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Ten key recommendations to strengthen pediatric intensive care: a narrative review from Latin America

Diez recomendaciones clave para fortalecer los cuidados intensivos pediátricos: una revisión narrativa desde América Latina

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Abstract

This narrative review presents ten key recommendations aimed at strengthening pediatric intensive care unit (PICU) practice in today's clinical environment. These reflections emerged from the shared experience of Latin American pediatric intensivists and are supported by relevant literature. They address common challenges such as early recognition and management of clinical deterioration, balancing fluid resuscitation with early vasopressor use, early detection of non-invasive ventilation (NIV) failure, and promoting enteral nutrition. Additional topics include rational antibiotic use, ethical restraint practices, and the integration of families as active participants in care. The review also highlights the value of timely extubation decisions, better resource use, and the balancing clinical judgment with objective tools. Although developed from the perspective of Latin American clinicians, we consider these recommendations to have universal applicability.

Keywords: Child. Noninvasive ventilation. Airway extubation. Enteral nutrition. Clinical deterioration.

Resumen

Esta revisión narrativa presenta diez recomendaciones clave para fortalecer la práctica de las unidades de cuidados intensivos pediátricos (UCIP) en el entorno clínico actual. Estas reflexiones surgieron de la experiencia compartida de intensivistas pediátricos latinoamericanos y se sustentan en la literatura relevante. Abordan desafíos comunes como el reconocimiento y el manejo tempranos del deterioro clínico, el equilibrio entre la reanimación con líquidos y el uso temprano de vasopresores, la detección temprana de la falla de la ventilación no invasiva (VNI) y la promoción de la nutrición enteral. Otros temas incluyen el uso racional de antibióticos, las prácticas éticas de restricción y la integración de las familias como participantes activos en la atención. La revisión también destaca la importancia de tomar decisiones oportunas sobre la extubación, un mejor uso de los recursos y el equilibrio entre el juicio clínico y las herramientas objetivas. Aunque estas recomendaciones surgieron en América Latina, consideramos que son de aplicación universal.

Palabras clave: Niño. Ventilación no invasiva. Extubación de la vía aérea. Nutrición enteral. Deterioro clínico.

Introduction

Pediatric intensive care units (PICUs) face constant pressures to adapt and improve their approaches in response to clinical and system-level challenges. This narrative review presents ten key recommendations intended to strengthen contemporary pediatric intensive care practice.

These recommendations did not arise from a formal consensus methodology but from the shared clinical experience of a group of Latin American pediatric intensivists. Based on recurrent challenges observed in daily practice, the authors selected topics that, in their view, represent critical areas for improvement in the care of critically ill children. The reflections were subsequently refined and supported by a review of relevant literature, with the aim of offering practical guidance for real-world clinical decision-making.

Rather than providing exhaustive guidelines, this review highlights pragmatic strategies to address frequent problems encountered at the bedside, particularly in resource-limited settings where variability in practice and inequities in access are common. By framing these issues through both clinical experience and available evidence, the authors aim to stimulate discussion, promote best practices, and encourage further investigation.

1. Do not delay critical therapies while waiting for a PICU admission

Pediatric intensive care is often associated with physical spaces equipped with advanced technology, including monitors, ventilators, infusion pumps, and extracorporeal support[1]. However, intensive care is increasingly recognized as extending beyond physical spaces to represent a comprehensive, holistic approach to the management of critically ill patients[2].

Continuous monitoring of vital signs and selected laboratory parameters allows clinicians to detect clinical deterioration promptly and address increased mortality risks. This facilitates timely interventions to restore homeostasis and track responses, and reduce mortality[3,4].

In respiratory failure, prompt application of invasive or non-invasive respiratory support can prevent further deterioration and improve clinical outcomes[5,6]. Similarly, in shock, guided fluid resuscitation combined with early administration of vasoactive agents can stabilize hemodynamics, enhance organ perfusion, and improve prognosis[4].

Pediatric intensive care should not be limited to advanced technology or specific physical spaces. Instead, it is a holistic approach that integrates the recognition of life-threatening dysfunctions, careful planning of laboratory investigations, and timely implementation of stabilizing therapies. These actions must be taken promptly, regardless of the care setting, using available resources effectively instead of waiting for access to high-complexity services.

