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Decision-Making in the ICU

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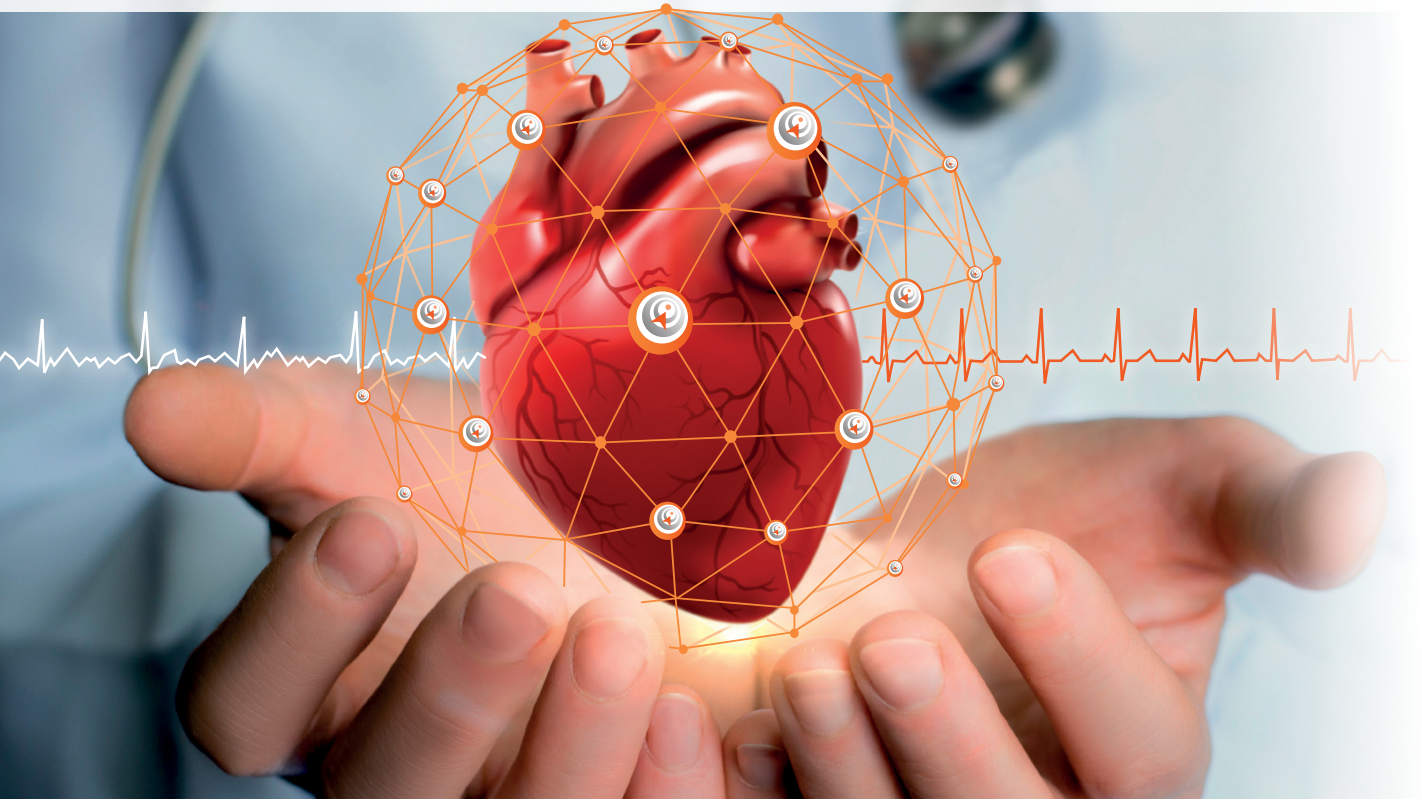

Rapid control of ventricular rate in patients with SVTs and AF[1]

First-line for patients with cardiac dysfunction[2]

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Rapibloc® 300 mg: Rapibloc® 300 mg powder for solution for infusion. **Composition:** A vial of 50 mL contains 300 mg landiolol hydrochloride which is equivalent to 280 mg landiolol. After reconstitution each mL contains 6 mg landiolol hydrochloride (6 mg/mL). Excipients with known effect: Mannitol E421, sodium hydroxide (for pH adjustment). **Therapeutic Indication:** Landiolol hydrochloride is indicated for supraventricular tachycardia and for the rapid control of ventricular rate in patients with atrial fibrillation or atrial flutter in perioperative, postoperative, or other circumstances where short-term control of the ventricular rate with a short acting agent is desirable. Landiolol hydrochloride is also indicated for non-compensatory sinus tachycardia where, in the physician's judgment the rapid heart rate requires specific intervention. Landiolol is not intended for use in chronic settings. **Contraindications:** Hypersensitivity to the active substance or to any of the excipients, severe bradycardia (less than 50 beats per minute), sick sinus syndrome, severe atrioventricular (AV) nodal conductance disorders (without pacemaker): 2nd or 3rd degree AV block, cardiogenic shock, severe hypotension, decompensated heart failure when considered not related to the arrhythmia, pulmonary hypertension, non-treated phaeochromocytoma, acute asthmatic attack, severe, uncorrectable metabolic acidosis. For further information on warnings and precautions for use, interaction with other medicinal products and other forms of interaction, fertility, pregnancy, lactation, effects on ability to drive and use machines, unsiderable effects, and habituation effects, please refer to the published SmPC **Prescription only/available only from pharmacy. Date of revision of the text:** 09/2021. **Marketing authorization holder:** Amomed Pharma GmbH, Leopold-Ungar-Platz 2, 1190 Vienna, Austria

1 Summary of Rapibloc® Product Characteristics, current version. – **2** Hindriks G., et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association of Cardio-Thoracic Surgery (EACTS). European Heart Journal (2020) 00, 1-126. – **3** Shibata et al. Direct Effects of Esmolol and Landiolol on Cardiac Function, Coronary Vasoactivity, and Ventricular Electrophysiology in Guinea-Pig Hearts. J Pharmacol Sci 118, 255 – 265 (2012). – **4** Yokoyama H. (2016) Stabilization in Off-Pump Coronary Artety Bypass. Springer Tokyo Heidelberg New York Dordrecht London © Springer Japan. – **5** European Heart Journal Supplements (2018) 20 (Supplement A), A1-A24. – **6** Nasrollahi-Shirazi S et al. Comparison of the b-adrenergic receptor antagonists landiolol and esmolol: receptor selectivity, partial agonism, and pharmacochaperoning actions. J Pharmacol Exp Ther 2016; 359:73–81

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Decision-Making in the ICU

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Decision-making in the ICU is a multifaceted process that involves clinical assessment, collaboration among multidisciplinary teams, ethical considerations, evidence-based practice, communication, and continuous adaptation to evolving clinical scenarios. Balancing the complex factors requires expertise, teamwork, and a patient-centred approach. Improving the decision-making process in ICUs is crucial for optimising patient outcomes and resource utilisation.

Clinical assessment and monitoring is an important component that guides decision-making in critical care because diagnostic and therapeutic interventions are typically based on this assessment. Decision-making in the ICU also involves a comprehensive assessment of the risks and benefits of these interventions based on the patient's prognosis, underlying comorbidities, and potential complications. Following evidence-based guidelines and considering ethical dilemmas, particularly in end-of-life care and resource allocation, further complicate the process. In addition, the condition of a critically ill patient can change rapidly and requires continuous reassessment and adaptation of treatment strategies.

ICU decision-making is informed by evidence-based medicine. Critical care professionals rely on clinical practice guidelines, research literature, and their own experience to make informed decisions. They are also guided by principles of quality improvement and patient safety. In many cases, decisions in critical care involve discussions with the patient's family. Effective communication among healthcare team members, patients, and families is essential for shared decision-making and continuity of care.

Implementing standardised protocols and clinical pathways can streamline decision-making, reduce variation in care, and improve efficiency. Regular multidisciplinary team meetings and case conferences provide opportunities to discuss complex cases, share expertise, and collaborate on treatment plans. Decision support tools such as clinical decision algorithms, risk prediction models, and scoring systems (e.g., APACHE, SOFA) can aid clinicians in risk assessment, prognostication, and treatment selection. Adherence to evidence-based practice guidelines and incorporating the latest research evidence into clinical decision-making can improve the quality and consistency of care in the ICU.

In this issue, our contributors explore the **decision-making process in the ICU,** discuss factors that influence decisions related to critical care treatment and highlight the importance of clear guidelines to help clinicians through this complex process.

As always, if you would like to get in touch, please email JLVincent@icu-management.org.

Jean-Louis Vincent

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DECISION-MAKING IN THE ICU

IN EVERY ISSUE

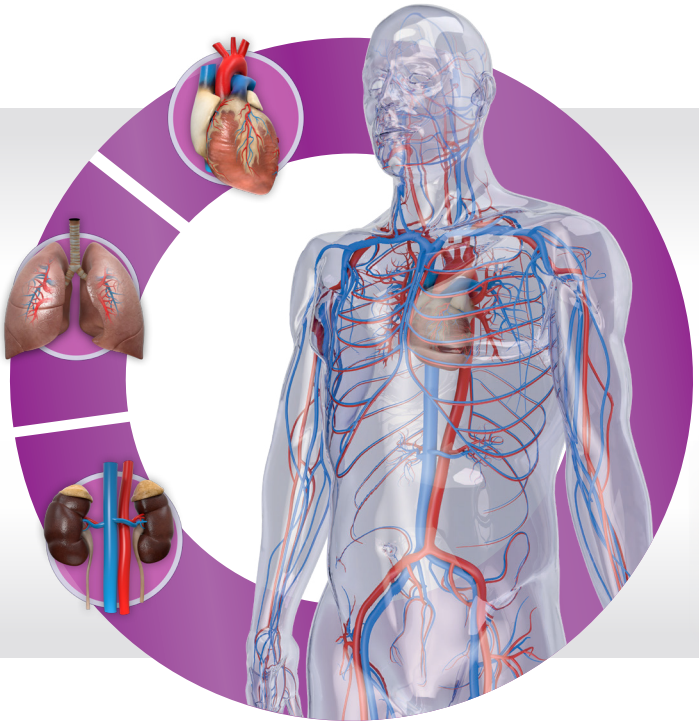
Treating Catecholamine Refractory Hypotension in Septic Shock

EMPRESSIN®
ARGIPRESSIN

Increase mean arterial pressure
in catecholamine refractory septic shock[1,3]

Reduce Norepinephrine Infusion
while maintaining mean arterial pressure[1,2]

Increase Chances of Survival
for patients with less severe septic shock (<15 µm/min NE)[5] and patients at risk of AKI (increased serum creatinine x1.5)[4]



