's brain maturation.

When the PICU Up! Programme was being developed for Johns Hopkins, we decided to first address sleep as the "low-hanging fruit" because sleep is very disrupted for a number of reasons in the ICU, with modifiable risk factors. There is a great deal of discussion related to delirium in the adult literature, but we were only just starting to recognise it in paediatrics. Sleep disruption can be a risk factor for delirium.

> "mobilising children during the daytime and optimising their sleep at night was the best way to minimise exposure to opioids and sedative drugs and facilitate their functional recovery"

Over the years, the mortality rate in PICUs has declined quite significantly. The focus now has become not just survival, but survivorship. How does the child's stay in the PICU affect their life? For most children, their lives are very different when they go home then they were before they came to the PICU. They are weak, and their mobility is impaired. The quality of life they knew before PICU was different from the one after hospitalisation. PICU Up! was born out of all of those different issues.

When designing the core elements of PICU Up!, we had to create an overhaul in PICU culture. Our theory was that bed rest is bad and that mobilising children during the daytime and optimising their sleep at night was the best way to minimise exposure to opioids and sedative drugs and facilitate their functional recovery. These factors grounded the foundation of our PICU Up! programme strategy.

PICU Up! Champions

PICU Up was born out of engagement from a huge multidisciplinary group of champions from nursing, physical therapy (PT), occupational therapy (OT), respiratory therapy, child life specialists, nurse practitioners, and physicians. No additional staff was hired for this programme. We worked as a team to change our PICU culture to a culture of mobility instead of a culture of immobility. We outlined strategies to decrease sedation while keeping kids still safe and comfortable. And while we did this, we also addressed other issues that impact mobility, such as sleep hygiene and delirium. Together, we were able to create a structured programme to address each child's unique mobility needs, and championed setting a mobility goal for "Every kid, Every day." A major goal of our PICU Up! initiative was to get children and their families back into a routine as close to what they had at home.

PICU Up! Tiered System

PICU Up! is a three-level system - PICU up! Level 1, 2, and 3. There are objective clinical criteria for levelling the patients based on how sick they are, and where each level is connected with a set of interventions based on the needs of those children. The most criti-

Images provided by Johns Hopkins Children's Center.

cally ill patients would be considered Level 1, patients who are intubated with a high oxygen requirement, for example. As they start to get better or their clinical status improves, they move to Level 2. Level 2 generally includes patients who are on non-invasive mechanical ventilation or are intubated and getting close to extubation. Finally, Level 3 patients are on the launching pad for discharge to home or the inpatient floor, but still have critical care needs- these patients have the highest potential for mobilisation.

The purpose of creating the tiered system was to define the minimum requirements for children at each of those levels. We needed to make it clear to everyone that the goal was NOT to get every intubated kid up and out of bed and walking, but that there is an individualised spectrum of mobility for every child. We wanted every kid, every day to do the most that was possible, both safely and without overwhelming available resources. It was also important to change the way we thought about patients who were traditionally considered to be "too sick for therapy." Regardless of a child's severity of illness, almost always a therapy evaluation can offer something beneficial, even if those therapies don't start immediately. No patient is too sick for a physical or occupational therapy consultation, and our rehabilitation team appreciates being in the loop from the very beginning.

All patients at Johns Hopkins PICU get a PT or OT consult by day 3 of admission, and all of our patients have their sleep hygiene addressed and their routine set so that we're ideally not giving baths at 2am and not scheduling routine x-rays at 5 a.m. As patients progress, we start increasing their mobility, with an individualised mobility goal set for the day. The PICU Up! programme was implemented over a three-month period to demonstrate safety and feasibility. We collected a year of baseline pre-implementation data, implemented the programme over three months, and then looked at one year of post-implementation data. Our findings showed that the implementation of PICU Up! resulted in an increase in occupational therapy consultations and physical therapy consultations by day 3. The median number of mobilisations per patient by day 3 doubled, and more children were able to engage in mobilisation activities because of this intervention (Wieczorek et al. 2016). Twenty-seven percent of children ambulated by day 3, which was an increase of 15% pre-implementation. Among children 3 years or older, 20% ambulated prior to the implementation of the programme while 39% ambulated after implementation (Weiczorek et al. 2016).

Incorporating rehabilitation team consultation by day 3 made a huge difference, creating a culture where our nurses and our therapists were partnering together early in a child's course. The therapist isn't at the

Images provided by Johns Hopkins Children's Center.

bedside 24 hours a day, but the bedside nurse is. Therefore, it is really important for nurses to feel educated and empowered to facilitate mobility activities. Previous adult rehabilitation point-prevalence studies and emerging paediatric data are demonstrating just how crucial nursing engagement is for facilitating mobility.