2. Optimize stay times in the ICU

Admission to the pediatric intensive care unit provides critically ill children with access to advanced

technology, specialized diagnostic tools, and multidisciplinary care teams equipped to manage severe conditions[7]. However, the distribution of these units is often unequal, particularly in regions like Latin America, where limited resources are concentrated in urban centres, limiting access for children in rural or peripheral areas[8].

The efficient utilization of critical care services has important practical implications. Inefficient use of critical care beds, if it limits bed or staff availability, may result in delays in care, management of patients in suboptimal locations, or patients diverted to other facilities with the associated risks of transport and delayed therapies[9]. Optimizing the use of available resources requires clear admission and discharge criteria. Timely discharge decisions allow for effective allocation of beds, ensuring that patients no longer requiring intensive monitoring or therapy can transition to lower-acuity settings without unnecessary delays[10].

Prolonged stays are associated with higher risks of complications, including infections (both device-related and non-device-related) and post-intensive care syndrome[11,12]. This underscores the importance of reducing unnecessary ICU exposure while ensuring continuity of quality care.

Families often experience significant anxiety during their child's stay. Initially focused on survival, they may later resist transferring their child to less intensive care settings, fearing a loss of continuous monitoring and immediate medical attention. While these concerns are understandable, prolonged stays for patients who no longer require intensive care reduce bed availability for critically ill children in need and increase healthcare costs.

To address these challenges, healthcare teams must adopt a proactive, multidisciplinary approach to discharge planning, as part of the humanization of intensive care. Balancing clinical needs with resource stewardship promotes timely transitions, reduces risks, and maintains ICU availability for patients who truly require it[13].

3. Family members are not visitors

The mission of pediatric intensive care extends beyond clinical excellence to creating a warm, humane environment that supports both patients and their families[14]. Parents of children admitted to intensive care units often face significant emotional distress [15]. They are at heightened risk for anxiety, depression, and other challenges as they confront uncertainties about their child's health and survival. Many parents feel relegated to passive observers, leading to feelings of helplessness and a loss of control[15].

Family-centered care models address these challenges by empowering parents to actively participate in their child's care[16]. These models invite parents to become primary caregivers, involving them in activities such as passive mobilization, rehabilitation, and participation in multidisciplinary rounds. This engagement reduces family anxiety and strengthens the therapeutic relationship between families and healthcare providers[16].

To support this approach, many pediatric units have adopted protocols designed to standardize family involvement, as part of the humanization of intensive care. These protocols emphasize parental participation and empowerment, and include education to help families optimize contribute meaningfully to care, based on each child's needs[17,18].

Healthcare teams must embrace families as integral members of the care team, rather than categorizing them as "visitors." Family participation should include permanent presence whenever possible, even during resuscitation or selected procedures. This approach fosters improved communication, enhances understanding of the medical process, and equips families with strategies to navigate this stressful experience more effectively, regardless of the clinical outcome[19].

4. Not every cry warrants sedation, and not every restless child needs restraints

Physical restraint (PR) in pediatric intensive care units is a complex and controversial practice. Definitions vary internationally, but restraint generally refers to restricting a patient's movement using manual techniques or mechanical devices, such as belts or other tools to "secure" the patient[20,21]. Restraints, applied without the patient's consent, are among the least accepted containment measures, often described as distressing and inhumane[22]. They have been linked to fear, anger, and even trauma[23]. Although the long-term effects on cognitive, psychological, physical, and motor development remain unclear, the potential for negative outcomes is significant[24].

In PICUs, restraint is often justified as necessary to protect life-support devices, such as central venous catheters or endotracheal tubes. However, its effectiveness is uncertain, and in many instances, it infringes on patient rights and autonomy. Despite this, restraint is widely used. Studies indicate that two-thirds of PICUs in Great Britain implement some form of restraint[25]. In Spain, a prevalence of 96% has been reported in children aged 5 days to 14 years, with 92% involving hand restraints[26]. Similarly, a Latin American survey of pediatric intensivists found that over 90% reported using restraints (based on unpublished data).

The routine use of restraint should be avoided. Each case must be individually evaluated, considering the child's understanding of their situation, their ability to express themselves, their cooperation, and the availability of less restrictive alternatives[24].