Empressin 40 I.U./2 ml concentrate for solution for infusion. Active substance: Argipressin. **Composition:** One ampoule with 2 ml solution for injection contains argipressin, standardised to 40 I.U. (equates 133 microgram). 1 ml concentrate for solution for infusion contains argipressin acetate corresponding to 20 I.U. argipressin (equating 66.5 microgram). **List of excipients:** Sodium chloride, glacial acid for pH adjustment, water for injections. **Therapeutic indication:** Empressin is indicated for the treatment of catecholamine refractory hypotension following septic shock in patients older than 18 years. A catecholamine refractory hypotension is present if the mean arterial blood pressure cannot be stabilised to target despite adequate volume substitution and application of catecholamines. **Contraindications:** Hypersensitivity to the active substance or to any of the excipients. **Undesirable effects: Metabolism and nutrition disorders:** Uncommon: hyponatremia Unknown: Water intoxication, diabetes insipidus after discontinuation. **Nervous system disorders:** Uncommon: tremor, vertigo, headache. **Cardiac disorders:** Common: arrhythmia, angina pectoris, myocardial ischaemia. Uncommon: reduced cardiac output, life threatening arrhythmia, cardiac arrest. **Vascular disorders:** Common: peripheral vasoconstriction, necrosis, perioral paleness. **Respiratory, thoracic and mediastinal disorders:** Uncommon: bronchial constriction. **Gastrointestinal disorders:** Common: abdominal cramps, intestinal ischaemia Uncommon: nausea, vomiting, flatulence, gut necrosis. **Skin and subcutaneous tissue disorders:** Common: skin necrosis, digital ischaemia (may require surgical intervention in single patients). Uncommon: sweating, urticaria. **General disorders and administration site conditions:** Rare: anaphylaxis (cardiac arrest and / or shock) has been observed shortly after injection of argipressin. **Investigations:** Uncommon: in two clinical trials some patients with vasodilatory shock showed increased bilirubin and transaminase plasma levels and decreased thrombocyte counts during therapy with argipressin. **Warning:** less than 23 mg sodium per ml. **Prescription only**. **Marketing authorisation holder:** OrphaDevel Handels und Vertriebs GmbH, Wintergasse 85/1B; 3002 Purkersdorf; Austria. **Date of revision of the text:** 02/2022

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STAT PROFILE Prime+®

The Most Clinically Advanced Test Menu for Critical Care Includes–

Creat eGFR Urea ePV iMg MCHC

Prime Plus provides the most clinical value of any blood gas/critical care analyzer profile by adding essential tests for kidney function (Urea, Creatinine, eGFR), plasma volume (ePV), ionized magnesium (iMg) and MCHC.

Creatinine, eGFR, and Urea

Over 50% of patients admitted to the ICU develop some degree of acute kidney injury.[1] Creatinine, eGFR, and Urea monitoring provides indication of changes in kidney function and helps guide therapy to prevent AKI.

Estimated Plasma Volume (ePV)

The plasma volume status of a patient is one of the top priorities in evaluating and treating critical illness including CHF, ARDS, AKI, and Sepsis.[2-4]

Ionized Magnesium (iMg)

Hypomagnesemia is a frequent finding in critically ill patients.[5] Magnesium therapy guided by real time ionized magnesium monitoring has been shown to improve outcome in these patients.[6]

Mean Corpuscular Hemoglobin Concentration (MCHC)

Helps differentiate types of anemia.

Test Menu:

pH PCO_2 PO_2 SO_2% Hct Hb MCHC Na K Cl TCO_2
iCa iMg Glu Lac Urea Creat CO-Ox tBil HbF

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Dealing With Uncertainty in ICU Decision-Making: A Practical Guide

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When the stakes are high, and the path ahead is uncertain, the decisions made, especially if a patient continues to worsen, can be sources of self-torment and can haunt us for a long time. Our goal is to suggest ways to steer decision-making for intensivists in the face of uncertainty by proposing a clear, practical, stepwise approach through the creation of a new algorithm that reflects our common goal in such situations, which is to STABILIZE our patients.

"Nothing in life is to be feared; it is only to be understood. Now is the time to understand more so that we may fear less"

Marie Curie

"The only thing we can count on is uncertainty"

Albert Einstein

Introduction

An intensive care unit is a fast-paced, high-stakes environment in which patients with life-threatening illnesses require near-constant attention, especially when first admitted to prevent them from dying. Important decisions must be made quickly: ones that engage a complexity of inter-related issues, ones that trade-off benefits and undesired effects, ones that have irreversible consequences, and ones that must be made in the context of missing data and constant ambiguity. Often, significant aspects of the nature of the patient's critical illness itself remain uncertain throughout their admission.

How Do We Make Decisions?

Making effective decisions is an essential quality for any medical leader. Almost unique to the intensity of critical care practice is the sheer number of decisions that must be made within short periods of time. Research shows that intensivists make more than 100 decisions/day, just during patient rounds alone (i.e. over a mean time of 3.7 hours), with more decisions being made for those more recently admitted, those seen earlier in the day, and by female intensivists (McKenzie et al. 2015; Dennis et al. 2023). This does not include the number of decisions made as new patients get admitted and as others deteriorate. This relentless need to make decisions is a critical aspect of training in critical care medicine and is one of the principal causes of the exhaustion of clinical practice.

Our approach to making decisions can be considered in two different psychological models: the normative and the descriptive models. Simplistically, a normative model describes how doctors *should* make decisions – using a rational or hypothetical-deductive cognitive process. Conversely, a descriptive model describes how we *actually* make decisions – using intuition and recognition-primed decision-making.

How We *Should* Make Decisions

Ideally, decision-making in the ICU should follow a hypothetical-deductive model. This is a rational approach in which hypotheses are formed from the patient's history and physical examination, refined through confirmatory and eliminatory diagnostic testing, followed by simultaneous intervention and evaluation of response (Christenson et al 2022; Lighthall and Vazquez-Guillamet 2015). Also known as evidence-based reasoning, the generation of several hypotheses, or differential diagnoses, is fundamental to this process. Each hypothesis or diagnosis should have some sense of likelihood, such that each possibility is grounded in history, physical examination findings, and initial investigations.

How We *Actually* Make Decisions

In contrast, intuitive decision-making or recognition-primed approaches employ heuristics or shortcuts. The cognitive psychology literature suggests that we make 95% of our decisions in this way (Lakoff 1999). Known also as experience-based reasoning, the brain's automatic and initial response to what we see, hear, smell, etc., is to try to match it to a familiar pattern. In clinical medicine, one summons remembered experiences and understanding of similar presentations, missed diagnoses (ours and

those of our colleagues), and even stories in the media (academic, social or otherwise). If these memories form a matching pattern, they become the basis of a healthcare provider's decision-making – in ways that are almost certainly subconscious or automatic (Christenson et al. 2022; Lighthall and Vazquez-Guillamet 2015). For a highly pathognomonic case and for a clinician with significant experience, the diagnosis is likely to be correct. How often is this truly the case?

Impediments to Decision-Making and Bias

Both rational and intuitive decision-making may be used together in any given situation. Just because our intuition influences a decision does not mean that we cannot change it with rational, reflective thinking and metacognition. This executive override is vital as intuitive decision-making (and, to an extent, hypothetical- deductive) is subject to biases (i.e. likelihood and/or recall). This failure to consider and/or discount evidence that would point to a different diagnosis or a new issue (confirmation and/or anchoring bias) may result in overconfidence regarding the accuracy of the assessment of any given patient (Christenson et al. 2022; Lighthall and Vazquez-Guillamet 2015). A final and sometimes dangerous pitfall of decision-making is that of status quo biases or diagnostic momentum in which healthcare providers are more likely to not intervene or change the decision-making course once set (Christenson et al. 2022; Lighthall and Vazquez-Guillamet 2015). All of these challenges can, of course, lead to error events and less-than-ideal patient outcomes.

Managing Uncertainty

There are often many paths to stabilising critically ill patients and achieving good outcomes. Yet what happens when the road is not clear and when you aren't sure what to do next? Decisions must still be made, decisions to intervene either further or differently or decisions to give the patient more time, to wait

STOP (Timeout Pause and Review)	• What do I know? • What have I done so far? What has happened? • What was unexpected? • What do the unexpected responses/results tell me?"
TURN TO PHYSIOLOGY	• What is happening with venous return, ventricular filling, contractility and afterload? • What has been done to manipulate it so far? • What dynamic parameters of fluid resuscitation have been tried/ assessed? • What vasopressors/ inotropic agents have been tried, and what is the rationale for them? • Why is the patient's physiology not normalising?
ADMIT YOU MIGHT BE WRONG	• Promote humility • Avoids overconfidence, will • Early re-evaluations of hypotheses • Support the generation of hypotheses when/if required
BUILD a LIST of OPTIONS	• Create a list of possible interventions and alternatives • Write them down to create a roadmap
INVESTIGATE	• What information or investigations do you still need to make a decision to move forward? • What other investigations are possible? • If imaging is needed, can the patient be transported safely?
LISTEN	• Ask the team for their observations/ ideas/ thoughts • Ask colleagues for help • Consult other services when appropriate
IRREVERSIBLE?	• Has a point been reached when all subsequent treatments will only prolong death and add to suffering? • What ICU treatments should be offered? • Should the alleviation of distressing symptoms and suffering be the sole focus?
ZENITH of decision-making in uncertainty	• After a comprehensive review of facts, an objective examination of past decisions and their results, after considering physiological principles and body mechanics, after consulting others and asking for input and help and finally, after considering if any further interventions could potentially change the patient's outcome, the time for decision-making is at hand.
EVALUATION Endpoints	• What evaluation endpoints should be set a priori?

Table 1. The STABILIZE algorithm

and see if there is a delay in response, without any change in course within the treatment plan. Uncertainty is often lauded as a concept that stimulates creativity, leads to new scientific discoveries and promotes humility. Uncertainty, when the explanation for what is happening with a critically ill patient, when it's unclear how to proceed, is distressing (Dunlop et al. 2020) and frankly isolating. Even if uncertainty is a common experience in the ICU, such uncertainty is arguably only really perceived by intensivists as a normal component of critical care medicine when it pertains to patient outcomes because of the severity of their illness and the understanding that unexpected events may occur as one navigates one's way back to health. Otherwise, in a field built on the concepts of regaining and not losing control of severe illness, normalising physiology, paying attention to details, making difficult choices and decisions and living with each of our sickest patients, moment by moment, uncertainty is terrifying and may be paralysing.

In a thematic analysis, Helou et al. (2020) have sought to address uncertainty by emphasising the need to recognise it, classify the type of uncertainty, explore stakeholder (in particular patients') perspectives and acquire knowledge while seeking to assess, synthesise and reflect on the impact of different perspectives and new information on its resolution and the ability to move forward in decision-making. Yet, in our opinion, these approaches do not provide a clear enough guide for intensivists struggling with uncertainty, whether diagnostic or treatment related—the causes of uncertainty are usually pretty clear, patients' values are usually known, or they (or their families) are unable to convey them, nor are they able to describe what they are experiencing and there are typically already a myriad of tests and results and a mass of information available. The issue is navigating through these chaotic situations.