It was also really important to involve family members in mobility because they obviously play a huge role in engaging their child. Since most of our patients are infants and toddlers, a major part of our mobility goals is to get children out of bed and to let them be held by their parents – I call it "therapeutic cuddles." That in itself is the daily mobility goal for many of our patients. PICU Up! has enabled us to completely change the culture of the unit to a unit of mobility and to ask questions that we've never thought to ask before. For example, there are infants in the PICU that have never been outside because they've lived in the hospital since they were born. We ask if a child can safely go outside with their parents and nurse. And if they can, our staff comes together to make it happen. Natural sunlight and outdoor time can also work wonders for older children and their families, not just physically but emotionally.

The new paradigm in our unit is to have patients who are minimally sedated and comfortable while avoiding continuous benzodiazepine infusions which have been shown to be an independent risk factor for delirium. Most of our patients receive a low dose of opioid to keep them comfortable with the noxious stimuli of the endotracheal tube, with a low-dose sedative as needed, usually dexmedetomidine. Some of our older patients do beautifully with patient-controlled analgesia, which gives them a feeling of control over their own pain management. Many of our patients participate in their care and communicate with their families and our staff, telling us what their needs are. Are there patients who still receive deep sedation? Yes- there will always be patients who must be deeply sedated to facilitate physiologic stability, but the major difference is that deep sedation is no longer the default.

Primary goals of PICU Up!

Ultimately, what we want to do is to use standardised, evidence-based interventions to increase each child's activity level in the PICU and to promote a culture of mobility. Our big picture goal is to normalise the child's routine as much as possible and optimise their functional outcome so they can go home to the best quality of life possible. Mobility, sleep hygiene, delirium prevention, and management, family engagement, and goal-directed sedation are all key components of PICU Up! and the Society of Critical Care Medicine's ICU Liberation 'ABCDEF' bundle. A recent multicenter study of 15,000 adults showed that ABCDEF bundle compliance was associated with a decrease in the duration of mechanical ventilation, mortality, and delirium (Pun et al. 2019). In the PICU, all five of these issues are intricately interrelated. If you're not sleeping at night, you're less likely to mobilise during the day. If you're not sleeping well, you're more likely to be delirious. If you're not mobilis-

ing, you're less likely to sleep well at night. If you're delirious and agitated, you're going to receive more sedation. If you're getting more sedation, you're more likely to be delirious. If your family is not engaged, you are less likely to mobilise. It's a vicious cycle, and all of these issues feed into each other. Therefore, the levels and the activities associated with each level incorporate all four of those things: sleep hygiene, delirium screening, early rehab, and goal-directed sedation. The multicomponent bundled intervention is bringing it all together so that people think of it as a PICU liberation approach as opposed to the sedation, delirium, and rehabilitation silos.

Types of activities for children in the PICU

Early mobilisation activities include in-bed activities such as passive range of motion, passive bed positioning, splinting, active range of motion, and active bed positioning. As patients progress, activities include motivating patients to sit on the edge of the bed, sit to stand, transfer, ambulate, and play (Wieczorek et al. 2016). Play is a key part of this programme. For babies, there's developmental play that is facilitated by our occupational therapists and child life specialists who bring in all sorts of unique items for the babies to play and engage with. The older children who can leave the unit can go to the rehab kitchen and bake cookies and brownies. They may not always be able to eat their baked goods, but they can always come back and distribute them to our staff! We also have riding and stationary bikes and portable treadmills for older children. Video games are an excellent way to facilitate dexterity for some of our older patients who aren't ready to get out of bed but can still use their hands.

Another key part of our rehabilitation initiative is our Augmented and Assistive Communication (AAC) programme. With more PICU patients awake and alert while intubated, we quickly realised we needed to give them more ways to communicate. Our child life specialists, occupational therapists, speech language pathologists, and nurses work together to identify a child's needs and create a communications plan with low-tech and high-tech devices. It may be as simple as a whiteboard or a board with pictures for them to point to; many of our older patients are writing, and can also use other devices like an iPad, and their families can also communicate with them. Several of our patients have texted with their friends, done homework to keep up at school, and use video chat to communicate with family when they are not at the bedside. Even for children who do not survive their PICU stay, facilitating communication can be priceless for patients and families at the end of life.

Mobility and the sedated child

For children who require deep sedation, we get our rehabilitation team to the bedside as soon as possible and make sure that we're doing as much as possible while they're sedated to prevent morbidity. For other patients, we optimise active engagement in mobility which has changed how much sedation they need. Increased activity during the day means less delirium and improved circadian rhythms. There's no question that the PICU Up! programme has helped decrease sedative and opioid use among PICU patients, and we are actively studying these outcomes.