Continuous supervision, non-invasive containment devices, environmental modifications, and family involvement should be prioritized. Families play a critical role and should be actively involved in decisions regarding the need for restraints. Maintaining transparent and honest communication with families fosters trust and collaboration[25,26].

If restraint is deemed necessary as a last resort, its use must be justified through individualized assessment. PICU staff should be adequately trained in the proper application, monitoring, and care of restrained patients. Decisions about restraint in pediatric patients must prioritize the child's safety and well-being, balancing ethical considerations with clinical necessity.

5. Antibiotic therapy is not automatically indicated upon ICU admission

Systemic inflammatory response syndrome (SIRS) is a frequent clinical presentation among patients admitted to intensive care units, regardless of the underlying condition. It is often linked to infectious processes, given the high prevalence of sepsis in critical care and the devastating consequences of delayed treatment[27,28]. The initial approach to critically ill patients involves assessing severity indicators to facilitate etiological characterization and problem-based management, which includes addressing infections of varying severity[29]. Differential diagnosis relies on the use of biomarkers selected according to pre-analytical probability[27].

It is common to encounter altered biomarker results in cases of non-infectious inflammatory response activation or viral etiologies[30]. Misinterpretation of these findings can lead to indiscriminate antibiotic use, resulting in adverse effects such as dysbiosis, colonization by resistant microorganisms[30,31], toxicity, and the risk of idiosyncratic reactions[31,32]. While microbiological testing is widely recommended for suspected infections, its general utility is often limited by low sensitivity and lengthy turnaround times. This limitation has driven the adoption of highly sensitive molecular tests, which allow for rapid and precise etiological diagnosis[32].

Efforts to optimize antimicrobial use in critical care aim to reduce toxicity, control infections, mitigate antimicrobial resistance, and minimize costs. These initiatives focus on improving diagnostics by integrating clinical signs, symptoms, biomarkers, and pre-analytical probability. Daily evaluations of antibiotic therapy, including adjustments based on microbiological isolation and susceptibility patterns, are essential components of these strategies[32,33].

6. Attempt non-invasive ventilation, but know when to stop

Respiratory failure is a leading cause of PICU admissions. Non-invasive respiratory support strategies, such as high-flow nasal cannula (HFNC) and non-invasive ventilation (NIV)—including continuous positive airway pressure (CPAP) and bilevel positive airway pressure (BiPAP)—have become cornerstones in the management of acute respiratory distress. Their main goal is to avoid invasive mechanical ventilation (IMV) and its complications, such as ventilator-associated infections, airway injuries, and sedation-related risks[33–35].

NIV improves oxygenation, reduces respiratory effort, and may shorten ICU length of stay. However, its success depends on proper patient selection and timely recognition of failure. Key predictors of NIV failure include high respiratory effort, excessive tidal volumes, refractory hypoxemia, and persistent tachypnea despite therapy[35,36]. Clinical tools, such as the ROX index (SpO_2/FiO_2 to respiratory rate ratio), have demonstrated utility in predicting failure in adults[37]. While promising, their applicability in pediatric populations remains uncertain and warrants further investigation[38]. Clinical judgment remains essential, but must be supported by objective tools and structured monitoring. Objective parameters should complement experience to guide timely intubation and avoid delayed escalation[39].

Delays in escalating to IMV can significantly increase mortality. Data suggest that in pediatric acute respiratory distress syndrome (PARDS), failure often occurs within the first 6-24 hours, highlighting the importance of close monitoring and early decision-making[36,40,41]. For patients with NIV failure, prolonged delays increase the risk of severe complications, including pulmonary injury from patient self-inflicted lung injury (P-SILI) due to excessive swings in pleural pressures and worsening gas exchange[40].

To optimize outcomes, healthcare professionals must establish clear failure criteria, such as increased work of breathing, deterioration in oxygenation indices, or neurological compromise. Early identification of high-risk patients and rapid escalation to IMV, when necessary, remain essential to prevent adverse outcomes in cases of respiratory distress.