Others have proposed the use of checklists, decision support tools, cognitive forcing strategies (self-reflection and monitoring during decision-making) and post hoc metacognitive strategies (e.g. morbidity and mortality rounds, critical incident reviews and root cause analysis) focusing on the potential for system failures to contribute to diagnostic failures, education on how decisions are made and group decision-making (Christenson et al. 2022). Christenson et al. (2022) also discuss relational reasoning, exploring concepts of analogy, anomaly, antimony and antithesis, vertical and horizontal tracing of inter-relationships of diagnosis and aetiologies and associated illnesses have the potential to mitigate bias and assist with decision-making although these strategies are not well studied in critical care. Yet, still, only some of these concepts provide the intensivist with guidance on how to move forward in the moments when facing uncertainty.

So what should happen when a patient is getting sicker, is barely hanging on, and you can't decide what to do? Our goal is to suggest ways to steer decision-making for intensivists in the face of uncertainty by proposing a clear, practical, stepwise approach, one that we have developed and honed based on self-reflection/analysis of our own clinical practices and on dissection of our teachings to our critical care fellowship trainees in the University of Toronto, Canada. For ease of recall, we are suggesting the creation of a new algorithm that reflects our common goal in such situations, which is to **STABILIZE** our patients.

The STABILIZE Algorithm in Decision-Making Uncertainty

Stop and review

In the midst of an acute resuscitation, it can be challenging to find time to stop reacting and instead take time to think. Timeouts have been recognised as invaluable in improving patient safety and outcomes in many healthcare settings, such as the OR (Borchard et al. 2012; LoPresi et al. 2021; Papadakis et al. 2019), in medication administration (Mishima et al. 2023; Tainter et al. 2018), transfer of accountability, patient transport and around procedures such as intubation, post-intubation mechanical ventilation, central lines and lumbar punctures to name but a few. The same impact of timeouts can be true with respect to dealing with uncertainty, in particular when a patient is not responding as expected to resuscitation. Some of the most important questions that intensivists can/should ask themselves are aimed at re-examining the foundations on which they began their initial resuscitation plans. These foundations begin by returning and reviewing the initial history, physical exam and investigations. Questions such as 'What do I know? What have I done so far? What has happened? What was unexpected? What do the unexpected responses/results reveal?" can help in developing a cold, hard look at the assumptions and available evidence. These questions integrate some of the concepts previously described (Christenson et al. 2022; Helou et al. 2020). Time pressures have been identified as barriers to implementing such diagnostic timeouts (Yale et al. 2022). Yet such a pause and review can assist in generating new hypotheses and/or identifying what is going wrong and perhaps open the door to answering the crucial questions of why and where we go from here.

Turn to physiology

The foundations of critical care medicine seek to understand, manipulate and normalise physiology. Understanding organ system interactions and responses to severe illness are the basic knowledge requirements to successfully resuscitate a person with a life-threatening illness. Importantly, while a lot of attention, research and guidance in critical care medicine has been paid to lung physiology and its interactions with mechanical ventilation, this is not the only physiology, nor, in a given patient, may it be the most important one at any given time. Nor does pulmonary physiology live in a vacuum. Heart-lung physiology is a more important cornerstone in an acute resuscitation of shock states—remember there is no V unless there is Q (we have been known to remind our trainees that Q comes before V in the

alphabet)— returning to concepts of "What is happening with venous return, ventricular filling, contractility and afterload? What has been done to manipulate them so far? What dynamic parameters of fluid resuscitation have been tried/assessed? What vasopressors/inotropic agents have been tried, and what is the rationale for them? Why is the patient's physiology not normalising?" can help understand what is happening to your patient and reduce the uncertainty on how to move forward. Furthermore, it is important to understand that other organs (e.g. brain, liver, kidneys, etc.) are also not idle bystanders and how they respond requires an understanding of the impact of the underlying illness on their function and of their own pathophysiological responses to attempts at resuscitation. Finally, the goal of any resuscitation is to save a person and the importance of always considering the impact of critical illness that is failing to respond to treatment on the brain – this may affect both the decisions made and the urgency of their implementation moving forward.

Admit you might have been wrong before and with the decisions you will now make

One of the most common and repeated fallacies in critical care is to fall in love with a theory of what is happening and to ignore the need for separation, and even that of eventual divorce, as scientific evidence emerges that the original premise is wrong. The emotional and psychological intensity of critical care medicine results in being prone to a multitude of biases that negatively impact any ability to solve or reduce uncertainty in decision-making. The first step is, therefore, to admit you may have been wrong, to suspend belief. Equally important is to admit you may still be wrong moving forward with whatever decisions you take. Such an approach engages cognitive forcing strategies (Christenson et al. 2022), promotes humility, avoids overconfidence, mitigates bias, will result in earlier re-evaluations of the accuracy of your hypotheses and will continue to support the generation of new ones when/if required.

Build a list of potential differential diagnoses, paths forward/ treatment options

The analysis of data up to this point, consideration of physiology, and separation/divorce from previous thinking should help create a revised list of differential diagnoses, including what the diagnosis may be and what problems are occurring. This analysis can then be used to create a list of possible interventions and trials of treatment plans as well as a series of plans, i.e. plan A, B and C., in anticipation of negative events or new challenges. Writing these down can also serve as a potential roadmap to return to if any other difficulties arise along the way.

Investigate

What information or investigations do you still need to make a decision to move forward? As new potential causes and reasons for failure to respond to resuscitation/treatments are considered, more investigations and information may need to be sought. Or existing lab work may need to be repeated. A core question with respect to any new imaging is whether such imaging is possible if the patient needs to be transported out of the ICU for it to be performed. What information will it add? How will patient safety be maintained? (Lee et al. 2019).

Listen to others

Uncertainty and not knowing what to do next is not all that uncommon when a patient fails to respond to the initial resuscitation and treatment plans. The ICU can feel like a very isolating environment, yet intensivists do not work alone. Every healthcare provider plays a vital role in getting a patient through a life-threatening illness, and our inter-professional team is highly skilled in providing invaluable observations and insights into what is happening and generating ideas as they also attempt to stabilise the patient. Consulting with other intensivist colleagues and asking consulting services for help can make a significant difference. We conceive of this process as obtaining a 360-degree perspective of what is happening rather than a group thinking process (Christenson et al. 2022), for ultimately, decision-making responsibility will rest with the intensivist.

Irreversible

Though at times difficult to acknowledge, considering whether achieving stability is not possible is crucial. When a patient is not responding to treatment, it may be that a point has been reached when all subsequent treatments will only prolong death and add to suffering. If this is the case, then open, honest conversations should occur with the patient, their substitute decision-maker and family regarding what, if any, further treatment can/will be offered, taking into account whether such treatments would still fall within the standard of care (Lee et al. 2019) and, if they do, whether they would reflect the patient's values. If no further ICU treatments would change the outcome, the focus should be on alleviating distressing symptoms and suffering, and a palliative care plan should be initiated.

Zenith

After all these steps, though they may still feel very uncertain, intensivists are at the zenith of the decision-making process in the face of uncertainty. Decisions regarding the next steps now need to be taken, knowing they have done their best to undertake these after a comprehensive review of facts, an objective examination of past decisions and their results, after considering physiological principles and body mechanics, after consulting others and asking for input and help and finally after considering if any further interventions could potentially change the patient's outcome. The decision at this point may also be one to give more time for previous treatments to work, but it is important to understand that inaction must be an active choice.

Evaluation Endpoints

The final step of navigating an urgent path through uncertainty when a patient is acutely critically ill and not responding to treatment is to devise, a *priori*, a set of signs that would indicate

either a response or a failure to respond to the newly initiated resuscitation/treatment plans. These evaluation endpoints may include haemodynamic and physiological parameters, laboratory values, active reassessments of heart-lung physiology, including echo/ultrasound, and mechanical ventilation parameters. Setting these endpoints in advance mandates a new therapeutic stop/pause during which this whole STABILIZE clinical algorithm can be repeated as required in the attempt to achieve the best possible outcomes that reflect patient wishes and values.

Conclusion

Some of the most challenging moments in critical care medicine encompass the need to make difficult, complex decisions in the face of uncertainty when patients are rapidly deteriorating and/or are failing to respond to the initial resuscitation and treatment plans. These are decisions that can haunt us throughout our careers. It is our hope that the STABILIZE algorithm may provide a path forward and help, in a small way, to reduce the anxiety and stress that intensivists feel in such situations.

Conflict of Interest

None.

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The Least Bad Decision: Crisis Standards of Care After the Pandemic

COVID-19 was an emergency that lasted for years and left few regions of the world untouched. The pandemic shone a spotlight on both the strengths and weaknesses of our disaster planning. What worked, what did not, and how can we better plan for future emergencies?

The COVID-19 pandemic forced hospitals and health systems around the world to confront shortages on a massive scale. Previous public health emergencies have strained intensive care units (ICUs), but these events tended to be time-limited, geographically restricted, or less severe. COVID-19 was unique: an emergency that lasted for years and left few regions of the world untouched. As such, the pandemic shone a spotlight on both the strengths and weaknesses of our disaster planning.

Large-scale emergencies, such as natural disasters and pandemics, lead to patient needs that exceed the capacity of hospitals to provide safely. When hospital capabilities are exceeded, careful planning is needed to provide the best available care possible under difficult circumstances. In 2009, the Institute of Medicine (IOM) in the United States defined crisis standards of care (CSC) as "a substantial change in usual healthcare operations and the level of care it is possible to deliver which is made necessary by a pervasive or catastrophic disaster" (Altevogt 2009). The goal of CSC is not to provide less care but rather to provide the best care possible under difficult circumstances, within the limitations imposed by external factors. As the IOM report put it in 2009, "in an important ethical sense, entering a crisis standards of care mode is not optional—it is a forced choice, based on the emerging situation. Under such circumstances, failing to make substantive adjustments to care operations—i.e., not to adopt crisis standards of care—is very likely to result in greater death, injury, or illness". Today, with the acute phase of the pandemic hopefully behind us, professionals in intensive care medicine need to assess the effect of our CSC plans: what worked, what did not, and how can we better plan for future emergencies?

The core pillars of CSC planning are "staff, stuff, space, and systems". Staff are the personnel needed to provide patient care in the hospital, both direct patient care at the bedside and the supporting personnel needed to maintain core hospital functions. Stuff is the material needed to provide patient care, including durable equipment such as ventilators and consumables such as personal protective equipment (PPE) and drugs. Space is the physical location for care, not only in the traditional ICU but also in overflow spaces such as emergency departments (EDs), post-anaesthesia care units (PACUs), and medical wards. Overarching all three are systems to organise care within and between institutions (Christian et al. 2014).