Wider implementation of PICU Up!

We want to facilitate the implementation of multicomponent mobility programmes as widely as possible to decrease the need for PICUs to "reinvent the wheel." PICU Up! is already being implemented in several other PICUs in the United States including the Cincinnati Children's Hospital, Northwestern Lurie Children's Hospital, University of Virginia, Vidant Hospital in North Carolina and St. Jude Children's Hospital. Every year we host about 150 multidisciplinary team members who come to learn specifically about paediatric critical care rehabilitation implementation at the Annual Johns Hopkins Critical Care Rehabilitation Conference (bit.ly/icurehab). If a PICU wants to license our programme, we can make that happen. Or if they want to create and implement their own programme, we are here to help. The goal is to ensure that a culture of mobility is disseminated safely and effectively. We have six other ICUs that are set to implement the programme within the next year as part of a multicentre, randomised controlled trial (**clinicaltrials.gov/ct2/show/NCT03860168**).

Future Plans

First, we need to demonstrate that programmes like PICU Up! have an impact on both short and long-term patient outcomes. The natural next step is then to start to hone in more on the mechanisms by which our interventions are working and to determine the appropriate dose, frequency, and duration of rehabilitation for critically ill children. We also want to determine what activities are the most beneficial for which patients, and how often should we be doing them moving forward. It's important for children to be able to get back to the lives they had before their critical illness as quickly as possible. We need to ask if these children, once discharged from the PICU, are sleeping differently when they go home? Are we making a difference in their long-term sleep patterns and sleep trajectory? What are the underlying mechanisms by which all of these interventions are working so that we can continue to understand more on a patient-based level and can optimise outcomes for every child in the PICU? There is much work to do. ■

Key points

- The primary goals of the PICU Up! programme include increasing mobility, normalising the child's routine, optimising their functional outcome, optimising sleep hygiene, and decreasing exposure to sedative and interventions with medications.
- PICU Up! was made possible by engagement from a huge multidisciplinary group of champions.
- PICU Up! is a tiered system that uses objective clinical criteria for levelling patients based on their severity of illness.

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CARING FOR THE CRITICALLY ILL CHILD

PICUs – KEY FACTS

- Paediatric Intensive Care Units (PICUs) occupy a central position in the care of hospitalised children.
- Approximately 200 children per 100,000 require hospitalisation in PICUs because of serious illness.
- Nearly 90% of paediatric deaths occur in neonatal and paediatric intensive care units.
- Most deaths in the PICU are preceded by withdrawal of mechanical ventilation.

Sources: Kanwaljeet, A (2014) Front Pediatric 2:35.
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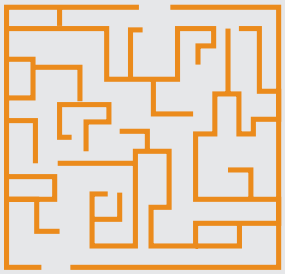
CHALLENGES FOR PICU PATIENTS AND SURVIVORS

- Reduced physical function
- Delayed recovery
- Cognitive decline
- Feeding disorders
- Functional impairments
- Psychological stress
- Reduced quality of life



Source: Walker and Kudchadkar (2018) Translational Pediatrics, 7(4): 308–313.

CRIPPLING EFFECTS IN PICU PATIENTS

- ICU-acquired weakness
- Delirium
- Pain
- Agitation

Source: Walker and Kudchadkar (2018) Translational Pediatrics, 7(4): 308–313.

ICU LIBERATION COLLABORATIVE

ICU liberation collaborative is a campaign designed to create lean, sustainable, and highly functioning ICU teams that work with patients and families to create a safe and comfortable patient environment by implementing the Pain, Agitation, and Delirium (PAD) guidelines utilising the ABCDEF bundle.

Source: Society of Critical Care Medicine (sccm.org/ICULiberation/About)

TOP REASONS FOR CONFLICTS IN PICU

60%	Conflicts between healthcare and family
48%	Poor communication
39%	Unavailability of a parent/guardian
39%	Disagreements over the child's care plan
21%	Coping problems
12%	Dysfunctional families
9%	Conflicts about decision making
6%	Young parents

Source: Doorenbos et al. (2012) J. Soc Work End Life Palliat Care, 8(4): 297–315.

COMPONENTS OF THE ABCDEF BUNDLE

A	Assess, Prevent and Manage Pain
B	Both Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT)
C	Choice of Analgesia and Sedation
D	Delirium: Assess, Prevent and Manage
E	Early Mobility and Exercise
F	Family Engagement and Empowerment

Source: Society of Critical Care Medicine (ccm.org/ICULiberation/ABCDEF-Bundles)