7. Do not wait for central access to initiate vasoactive support

One of the most common decisions faced by professionals managing critically ill pediatric patients is selecting the most appropriate intravascular device based on the clinical scenario and patient characteristics. In many cases, this decision is guided by clinician discretion or implicit protocols established within the critical care unit.

Clinicians are encouraged to evaluate the specific indications and available options for intravascular device selection, tailoring the choice to the patient's physiological condition and considering multiple factors. In term neonates, the venous network and blood vessels undergo significant maturation during the first year of life, necessitating smaller catheters for both peripheral and central devices. This influences the ease of insertion and the functionality of the catheter itself[42].

To address these challenges, the Michigan Appropriateness Guide for Intravenous Catheters in Pediatrics (MiniMAGIC) was published in 2020[43]. This guide provides evidence-based recommendations for vascular device selection in children, particularly in critically ill patients. It emphasizes that device choice should depend on physiological stability, the care setting, monitoring needs, and the specific characteristics of the infusion being administered.

Noninvasive or minimally invasive hemodynamic monitoring via peripheral arterial catheterization offers reliable data collection, including cardiac output measurements[44]. These findings can be augmented with bedside ultrasound (POCUS), following evidence-based guidelines for critically ill children and neonates[45]. In addition, clinicians are encouraged to use peripheral-compatible infusions, including vasoactive agents, which have been shown to carry a low prevalence of complications in current studies[46].

The risks associated with central vascular devices, including infectious, mechanical, and thrombotic complications, should not be underestimated., nor should the risks of extravasation from peripheral vasoactive infusions be overlooked[47]. Furthermore, non-clinical factors such as hospital complexity and the involvement of trainees often increase the likelihood of central catheter placement without corresponding improvements in patient outcomes[48]. This underscores the importance of critically evaluating the necessity of a central venous catheter in each case by asking whether central access is truly necessary for this patient.

Vasoactive support should not be delayed, and central access can be established when feasible based on risk and clinical context.

8. Stop excessive crystalloid boluses and start early vasopressors

Fluid therapy is a cornerstone in the initial management of shock, with crystalloid solutions (balanced or unbalanced) being the primary choice. However, recent evidence has identified increasingly stringent limitations on their use due to the potential for adverse events, including fluid overload, pulmonary congestion, endothelial injury, renal failure, and the need for renal replacement therapy[49].

In cases where shock is refractory to fluids, vasopressors should be initiated through any available intravenous route, including peripheral, central, or intraosseous access. A small study reported that infiltration and extravasation occurred in only 2% of patients, none of whom required medical or surgical intervention[50]. Peripheral vasopressor use is particularly relevant for patients requiring transfer to higher levels of care. All vasoactive agents, including norepinephrine, can be safely initiated via a peripheral line when central or intraosseous access is unavailable, especially in emergency departments or other non-intensive care settings[51].

Extravasation from peripheral lines is rare, and agents such as phentolamine and nitroglycerin can effectively prevent local ischemic injury. Pediatricians should not automatically equate the use of vasoactive medications with the need for central venous access, but should aim to establish central access as soon as clinically feasible[51].

Early administration of inotropes is essential for children with septic shock unresponsive to fluid therapy[52]. The routine use of large-volume crystalloid boluses is now questioned in terms of both dose and fluid type. Fluid therapy has historically been implemented in clinical practice without robust evidence of its efficacy and safety. Precision medicine strategies for fluid resuscitation should form the foundation of treatment in critically ill patients, selecting the most appropriate crystalloid based on individual patient factors[53].

In healthcare systems with limited access to intensive care, fluid boluses should not be administered to patients without hypotension; maintenance fluid therapy should be initiated instead. In settings with intensive care availability or restricted access, initial resuscitation for hypotension should involve fluid boluses of 10 mL/kg (up to 40 mL/kg) within the first hour. Vasopressor support should be initiated after 40 mL/kg if clinical signs of hypoperfusion persist. Vasopressors may also be started before 40 mL/kg if the patient exhibits signs of fluid overload or other contraindications to further fluid administration[54].