Crises differ in terms of severity. It has been estimated that a typical ICU can increase its capacity by approximately 20% with existing resources (Hick et al. 2014). In this conventional phase of CSC, ICUs may need to call on additional staff members to support and use caches of supplies stored in advance, but local resources should be sufficient to maintain routine ICU functions. Contingency care occurs when ICU demand increases to the point where demand is up to 100% greater than a normal census. In this phase of CSC, additional patient care spaces, including EDs and PACUs, may need to provide extended care for ICU patients; supplies may need to be conserved or re-purposed; and non-ICU-trained staff may be needed to serve as critical care extenders, such as hospitalists, cardiologists, and medical-surgical nurses. Paediatric ICUs may provide care for selected adult patients and vice versa (Wasserman et al. 2021). Despite this, the standard of care during the contingency phase is essentially unchanged, and the intent of these surge responses is to maintain a close approximation of routine operations and to avoid the need for crisis standards and triage.

The final phase of CSC is true crisis care, the time when patients' needs are greater than available resources despite attempts to increase capacity through surge responses. At this point, triage becomes necessary to identify which patients are allocated the necessary resources. During the early COVID-19 pandemic, a great deal of concern was reasonably focused on ventilator availability. Some of these efforts led to improvements in care, e.g., increased usage of noninvasive respiratory support modalities such as high-flow nasal oxygenation (Long et al. 2021). Other

efforts were less successful, such as the use in the United States of the Defense Production Act to construct 200,000 ventilators, the great majority of which were unsuitable for the care of patients with severe acute respiratory failure, and strategies such as shared ventilators where a single device would provide support to multiple patients (Branson and Rodriguez 2021). Any scarce resource may require triage and allocation, however. Continuous renal replacement therapy (CRRT) machines and circuits were scarce in many regions during the pandemic. Allocation systems were implemented for initially limited supplies of remdesivir, with reasonable success (Devereaux et al. 2022).

As noted above, the aim of triage is to provide the best possible care to the greatest extent possible in an emergency. Triage systems seek to identify patients most likely to benefit from critical care services. The ethical underpinnings of such systems can vary according to a community's standards; for example, a strictly utilitarian structure will seek to provide care to the numerically largest number of patients possible, whereas a more egalitarian system will allocate resources based on perceived needs, and a more communitarian system may place greater emphasis on social and cultural values (Maves et al. 2020). These triage systems, regarding of their underlying ethical models, should apply to all patients potentially requiring ICU care during an emergency, not just those with the pandemic disease of the moment.

The optimal "design" of a triage system is uncertain. Prior to the pandemic, it was proposed that decisions regarding triage should be made by triage teams distinct from the teams providing direct bedside care. This separation of functions would serve two purposes: first, to reduce any potential bias and ensure greater objectivity in these life-and-death decisions, and second, to reduce the moral distress faced by the bedside ICU team. Triage teams would then use diagnostic data and a variety of scoring systems to determine the likelihood of ICU survival, including metrics of short-term survival, such as the Sequential Organ Failure Assessment (SOFA) score and longer-term survival, such as the Charlson Comorbidity Index (CCI). Patients at a high risk of short-term mortality would be prioritised lower for scarce resources, such as a ventilator, than patients with a greater likelihood of recovery (Devereaux et al. 2008). It is important to note that "no ventilator" does not mean "no care". A patient not allocated a ventilator would still have access to noninvasive modalities as well as, if needed, the best available palliative care.

> **"the aim of triage is to provide the best possible care to the greatest extent possible in an emergency"**

Jurisdictions around the world rapidly adapted and published these triage plans early in the pandemic. Difficulties with these plans became apparent early on. SOFA-based triage scores were problematic in COVID-19; SOFA is highly predictive of in-hospital mortality in general ICU populations based on pre-pandemic data (Sanchez-Pinto et al. 2021), but SOFA at the time of presentation has not been shown to be strongly predictive of COVID-19 mortality (Raschke et al. 2021). Similarly, other prognostic scoring systems, such as the National Early Warning Score (NEWS), mostly appear useful in excluding the need for critical care. Low NEWS scores are prognostically favourable, but a score of 7 or greater is only about 50% predictive of either death or the need for invasive ventilation, an inadequate number for making triage decisions (Colombo et al. 2021). While there are scores with stronger predictive performances in COVID-19, e.g., the ISARIC 4C scores, they are also specific for COVID-19 and may not correlate as well with other disease states (Knight et al. 2022).

Why do these scoring systems perform poorly? One hypothesis is simple: COVID-19 is a different disease than influenza or bacterial sepsis, with (at least initially) a tendency to present with single-organ failure followed by prolonged hospitalisation and need for respiratory support. Acute illness scores, such as SOFA, may be insensitive as a result of the specific features of COVID-19. The problem with these scores, however, may be more fundamental. These scores are well-suited for many purposes, such as use as a screening test or for standardisation of acuity in clinical research; their use for crisis triage may be premature at best.

If not a physiologic scoring system, then what? Clinician assessment at the bedside is an imperfect tool for prognostication, but it performs reasonably well compared to formal scoring systems (Escher et al. 2018). Frailty is well-known to be a strong predictor for ICU mortality, independent of chronological age (Jung et al. 2021). However, all these systems carry the danger of exacerbating existing inequities. A score such as CCI or SOFA may, for example, give extra points for increased serum creatinine (and thus de-prioritise a patient for ICU resources). However, a patient with chronic kidney disease may be the victim of years of socioeconomic deprivation and limited access to medical care. Is it right, then, to penalise that person again during a public health emergency? Appreciating this imbalance, attempts have been made to account for these circumstances with tools to account for socioeconomic factors, reducing the potential inequities implicit in these systems (Kopar and Brown 2020).

Unfortunately, many triage plans did not survive first contact with the virus. Patients with COVID-19 did not present to our hospitals all at once but in a steady stream; patients needing intubation were intubated when they arrived, and first-come-first-serve was the rule rather than formal scoring by a triage team. Prioritisation systems may still be useful for less time-sensitive treatments such as haemodialysis or antiviral medications but not for emergency interventions like invasive mechanical ventilation (Troug 2021).

How should we reconsider our triage plans? If withholding intubation is not an option, time-limited trials of mechanical ventilation may be a reasonable alternative. A single SOFA

measurement at presentation may not be informative in pandemics, but serial changes in organ function over time could be more useful. It is additionally not clear that triage decisions should be separated from the bedside intensivist. While the goals of increasing objectivity and decreasing bias are praiseworthy, it is possible that we are merely transferring moral distress from one group (the primary ICU team) to another (the triage team). Subtle prognostic findings and changes over time may also be apparent to bedside intensivists but hidden from an external team. As such, triage teams made up of active attending clinicians on service, using time-limited trials as a model, may be a workable alternative to existing systems (Knochel et al. 2022).

We all hope that COVID-19 will remain a singular event in our lives, but disasters are not rare, and hope is not a strategy. We have increasing data that patient mortality rises with increasing levels of ICU strain (Kadri et al. 2021). Our priority must remain preventing crisis care and thus the need for triage. We can improve our surge responses through improved staffing, balancing patient loads between over- and less-burdened hospitals, and reducing ICU demand through public health measures such as vaccination and PPE (Dichter et al. 2022). Triage may be the least bad decision left to us in a crisis, but we need to try and make it one that we can live with.

Conflict of Interest

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Decision-Making in the PICU: Ethical Aspects in Paediatric Critical Patients

This article highlights some particularities to be considered when making decisions in paediatric ICUs and the role of parents (or legal guardians) and the physician in the dilemma involved in paediatric decision-making.

In these times, an ill individual is believed to be an autonomous moral agent to make decisions regarding their health. Decision-making inevitably requires correct information that must be provided by the healthcare team in an explicit and comprehensible manner. For that, the necessary time and adequate space should be dedicated. But what about the paediatric patient: are they autonomous moral agents?

There are emergency situations in which there is no time for informed consent. In these situations, the physician must make the decision according to their best moral judgement. In their actions, moral responsibility with a sense of holistic treatment and protection must be applied without attempting to mask a paternalistic approach. However, in most situations, which are unurgent, it is necessary to make a more considered decision involving other agents, like the child and their environment.

Paediatric Patient Autonomy

In decision-making, when it comes to competent adults, it is usually the patient, by virtue of the principle of autonomy, who consents and decides. However, when we face people who cannot express their opinion, as is the case in paediatrics, the main difficulty lies in deciding what is in the best interests of these people. How can we define the best course of action according to the interests of someone who cannot express them or even recognise them?

We will now consider the role of parents (or other legal guardians) and the role of the physician in the dilemma that may be involved in paediatric decision-making.

Ethics and law give parents the power to decide on medical interventions for minors. Their authority is ethically and legally incontrovertible. It is structured as a fiduciary function, which is exercised on behalf of and for the benefit of the incapacitated person (presuming his or her will). But should we consider all minor patients as legally incapable of making decisions? The acquisition of autonomy is a dynamic process, and logically, we cannot consider a newborn child whose decision-making capacity is nil in the same way as a seven-year-old child or a fourteen-year-old adolescent. The latter may often be capable of making decisions in matters that affect him or her from the point of view of health and who may make demands to maintain his or her privacy and autonomy from his or her parents.

An individualised study of each case is necessary to assess the maturity of the minor and the importance of the decision. It is incorrect to consider a decision on which the life of the adolescent may depend the same as others whose consequences may be less serious. The greater the complexity of the decision, the greater the degree of maturity required.

It is particularly in these circumstances that parents or other legal guardians will have a much greater role to play. The parent's view of the child's best interests will obviously be of paramount importance in decision-making. This view will often coincide with that of the physician, but at other times it may be markedly discordant, although this does not mean it is wrong per se.

Even so, there are situations in which we observe their point of view with reservation, and it is desirable they do not assume the weight of the decision:

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1. When they are unable to understand the most relevant aspects of the case.
2. When they show significant emotional instability, especially if this provokes a change of opinion between the decisions to be taken.
3. When they place their own interests before those of their children.

In the first case, it is necessary to ensure the parents' level of information is optimal. That is to say, that they understand in an accurate way the information communicated about the diagnosis, the prognostic judgements and the treatment. It is necessary to avoid technicalities and make it easily intelligible, adapting it to the parents' level of assimilation, as well as repeating it frequently and when requested.

The second and third cases are more complex. If the situation allows it and the decision can be delayed without any harm, further discussion can be encouraged later. In cases where this is not possible, the professional responsible for the patient should communicate with the unit referent and the rest of the team to establish the best course of action. It should be remembered that the doctor is also the guarantor of the patient's health. If, either because of emotional instability or because of putting one's own interests first, a family makes a clearly detrimental choice to the child, it should not be carried out. Some resources may be necessary for the family to understand the best interests of the child. The role of nursing is also key, given its constant proximity to the patient, as well as that of the psychology, social work, or spiritual care team. Even so, if disagreement persists, there is the possibility of convening the health care ethics committee and, as a last resort, taking legal action.

The Figure of the Mature Minor

From what age is a patient's autonomy considered? In Spain, for example, the legal and criminal age of majority is 18. In contrast, the age of majority in healthcare is a legal concept incorporated by the Basic Law on Patient Autonomy and is established at the age of 16 (except in exceptional situations) or by emancipation, provided that the person is not considered incapacitated or incapable. Below this age, between 12 and 16 years of age, the figure of the mature minor is recognised. The mature minor is understood as a minor with sufficient capacity to make decisions in relation to a specific action. In other words, a patient who understands the information provided by the medical staff and the situation in which he or she finds him or herself and who, in addition, gives reasonable grounds for his or her decision, weighing up the risks and benefits of the various options.

The figure of a mature minor should be recognised by the physician, who should assess the minor's capacity to make decisions in specific matters in a progressive manner according to their age, degree of maturity, development, and personal evolution. If not considered mature, proxy consent should be considered. In practice, in intensive care units, given the critical state of the patients, it is very challenging to assess the degree of maturity of the minor, and in most cases, consent by representation is assumed.

The Complex Chronic Patient

In paediatrics, a complex chronic patient (CCP) is defined as a patient with a disease, or more than one, of a long evolution and with a clinical situation that is difficult for professionals to manage. These patients represent around 5% of the population and consume approximately 65-75% of healthcare resources. They have changing needs that require continuous reassessment and necessitate the orderly use of different levels of care and, in some cases, health and social services.

CCPs are often dependent on technology (tracheostomy, home ventilation, gastric button...) and, due to their frailty, require regular hospital admissions in the context of intercurrent diseases. Both throughout the course of their illness and during these admissions, the patient's baseline situation and the therapeutic horizon (whether it will improve over time or, on the contrary, will progressively deteriorate) must be assessed, and the family must be aware of the latter. Depending on these factors and the severity of the decompensation, the place of admission for these patients should be chosen. Sometimes, these patients are subject to a therapeutic ceiling (e.g. no admission to the PICU, no resuscitation manoeuvres, etc.), especially when they do not achieve a minimum quality of life.

According to Francesc Abel, one of the pioneers of bioethics in Europe and founder of the Borja Institute of Bioethics, "human life is not a supreme good in itself but is dependent on

other values that can be achieved with it and that give it meaning". In general, it is necessary to assess whether an insufficient quality of life exists in the following cases: severe intellectual retardation, deprivation of the minimum capacity to relate to the environment, permanent immobility, and absence of cognitive and motor development. Therefore, the minimum quality of life to be preserved could be understood as a minimum capacity for affective and intellectual relationships with others.

Thus, in these patients, measures that could be provided and proportionate in other patients may be totally disproportionate and lead to therapeutic obstinacy, contrary to professional ethics. We must examine diagnostic or therapeutic medical practices that are not indicated due to the high risk of side effects and/or suffering in relation to the little benefit that can be obtained.

Positions of Vitalism-Abstentionism

In severe situations, we can define two types of attitudes that we consider incorrect as extremes of a spectrum of decision-making. On the one hand, vitalist attitudes can be proposed in situations in which it would be more reasonable to carefully delimit therapeutic actions (unrealistic or miraculous hopes of improvement or cure, cultural reasons and even acceptance of extremely complex situations that are assumed to maintain family dynamics). On the other hand, in a competitive and perfectionist society such as the one in which we find ourselves, abstentionist positions may be proposed from the therapeutic point of view, fearing precisely the survival of a child with certain disabilities or to whom they would have to dedicate more time and effort than desired.

Finally, although fortunately less frequent, there may be situations of agreement between certain healthcare professionals and the family that are not in the best interest of the patients. This can happen not merely with our PICU team but also when dealing with other teams (e.g. oncohaematology, cardiology, neurology, etc.). On the one hand, unrealistic messages or a very partial view of the patient (limited to their specialty) are sometimes conveyed to the family. Communication between the different people in charge is essential, as well as for everyone to have communication skills that allow them to speak honestly about the prognosis of different illnesses when these are relevant in relation to their quality of life and life expectancy. On the other hand, the growing interest in the diagnosis and treatment of new so-called rare diseases can lead to therapeutic obstinacy, encouraged by both specialists and families. In these situations, the proportionality of the different therapeutic measures needs to be carefully balanced, especially in the context of critical situations.

The following table outlines the various situations that can occur in the doctor-family relationship and the different problems they may present. This is obviously a theoretical level, but it allows the various aspects of the problem to be considered and analysed.

Confrontational situations can be challenging and tremendously problematic, creating situations of moral distress for intensive-care professionals.

The ideas expressed in this article may be of interest not only for decision-making in paediatric intensive care but also for many other situations in which the patient is not an autonomous moral agent to decide (neurodegenerative diseases, psychiatric pathologies, patient severity...). It is always advisable to individualise each case and invest the necessary time to clarify the situation. Currently, it is desirable that the opinion of the entire care team coincides, and consensus with the family is necessary. Every so often, the family simply requires more time to understand the situation and its implications. Even so, if consensus is not achieved or if the time is excessive to the detriment of the child, the resources previously discussed in this text should not be forgotten.

	Medical team	Family	
Concordance of criteria for the benefit of the patient	Proportionate treatment	Proportionate treatment	No problem
	Disproportionate treatment	Disproportionate treatment	No problem
Discordance of criteria	Proportionate treatment	Refusal of treatment	Problem
	Disproportionate treatment	Vitalist posture	Problem
	Vitalist posture	Disproportionate treatment	Problem
Concordance of criteria to the detriment of the patient	Vitalist posture	Vitalist posture	Severe problem
	Refusal of proportionate treatment	Refusal of proportionate treatment	Severe problem

Table 1. Problems related with different postures in the medical team-family relationship

Conflict of Interest

None.

Suggested Readings

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Decision-Making in Uncertainty – Time-Limited Trials

An overview of time-limited trials (TLT), collaborative agreements between the treating team and the patient to apply life-sustaining therapies to help reduce prognostic uncertainty and foster trust between teams and patients and/or patient surrogates.

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Introduction

Medical indication and a patient's consent form the basis of every diagnostic or therapeutic medical measure (Milliken and Sadovnikoff 2023). In intensive care medicine, particularly, making an appropriate medical indication can be a highly complex decision that requires sufficient clinical experience and knowledge, potentially consuming extensive diagnostic and therapeutic resources (Milliken and Sadovnikoff 2023; Neitzke et al. 2019). Indications often must be made at a time when not all the information required for a comprehensive treatment plan is available. Furthermore, next to the medical assessment, the treating team needs to take the patient's wishes and values into account for indication-making (Milliken and Sadovnikoff 2023; Girbes 2023). Also, the individual prognosis constitutes an important part of an indication. And as the prognosis may change – sometimes drastically – while a patient is treated in an intensive care unit (ICU), even the most thorough decisions as to indications suffer from prognostic uncertainty (Michalsen et al. 2023a; Simpkin and Schwartzstein 2016). It is, therefore, often difficult to assess whether life-sustaining treatments are (still) beneficial for the patient or whether their burden exceeds their benefits. Withdrawing such treatments can be a grave decision. At the same time, though, it is hardly ethically justifiable not to start a life-sustaining therapy out of (prognostic) uncertainty. How to resolve this impasse?

Time-Limited Trials

A time-limited trial (TLT) is a collaborative obliging agreement between the treating team and the patient to use life-sustaining therapies in a defined time period when reaching the original treatment goal is highly improbable. Its goal is to reduce prognostic uncertainty and, if necessary, change the therapeutic goal thereafter, often to comfort care only (Michalsen et al. 2023a; Simpkin and Schwartzstein 2016; Jöbges et al. 2024; Kruser et al. 2024; Michalsen et al. 2023b; Chang et al. 2021; VanKerkhoff et al. 2019; Vink et al. 2018). A TLT should always rest on a shared decision between the medical team and the patient or his/her surrogate decision-maker(s). Kruser and co-workers (2024) defined some critical elements for developing and implementing a TLT in intensive care medicine. According to this approach, a TLT consists of the following four phases: considering, planning, supporting, and reassessing.

Considering a TLT, the medical team needs to assess the patient's prognosis, the medically sensible treatment options, and the level of uncertainty under the circumstances prevailing. At the same time, it is essential to evaluate and discuss the patient's wishes and values, including the burden caused by and the probable restrictions and limitations after the intensive care treatment. For example, a patient with a respiratory condition may accept non-invasive ventilation during but not dependency on it after his/her stay in the ICU.

Planning the TLT, the medical team will approach the patient and/or the surrogate(s), especially explaining the time frame and the criteria of a positive TLT outcome, i.e. usually the improvement of the patient's condition (Jöbges et al. 2024; Kruser et al. 2024; Michalsen et al. 2023b). Choosing the right timeframe for a TLT is difficult, and suggestions in the literature vary depending on the patient's health status before treatment in the ICU, his/her present condition, and his/her treatment preferences (Jöbges et al. 2024; Kruser et al. 2024; Michalsen et al. 2023b; VanKerkhoff et al. 2019; Vink et al. 2018). The medical team needs to clarify that the therapeutic goal will need to be changed if the condition of the patient does not improve as defined by medical criteria (Jöbges et al. 2024; Kruser et al. 2024; Michalsen et al. 2023b).

Finally, the conditions of the TLT need to be documented in the health record.

Ideally agreed upon in consensus, the TLT will be supported by the whole team as well as by the patient and his/her family. In case of major changes in the patient's status, though, the duration of and/or the treatment measures during the TLT need to be re-evaluated.

Reassessing the TLT after the time period agreed upon, the clinicians and the patient and/or his/her surrogates meet again to discuss the patient's response to therapy according to the predefined clinical criteria. If the patient's condition improves during the TLT, the original treatment goal will be upheld, and therapeutic measures will be taken accordingly. If, however, the patient's condition does not improve – whereby a standstill equals non-improvement – the therapeutic goals usually should be changed to comfort care only. A second TLT must be restricted to special situations, as otherwise, decisional inertia will ensue (Jöbges et al. 2024; Michalsen et al. 2023b).

In summary, it is not mandatory for a TLT to follow a strict protocol, but its core elements are (1) considerable prognostic uncertainty, (2) a commitment to certain therapeutic measures for a limited time period, and (3) a subsequent reassessment of the situation followed by the decision to either continue life-sustaining measures or to change the treatment goal to comfort care only (Jöbges et al. 2024; Kruser et al. 2024; Michalsen et al. 2023b; VanKerkhoff et al. 2019; Vink et al. 2018). Another elementary component of a TLT is, obviously, adequate communication within the treating team as well as between the team and the patients and their relatives.

Case Report

A 55-year-old somnolent female patient was admitted to the ICU with acute liver failure and hepatic encephalopathy. Because of a hemiparesis, a computed tomography was performed, showing a big intracranial haemorrhage most likely caused by severe coagulopathy. The neurosurgeon consulted decided that surgery was not indicated.

"a TLT is a suitable instrument to prevent early surrender as well as continued suffering due to overtreatment"

The patient was treated in the ICU for several weeks, improving slowly. However, she was not able to communicate her wishes or values, nor had she appointed a surrogate decision maker before admittance. Communication with the family was considerably difficult because of a language barrier. At one point, the patient developed a fever caused by a urinary tract infection and pneumonia, and her condition deteriorated rapidly. At this time, some members of the nurses' team were concerned that the patient was no longer benefitting from ICU treatment but rather suffering needlessly. Subsequently, the local ethics committee was involved in a case discussion.