9. Do not delay enteral feeding in critically ill children.

Malnutrition is common among critically ill children and is associated with poorer clinical outcomes, making nutritional support a vital component of their treatment. Enteral nutrition (EN), as defined by the American Society for Parenteral and Enteral Nutrition (ASPEN), involves delivering nutrients directly to the gastrointestinal tract via a tube or ostomy[55]. EN is

the preferred route because it is more physiological and lowers the risk of fluid overload, which frequently occurs in critically ill children due to systemic inflammation, reduced oncotic pressure, and capillary leak, among other factors[56,57]. Positive fluid balance is an independent predictor of worse oxygenation, prolonged mechanical ventilation, and extended PICU stays[58].

EN is indicated when oral nutritional needs cannot be met. Minimal, early, or trophic EN, defined as the administration of small volumes to stimulate the gut, has been associated with significant benefits. Observational studies indicate that initiating EN within the first 24[55,59] to 48 hours of PICU admission[60] improves blood flow, enzymatic activity, mucosal integrity, and motility. These changes correlate with better clinical outcomes, including improved feeding tolerance, reduced morbidity and mortality, and shorter lengths of stay[55,58,59,61]. Nutritional goals should include a minimum protein intake of 1.5 g/kg and at least 25% of resting energy expenditure (REE)[59].

Most PICU patients tolerate enteral feeding, meeting both energy and protein targets. However, EN initiation must be carefully evaluated in patients with compromised gastrointestinal perfusion. EN is contraindicated in specific conditions, such as hemodynamic instability, high-dose vasopressor use, intestinal failure secondary to resection, or high-output fistulas[55,58,60].

10. Extubation should not–wait until morning rounds

The multidisciplinary team managing critically ill pediatric patients must balance the duration of invasive mechanical ventilation (IMV), the risk of extubation failure, and the development of associated morbidities. Although international efforts have aimed to establish operational definitions and clinical guidelines for weaning and respiratory support, many statements lack clinical applicability and comparability among peers, limiting their utility for benchmarking and quality improvement initiatives[62,63]. For instance, these guidelines often avoid defining prolonged mechanical ventilation, fail to establish specific time-based metrics, and extrapolate definitions of respiratory failure from adult populations[64,65].

In children, the duration of IMV is generally shorter than in adults, making differences of 12 to 24 hours significant in preventing complications such as oversedation, unplanned extubation, and delirium. Many factors influence the duration of IMV, including unnecessary routine practices when the patient is clinically ready for extubation. Most pediatric patients requiring IMV for respiratory failure can be safely extubated after their first spontaneous breathing trial, provided a multidisciplinary evaluation protocol is in place[66,67]. Therefore, extubation readiness assessments and trials should be part of a continuous 24-hour process aimed at minimizing IMV exposure[68,71].

Despite these principles, extubations in many pediatric ICUs are often scheduled after morning rounds, based on concerns about reduced staffing or higher perceived risk during night hours[72]. However, recent evidence suggests otherwise, even in complex pediatric patients with comorbidities[73,74,75].

Resource-limited pediatric ICUs face additional challenges, including staffing limitations, high patient loads, restricted access to diagnostic tools, and reduced subspecialty support, particularly during night shifts or non-working days. Fatigue and workload during night shifts have also been linked to errors, further complicating extubation timing decisions[75,76].

A recent study in a Latin American ICU found that morning extubations occurred 3.5 times more frequently than nighttime extubations, with no associated negative outcomes[77]. Similar findings from other single-center studies support this observation. High-risk groups, such as patients with critical or surgical airway histories or craniofacial malformations, may benefit from extubation in the presence of airway specialists. However, delaying extubation beyond 24 to 48 hours in these cases can lead to negative effects. These high-risk patients typically represent less than 5% to 10% of cases.

Another group of interest includes post-cardiac surgery patients, where interactions between comorbidities, surgical insult, and pre- and postoperative physiology are particularly relevant. Nonetheless, studies indicate that extubation is safe during both daytime and nighttime in most cases of IMV lasting longer than 48 hours[78].

Weaning from IMV is a continuous process, and extubation should not be routinely delayed once clinical readiness is achieved. Prolonging IMV exposure based on arbitrary time metrics can increase iatrogenic complications and morbidity. Extubation timing should be guided by the patient's clinical condition, rather than the daily routine or shift schedules of the ICU team.