According to specialists involved in the patient's care, the neurological rehabilitation would take time but would be possible, and the liver function would most likely return to normal. They agreed that antibiotic therapy was necessary to treat the infection and could show an effect in approximately five days.

The interprofessional team decided that given the potential to regain a reasonable quality of life, it would be in the patient's best interest to continue care directed towards recovery. Because of the uncertainty about the effect of the antibiotics, a TLT of five days was suggested. The patient's family was informed about this procedure and agreed. During the TLT period, the patient's status had improved, and therefore, curative care was continued. A few days later, however, the patient showed signs of intestinal bleeding and went into haemorrhagic shock. As the bleeding could not be stopped, the treating team decided to change the treatment goal to comfort care only, and the patient died a few hours later.

Benefits and Challenges of TLTs

A key aspect of a successful TLT is adequate communication, both within the team and between the team and patient and/or the family (Kruser et al. 2024). As has been shown recently, a good ethical climate, including respectful and open communication between all ICU team members, is an important team asset as it helps diminish disproportionate care and moral distress (Van den Bulcke et al. 2020; Benoit et al. 2018). Explicitly recognising prognostic uncertainty helps navigate difficult treatment phases and arrive at individually appropriate treatment goals. When their realisability becomes highly questionable, a TLT is a suitable instrument to prevent early surrender as well as continued suffering due to overtreatment (Kruser et al. 2024; Michalsen et al. 2023b; VanKerkhoff et al. 2019; Michalsen et al. 2021; Simpkin and Schwartzstein 2016). As TLTs are primarily led by ICU clinicians, they do not require routine clinical ethics consultation.

As communication is a key feature, agreeing on a TLT can be especially difficult where language barriers or cultural differences are predominant (Metaxa et al. 2023). Another critical aspect is deciding on the right time to initiate a TLT. In our case report, it was the moral distress of nurses within the team that led to this decision. However, the freedom to raise concerns about the (present) extent of treatment depends on the work environment, as alluded to earlier. Finally, deciding on the criteria for a positive outcome of a TLT can be a complex process on its own. Advisably so, the outcome should be based on objective and reproducible parameters and the overall clinical impression – certainly not on single vital signs or laboratory values (Jöbges et al. 2024; Kruser et al. 2024). It is important to follow through accord-

ing to the prior agreement after the end of the TLT and not be persuaded into another TLT and yet another TLT (Kruser et al. 2024). If inadequately implemented, a TLT may contribute to conflicts within the team and with patients and/or surrogates. Furthermore, some prognostic uncertainty will persist despite accurate implementation of a TLT and frequent re-evaluations of the patient's course. However, decisions as to the extent of treatment need to be taken. Therefore, prognostic irrefutability should never be a goal.

Conclusion

A time-limited trial (TLT) is a collaborative agreement between the treating team and the patient to apply life-sustaining therapies in a defined time period with the overarching goal of reducing prognostic uncertainty and strengthening decision-making in the face of uncertainty. The duration and the criteria of a positive or a negative outcome – reflecting the continuation with or the change of the present treatment goal – need to be chosen with prudence and in consensus between the team and the patient and/or his/her legal representatives. Implementing a TLT may help reduce prognostic uncertainty and foster trust between teams and patients and/or patients' surrogates. Both patients' needless suffering due to overtreatment and moral distress within the teams will be diminished.

Conflict of Interest

None.

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Patient and Family Partnerships in the ICU: History, Benefits, and Strategies for the Future

The seamless integration of patient- and family-centred care in the critical care setting remains elusive. This review discusses the history and benefits of patient- and family-centred care, plus strategies for partnering with patients and families in the critical care setting.

Introduction

Patient and family partnerships in the intensive care unit (ICU) are an essential element of quality healthcare. Leading societies and organisations across the world have integrated families as key participants in shaping research priorities and improving hospital outcomes (Davidson et al. 2017; European Society of Intensive Care Medicine 2017; Feemster et al. 2018; Patient-Centered Outcomes Research Institute 2022). We define 'family' as a person or people identified by a patient as providing love, caregiving and/or support not necessarily related by blood or marriage. In this article, we 1) describe the history of patient- and family-centred care; 2) narrate the benefits of partnering with patients and families in the ICU; and 3) reflect on the COVID-19 pandemic's impact on partnerships with patients and families. We conclude with recommendations and resources to support current ICU providers in their efforts to incorporate patients and families into their daily ICU practice.

History of Patient- and Family-Centred Care

Patient- and family-centred care (PFCC) is a philosophy of care that is "grounded in mutually beneficial partnerships among healthcare providers, patients, and families" and supports patients and families in "determining how they will participate in care and decision-making". It recognises patients and families as essential allies—not only in direct care and decision-making but also in quality improvement, safety initiatives, education of health professionals, research, facility design, and policy development (Institute for Patient- and Family-Centered Care).

The family-centred care movement emerged as a major response to the widespread separation of children from their families during World War II (Isaacs 2019; Jolley and Shields 2009). Through the mid-20th century, it was common for children to be hospitalised for extended periods (Robertson 1970). Efforts to control disease spread led to restricting family visits to once a week, causing lasting psychological trauma to children (Robertson 1970). Until the 1960s, families were often kept out of the paediatric hospital care process. British researchers John Bowlby and James Robertson played pivotal roles in studying family separation during hospitalisation and advocating for the inclusion of parents in the care of hospitalised children (Alsop-Shields and Mohay 2001).

The evolution of U.S. healthcare to focus on patient-centred outcomes owes much to Avedis Donabedian's influential work. In his landmark 1966 paper, "Evaluating the Quality of Medical Care", Donabedian advocated for evaluating healthcare quality not only in disease management but also in care processes and patient-physician relationships (Donabedian 1966). His 1990 publication, "Seven Pillars of Quality", identified key aspects of healthcare quality: efficacy, effectiveness, efficiency, optimality, acceptability, legitimacy, and equity (Donabedian 1990). He explicated the importance of care acceptability as including the patient-practitioner relationship, accessibility, amenities, and patient preferences regarding care effects and costs. The

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importance of patient and family engagement was echoed in the Institute of Medicine's 2001 report "Crossing the Quality Chasm", which outlined aims for 21st-century healthcare: safety, effectiveness, patient-centredness, timeliness, efficiency, and equity (Baker 2001). These factors helped shape PFCC, and from this, PFCC in ICUs took shape.

In 2004, the Institute for Healthcare Improvement called for open ICU visitation policies (Berwick and Kotagal 2004). Despite the acknowledged importance of family presence and partnership in the ICU, barriers to family engagement remain. For example, a study of family engagement in the ICU found while 97% of family members were willing to participate in patient care, only 13.8% spontaneously participated or asked the ICU staff to help them participate (Garrouste-Orgeas et al. 2010). The emphasis on quality has led to the development of quality assessment measures like the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), the Family Satisfaction in the ICU (FS-ICU), and the Critical Care Family Needs Inventory (CCFNI) (Giordano et al. 2010; Molter 1979; Wall et al. 2007). More recent data shows families consider addressing patient psychosocial and spiritual needs as one of the most important ways they can participate in the ICU (Wong et al. 2019; Wong et al. 2020).

Benefits of Partnering With Patients and Families in the ICU

PFCC has gained prominence in critical care medicine and research in recent decades. For instance, a 2000 survey of U.K. clinicians ranked the impact of visitors on patient outcomes as one of the lowest priorities for ICU research (Goldfrad et al. 2000). However, by 2007, guidelines for PFCC in the ICU were introduced by the American College of Critical Care Medicine and updated in 2017 (Davidson et al. 2017; Davidson et al. 2007). These guidelines, along with the ABCDEF bundle—which integrates family involvement and improves patient survival and post-discharge disposition—underscore the importance of family engagement in care (Institute for Patient- and Family-Centered Care 2014; Marra et al. 2017; Pun et al. 2019). In a 2023 systematic review of randomised trials with family-centred interventions, 35 of 52 studies showed improvement in at least one family-centred outcome (Wang et al. 2023). (Tellingly, only 5 of the included studies occurred before 2010).

There is broad evidence for the benefit of using family caregivers to implement evidence-based interventions in the inpatient setting and a small but growing evidence base for their participation in direct ICU care (Dijkstra et al. 2023b; Fiest et al. 2018). Families want to participate in patient care, and ICU teams are generally supportive (Al-Mutair et al. 2013; Dijkstra et al. 2023a; Liput et al. 2016). Engaging family caregivers can improve hospital quality metrics vis-a-vis satisfaction ratings and implementation of best practices for reducing hospital-acquired weakness and delirium (Davidson et al. 2017; Fiest et al. 2018; Guerra-Martin and Gonzalez-Fernandez 2021; Rosgen et al. 2018; Rukstele and Gagnon 2013). Similarly, engaging caregivers in patient mobilisation in the hospital improves long-term patient mobility and home caregiver quality of life and reduces patient length of stay (Yasmeen et al. 2020). While clinicians and families see value in forming partnerships, the seamless integration of PFCC into ICU practice remains elusive.

A 2017 systematic review of ICU PFCC interventions demonstrated that PFCC interventions were associated with reduced ICU costs, shortened ICU length of stay, improved family satisfaction, and improved patient and family mental health outcomes (Goldfarb et al. 2017). For example, multicomponent trials of ICU patients with high risk of death by White and Curtis used nurse communication facilitators to support families; both studies showed reduced ICU length of stay (Curtis et al. 2016; White et al. 2018). In general, there is no single "silver bullet" intervention that addresses all patient and family needs for partnership in the ICU; it is, therefore, recommended that interventions have multiple components and engage patients and families as partners in multiple aspects (Xyrichis et al. 2021).

The ICU experience can provoke significant emotional stress for patients and families (Gurbuz and Demir 2023; Kose et al. 2016; Pochard et al. 2001). Individual clinician, ICU culture, and geographic area differences all contribute to a lack of standard approach for discussions about value-based treatment plans and patient preference alignment (Turnbull et al. 2016). Surrogate decision-making around potentially medically non-beneficial treatments or end-of-life treatment thresholds burdens families and patients with guilt and confusion and is associated with poor psychological outcomes (Greenleaf et al. 2023; Wen et al. 2024). Symptoms of Post-Intensive Care Syndrome-Family (PICS-F), a constellation of psychological symptoms including anxiety, depression, post-traumatic stress, and complicated grief, can affect up to 73% of family caregivers (Davidson et al. 2012; Kentish-Barnes et al. 2015; Lautrette et al. 2007; Pochard et al. 2001; Pochard et al. 2005). Furthermore, patient and family employment absenteeism and hospital financial expenses accrue additional psychological strain and suffering (Khandelwal et al. 2020; Khandelwal et al. 2018; Stayt and Venes 2019). The intersection of these and other complex variables can result in depression, post-traumatic stress, anxiety, and care that is often inconsistent with the patient's previously expressed preferences

(Vrettou et al. 2022). Embracing PFCC in the ICU is one way clinicians can help to mitigate emotional stress and PICS-F (Love Rhoads et al. 2022).

The emotional burden families carry can be exacerbated by communication breakdowns between physicians and surrogate decision-makers of critically ill patients (Connors et al. 1995; Ito et al. 2023). Provider disruption in the continuity of care, insufficient clinician training around palliative care, and difficult conversations are just a few of the barriers to successful communication with patients and families in the ICU and highlight the lack of consistent patient- and family-centred systems (Connors et al. 1995; Pochard et al. 2001; Schwartz et al. 2022). Recognising the essential role PFCC has in the care of critically ill patients is paramount to ensuring the successful transition of recovered critically ill patients and their families to healthy lives. Interventions to improve surrogate decision-making may reduce ICU length of stay without changing the mortality rate (Bibas et al. 2019). Overall, taking a proactive, structured approach to foster open communication, provide surrogate support, and engage families in treatment and medical decision-making is essential for PFCC (Azoulay and Sprung 2004; Lautrette et al. 2007; Schwartz et al. 2022).

Learnings from COVID-19: Family Partnerships and Presence in the ICU

The Institute for Patient- and Family-Centered Care (IPFCC) is a non-profit organisation based in the United State providing leadership in understanding and advancing the practice of PFCC in all care settings. As part of its mission, IPFCC champions family presence and participation through its ***Better Together*** campaign (Institute for Patient- and Family-Centered Care 2014). The campaign embraces families as essential members of the healthcare team and reduces restrictions on their presence and participation (Dokken et al. 2020; Dokken et al. 2015).

In Spring 2020, faced with the tremendous uncertainty of the COVID-19 pandemic, severe restrictions on family presence were imposed by health systems globally. The sudden and widespread implementation of these restrictions led to serious consequences and harm to ICU patients, their families, clinicians, and staff. For example, a study of ICUs in 49 Michigan hospitals documented high rates of delirium and sedation requirements in patients with COVID-19, two conditions that are reduced by increased access to family members (Valley et al. 2020). Unable to visit loved ones in the hospital, family members had increased psychological distress (Heesakkers et al. 2022).

To better understand the impact of visitor restrictions, IPFCC partnered with health systems in an engagement project, *"Learning from Experience: Exploring the Impact of Approaches to Family Presence in Hospitals During COVID-19"* (Institute for Patient- and Family-Centered Care 2023a). The project's purpose was to learn directly from patients, families, and healthcare workers about the impact of the restrictive family presence policies during the pandemic. Not surprisingly, the restrictive policies negatively impacted patient care, communication, information sharing, decision making and the emotional well-being of clinicians, families, and patients. Derived from participants who experienced hospital settings during COVID-19, these themes reinforce the benefits of family partnership (Institute for Patient- and Family-Centered Care 2023a). The IPFCC project was able to capture quotes from participants that illustrate the helplessness felt by patients, families, and clinicians when families are not allowed to be present and participate in the care of their loved ones (**Table 1**).

Despite growing evidence about the negative consequences of restricting family presence, many hospitals have not returned to pre-pandemic levels of open visitation and welcoming family members as partners and allies (Fernández-Castillo et al. 2024; Marmo and Hirsch 2023; McTernan 2023). Emerging and anecdotal evidence suggests this is a global phenomenon (Fernández-Castillo et al. 2024).

Strategies for Increasing Patient and Family Partnership

Involving Families in Care

Family members know the patient, their health history, and how care is managed at home—their deep understanding of their loved one provides a humanistic context for the patient's care in the ICU. Clinicians should be prepared to use a consistent and standardised approach in partnering with patients and families. Useful guides for families about how they can be involved in care

Stakeholder	Quotation
ICU patient with COVID-19	*I had the shakes really bad ...all I wanted was to FaceTime my kids, my husband, and my friend. I couldn't communicate, and there was nobody there to help me communicate with my words.*
Family member of a patient in the ICU during the pandemic	*It was devastating. Because, like I said, I could not be there for my mom... So [I] have to really trust these medical professionals to take care of her the way that I had always taken care of her... That was very, very hard.*
ICU frontline healthcare clinician	*It was really, really, really hard to stand there as people would pass away or people would get sicker... standing with this iPad, showing this person their family member, and they're just devastated, and there's absolutely nothing I can do besides stand there with an iPad.*

Table 1. Representative quotations from hospital visitation restrictions during the COVID-19 pandemic. Source: *Learning from Experience: Exploring the Impact of Approaches to Family Presence in Hospitals During COVID-19* (Institute for Patient- and Family-Centered Care 2023a)

Role	Description
Preserve patient individuality	Create a story board that shows the patient's humanity and supports physicians and staff to see the patient holistically (Ahmad et al. 2023).
Comfort the patient	Families can comfort the patient through gentle touch, applying lotion, light massage, being bedside, reminiscing, reading aloud or playing games (Dijkstra et al. 2023a; Momeni et al. 2020).
Provide care	Based on personal preferences and in consultation with ICU staff, families can help with care activities such as personal hygiene (e.g. combing hair, applying lip balm, bathing) and range of motion for mobility (Amass et al. 2020; Dijkstra et al. 2023a; Wyskiel et al. 2015).
Assist with communication	Serve as healthcare proxies and advocates by adding information to whiteboards and patient portals and assisting with technology or writing what the patient wants to say (Seaman et al. 2017).
Share clinical observations	Families observe subtle changes in patients (e.g. pain, altered mentation, and other concerns) and should be encouraged to bring them to the attention of the clinical team (Schwartz et al. 2022).
Keep an ICU diary	A log of the ICU experience written either by the family or in collaboration with ICU staff can help patients process their time in the ICU (Davidson et al. 2017; Mcilroy et al. 2019).
Participate in planning and decision-making.	Include families in rounds, change of shift, and other care planning meetings where important information is shared and decisions are made (Calderone et al. 2022; Davidson et al. 2017).
Support ongoing healing and recovery.	This is important when patients are transitioning to a different level of care (Ghorbanzadeh et al. 2022).

Table 2. Partnership roles for families in the ICU

Role	Description
Invite families to participate in daily rounds and shift change	Include in and educate about the purpose of rounds and change of shift invite observations, concerns, and questions (Calderone et al. 2022; Davidson et al. 2017).
Enable flexible, multicultural family participation.	In some cultures it may be preferable to engage a larger group of family in decision-making rather than one or two key individuals. In-person interpreter services or telehealth alternatives are essential (Jones 2023). Facilitate expanded in-person visiting hours as well as video visits.
Support a culture shift that relies on families being involved in care activities.	Families can assist with care according to their own preferences and patient appropriateness. Identify appropriate care activities and coach families to safely provide care (Amass et al. 2020; Momeni et al. 2020).
Participate in internal education and training.	Training workshops on relationship building, communication, shared decision-making, and minimising bias promote family-clinician partnerships in care (Dijkstra et al. 2023a).
Provide feedback systems	Implement systems that enable families to follow up if care is discriminatory. Enable systems that allow families to provide feedback anonymously.
Provide robust support for spiritual care, especially at end-of-life	Inquire about and respect spiritual beliefs such as the inclusion of church leaders and end-of-life practices such as deathbed vigils, last rites, and handing of body.

Table 3. Partnership roles for ICU clinicians

and decision-making are available online (European Society of Intensive Care Medicine 2017; Institute for Patient- and Family-Centered Care 2014; Minniti and Abraham 2013).

Involving families in care requires commitment from both families and healthcare professionals. To effectively integrate families as care partners, it is critical to provide families with clear expectations of their roles. These include: 1) maintaining the patient's identity, i.e., enabling clinicians to understand the patient within their life's context; 2) assisting with communication between the patient and healthcare team, including shared medical decision-making; and 3) acting as advocates for the patient (Ahmad et al. 2023; Calderone et al. 2022). Families can collaborate with staff to keep a diary to help patients process their time in the ICU. These diaries are associated with improved patient quality of life, decrease depression and anxiety, and may also reduce family caregiver post-traumatic distress (Mcilroy et al. 2019). A more detailed list of family roles can be found in **Table 2**.

Clinicians and healthcare staff can: 1) offer options for communication, including personalised technology and translation services; 2) encourage patients and families

Role	Description
Form patient and family advisory councils (PFACs)	PFACs can help improve bedside care and communication, contribute to PFCC environmental design and participate in quality improvement (QI) and research (Minniti and Abraham 2013). Engage patient and family partners in all phases of QI initiatives, from needs assessment to intervention development, implementation, and outcome evaluation.
Be inclusive	Ensure that councils, committees, and work groups are representative of the population served and include members who have been historically under-represented or marginalised (Institute for Patient- and Family-Centered Care 2023b).
Engage in narrative medicine through sharing experiences	Patients and families can provide constructive feedback: what went well, what could have gone better, and ideas for improvement (Minniti and Abraham 2013). Ask patients and families to share their experience and educate ICU health professionals, students, or trainees (Loy and Kowalsky 2024).
Collaborate	Collaboration among patients, families, and clinicians is nuanced, requires navigating power dynamics, and may be more successful using mentors and training sessions (Minniti and Abraham 2013; Patient-Centered Outcomes Research Institute 2021).
Prepare for specific initiatives.	Projects should centre on a specific topic and/or methodology. This allows for training that is relevant to the topic and explains models, methods, or processes that support effective participation (Minniti and Abraham 2013).
Evaluate collaboration	It is essential for sustainability to regularly assess the collaboration by capturing informal and formal candid feedback (Hamilton et al. 2021; Minniti and Abraham 2013). Outcomes of QI should be stratified by marginalised groups (i.e., race and ethnicity at minimum). This data can inform training and programme development.
Provide compensation	Patients and families should be appropriately compensated at a level that matches their time and effort. Compensation can be offered in various ways, and out-of-pocket expenses such as transportation or parking should be covered by the organisation (Dhamanaskar et al. 2024).

Table 4. Partnership roles for former patients and clinician leaders in improvement and change

to participate in rounds and change of shift, and educate them about the ICU environment, the purpose of rounds and shift change sign out; and 3) encourage families to ask questions, provide observations and assist with care activities according to the family's preferences (Calderone et al. 2022). Ultimately, ICU clinicians should strive to engage families in caring for patients and shared medical decision-making (**Table 3**) (Dijkstra et al. 2023a). A useful guide for clinicians and staff is available online (Institute for Patient- and Family-Centered Care 2014).

Involving Patients and Families in Improvement and Change

Former ICU patients and family caregivers have insight into the needs, values, and experiences of patients and families. Close partnerships—through collaborative committees, patient and family advisory councils, formal evaluations, and feedback systems—ensure patient and family voices are represented in organisational change (Schwartz et al. 2022). Partnership with patients and families is facilitated by identifying barriers, exploiting facilitators, and achieving buy-in at each level of engagement (Kiwanuka et al. 2019). An important consideration is ensuring that patients and family partners represent diverse perspectives and backgrounds, including diversity of race, ethnicity, religion, gender, education, socioeconomics, and disability status. Information about engaging former patients and families in change can be found in the resource, *Essential Allies: Patient, Resident, and Family Advisors* (Minniti and Abraham 2013). Additional strategies for improvement and change can be found in **Table 4.**

Conclusion

We discussed the importance of PFCC and patient and family partnership in the ICU for achieving high-quality healthcare. Organisational leaders, clinicians, and community members recognise the value of these partnerships for inpatient and outpatient care and the improvement of health systems. Buy-in and conscious integration of family partnerships in the ICU are required from clinicians, policymakers, and other non-clinical staff to achieve the desired cultural shift. The tables offer resources and recommendations that we hope will serve as a starting point to help interested parties implement PFCC worldwide.