Conclusion

These recommendations outlined in this narrative review provide a framework for addressing critical challenges in pediatric intensive care. By emphasizing timely interventions, early recognition of non-invasive ventilation failure, resource optimization, family integration, and evidence-based practices, they aim to improve the quality of care and outcomes in diverse clinical settings. Implementing these recommendations requires collaboration among multidisciplinary

Table 1. Summary of ten key recommendations for improving pediatric intensive care, with common barriers and proposed strategies.

Recommendation	Common Barrier	Proposed Strategy
1. Do not delay critical therapies while awaiting PICU admission	Lack of PICU beds or formal transfer protocols	Initiate care in current unit; use early warning scores and remote consults
2. Optimize stay times in the ICU	Parental fear or institutional pressure to retain patients	Standardize discharge criteria; communicate clearly with families
3. Family members are not visitors	Restrictive visitation policies or lack of family involvement protocols	Establish family-centered care protocols; allow 24/7 presence
4. Not every cry warrants sedation, not every restless child needs restraints	Lack of alternatives or training in non-restraint strategies	Train staff in de-escalation and involve families proactively
5. Antibiotics are not automatically indicated upon ICU admission	Over-reliance on biomarkers or protocolized sepsis bundles	Base decisions on clinical probability and reassess daily
6. Attempt non-invasive ventilation, but know when to stop	Fear of failure or delayed recognition of clinical worsening	Use objective failure criteria; train for timely escalation to IMV
7. Do not wait for central access to initiate vasoactive support	Belief that vasoactive agents require central access by default	Use peripheral lines with protocols while arranging central access
8. Stop excessive crystalloid boluses and start early vasopressors	Tradition of liberal fluid boluses and delayed vasopressor use	Apply goal-directed fluid strategy and start vasopressors early if needed
9. Do not delay enteral feeding	Delayed prescriptions due to hemodynamic concerns	Start trophic feeds early with close monitoring
10. Extubation should not wait until morning rounds	Cultural preference for morning rounds and staff availability	Use continuous readiness assessments, extubate when clinically ready

teams, a commitment to continuous learning, and adaptability to the realities of everyday practice.

As healthcare systems face increasing complexity and resource constraints, adopting these strategies can help bridge inequities, standardize practices, and inspire innovation. Their main limitation is that they do not arise from a formal consensus methodology but from the shared experience of a group of Latin American pediatric intensivists. Nevertheless, this pragmatic approach highlights everyday challenges and provides practical strategies where robust scientific evidence in children is often difficult or impossible to obtain. **Table 1** summarizes these ten recommendations, their common barriers, and suggested implementation strategies to support clinical application.

Ultimately, pediatric intensive care is defined not only by advanced technology but also by a proactive, holistic approach that prioritizes the timely recognition of clinical needs and the well-being of critically ill children and their families. We hope these recommendations will serve as a starting point to encourage colleagues to investigate these topics in greater depth, support clinical decision-making, and contribute to clearer communication with families, reflecting a shared vision of the Latin American pediatric intensive care community rather than individual positions.

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Use of AI tools

During the preparation of this work, the authors used ChatGPT to assist with translation and improve the clarity of the manuscript. All content was subsequently reviewed, edited, and approved by the authors, who take full responsibility for the final version.

Authorship Statement

This narrative review reflects the collaborative contributions of multiple experts in pediatric intensive care. Sarmiento, Higuera Alvarez and Alzate Hernández authored the sections on timely PICU discharge and family-centered care. Morantes collaborated with Jaramillo-Bustamante on prioritizing critical therapies while awaiting PICU admission and with López-Barón on appropriate antibiotic use. Torres, under the supervision of Vásquez Hoyos, contributed the section on early recognition of non-invasive ventilation failure. Roa and Ruge urges us not to wait to have a central line to start vasoactive support, Jabornisky addressed ethical considerations surrounding sedation and restraint practices. Aguilar Zamora and Zárate Castañón authored the section on early enteral nutrition. Gómez Lund provided insights on fluid resuscitation and early vasopressor initiation. Díaz and Donoso offered perspectives on extubation timing and weaning protocols.

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This table provides a practical synthesis of the ten lessons discussed in this review. Each recommendation outlines common challenges faced in implementation and offers concrete suggestions based on clinical experience and literature to support improvements in pediatric intensive care.

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