Conflict of Interest

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When Hospitals Shrink: Preventing Loss of Hospital Beds Through Effective Bed Management

With an ageing population and more sophisticated treatments, hospitals must become more bed-efficient or risk contracting. Strategic management is needed since ineffective bed management can reduce bed availability.

Introduction

There are multiple challenges for healthcare institutions in the coming decades. Important demographic changes are taking place in most countries in the world, demonstrating a progressive ageing of the population. By 2030, 1 in 6 people in the world will be aged 60 or over. This portion of the population will increase from 1 billion in 2020 to 1.4 billion. By 2050, it will double (2.1 billion). The number of people aged 80 and over is expected to triple between 2020 and 2050, reaching 426 million. Even though it is believed that this process is inherent to developed countries, the fact is that in 2050, two-thirds of people aged 60 or over will be in poor or developing countries (WHO 2022). Worldwide, there has been an increase in life expectancy, with a global average of 73 years in 2023 (WHO n.d.), reaching more than 80 years in some developed countries. A greater prevalence of chronic diseases leads to a greater number of medical consultations in emergency rooms, as well as admissions. Patients aged 65 or over accounted for 32.7% of medical consultations in the United States in 2018, although they account for approximately 16.7% of the American population (CDC 2021). These patients are also those who remain in the hospital for longer periods, as they are physically fragile. The need for beds is becoming increasingly greater, and healthcare institutions are increasingly under pressure to meet this demand. In Brazil, many hospitals work with high occupancy rates (Power360 2022), making increasingly efficient bed management necessary.

Hospital Bed Management Must Be Proactive, Not Reactive

Increasingly, hospital bed management (HBM) is seen as a marker of quality. Purely reactive responses to demands must be a thing of the past, making it necessary to search for an adequate turnover of hospital beds constantly proactively. Many institutions, however, have difficulties in unifying efforts between sectors, which have an interdependent relationship. An adequate HBM in one or two sectors of the hospital will have little effect if it is not replicated in other areas. Most sectors function as receivers and suppliers of patients in relation to the other, with one role or the other predominating. The Intensive Care Unit (ICU), for example, is responsible for receiving critically ill patients from all sectors of the hospital. Given the reality of a lack of beds for critically ill patients in Brazil and around the world, the beds in these units become especially valuable, both from an institutional and regional point of view, as it is not uncommon for patients

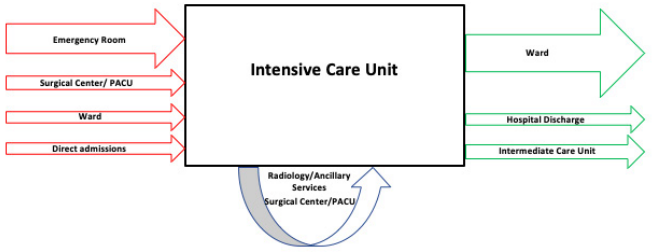

Figure 1. Admission and discharge of patients in the Intensive Care Unit. PACU (Post-Anaesthesia Care Unit)

to be transferred between hospital units in search of this type of support. Within the hospital, patients in the emergency room (ER) and infirmary are constant candidates to occupy an ICU bed **(Figure 1**). Therefore, it is very important that patients are discharged as soon as they are clinically fit to do so, freeing up space for more seriously ill patients.

On the other hand, lack of turnover in the ward beds can also compromise the ICU as it is the main destination for discharged patients (**Figure 2**).

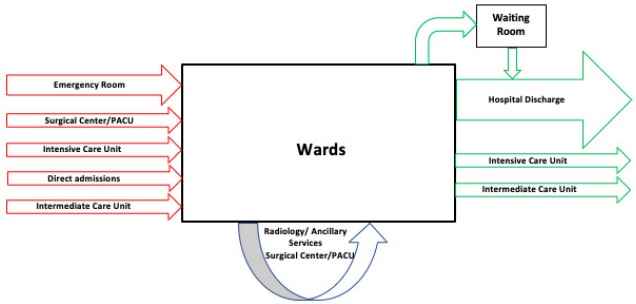

Figure 2. Admission and discharge of patients in the wards. PACU (Post-Anaesthesia Care Unit)

Intermediate care units, surgical centres, and emergency rooms (ER) are also interdependent, as they send and receive patients from all sectors (**Figures 3, 4 and 5**).

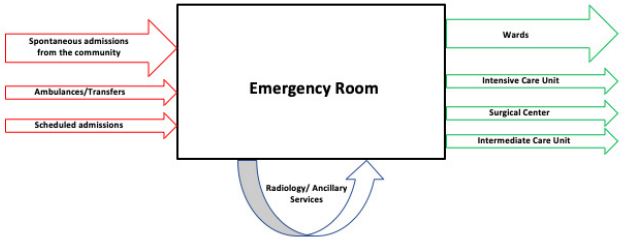

Figure 3. Admission and discharge of patients in the emergency room.

The ER is particularly sensitive and prone to inadvertently accumulating patients, as it depends heavily on other sectors to rotate its beds. Instilling a proactive HBM culture, with responsibilities and duties for employees, is very important so that there is no backlog of patients in the most varied sectors.

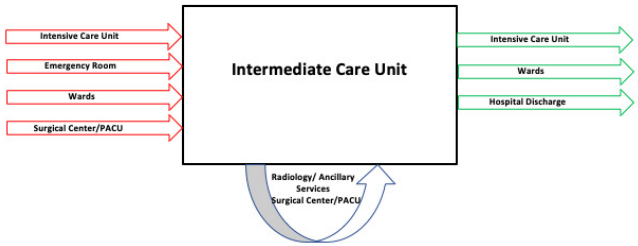

Figure 4. Admission and discharge of patients in the Intermediate Care Unit. PACU (Post- Anaesthesia Care Unit)

A microsystemic view may predominate in a certain area of the hospital, generating a negative impact on all others, as it is not uncommon for professionals in a certain sector to underestimate the institutional impact of their decisions.

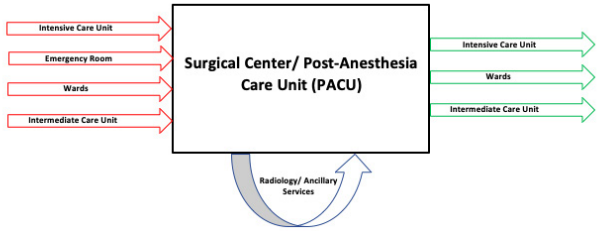

Figure 5. Admission and discharge of patients in the Surgical Centre/Post-Anaesthesia Care Unit

Barriers to Adequate Hospital Bed Turnover

There are many barriers to achieving an adequate turnover of hospital beds (**Table 1**). Among them, one that attracts the most attention is the lack of transparency regarding the beds available in the hospital. The value of a hospital bed is very high, especially when it comes to public health, and therefore, this is a resource that must be managed in the most transparent way possible. There should be no major bureaucracy so that nurses and doctors can access an electronic map of hospital beds, which shows which are available and in which sectors. The electronic system must replace other less efficient methods, such as telephone calls between sectors. Furthermore, each hospital must have a section responsible for managing the flow of patients and allocating them to the part of the hospital best suited to their needs, according to the severity and risks involved. To this end, it is necessary to establish criteria for admission to infirmary and ICU beds. In the United States and Canada, this section is colloquially called "bed flow" and is generally composed of nurses responsible for the institution's HBM. At a more advanced stage of bed management, it will be possible to view not only the institution's beds but also those of other hospitals in the region, allowing for more efficient regional regulation. Some Brazilian hospitals in the Unified Health System (SUS- Sistema Único de Saúde) have an Internal Regulation Center (NIR- Núcleo de Regulação Interna) (Ministério Da Saúde 2017), responsible not only for internal bed management but also for contacting the Health Service Offers Regulation Center (CROSS- Central de Regulação de Ofertas de Serviços de Saúde) (Alesp 2016). Through CROSS, it is possible to obtain resources not available in a specific hospital unit, such as ICU beds, consultations with a medical specialty, and laboratory or imaging tests.

Delays in obtaining a suitable bed contribute to another problem, which is the delay in starting medical care. Slow clinical processes are an important source of delays in the discharge and bed turnover process. Low adherence to evidence-based medicine delays clinical recovery, highlighting the importance of clinical leadership. Other frequent causes are the delay in test results or the lack of specific resources to obtain diagnoses, such as an MRI exam. It is also worth highlighting the occurrence of preventable adverse events, such as falls or infections associated with low-quality care. The lack of protocols for treating the main pathologies treated in the hospital environment, such as stroke, acute coronary syndrome, urinary tract infection, community-acquired pneumonia, and sepsis, among others, increases the morbidity and mortality of these diseases and the length of stay in hospital. It is also important to have other protocols: to avoid bronchoaspiration, prophylaxis of venous thromboembolism and stress ulcers, patient disinvasion, oral hygiene, weaning of mechanical ventilation and oxygen use, intravenous contrast

Lack of transparency regarding available beds
Absence of sectors responsible for internal regulation of beds
Insufficient criteria for admission to infirmary and ICU beds
Slow clinical processes
Low adherence to evidence-based medicine
Delays in laboratory and imaging test results
Lack of specific resources to obtain diagnoses (e.g. MRI)
Adverse events and complications (e.g. infections, falls, iatrogenic events)
Low quality assistance
Lack of protocols to treat the most prevalent diseases (stroke, acute myocardial infarction, sepsis, polytrauma, etc.)
Excessively bureaucratic hospital discharge processes
Social issues
Delays in transporting patients between sectors
Slow release of medicines by the pharmacy
Pharmacy far from healthcare sectors
Delay in sterilisation of materials
Delays in bed cleaning
Lack of fasting protocol for surgical patients
Slow operating systems/outdated computers
Failures in the maintenance of the hospital's physical structure

Table 1. Barriers to adequate bed turnover

injection, use of vasoactive drugs, precaution contact and isolation, palliative care, heparinisation, glycaemic control, analgesia and sedation and haemodynamic monitoring. The idea is that there is prophylaxis of common complications in the hospital environment, which are factors that increase the length of stay. Other protocols seek to speed up the removal of medications and devices that cause complications when they remain in the patient for an unnecessary time, such as vasoactive drugs, analgesia and sedation, venous catheters, and supplemental oxygen.

Slow bureaucratic discharge processes also constitute a considerable barrier. Prioritising medical discharge during the clinical visit in the morning should be a priority for the service, preferably by 10 am. When medical discharge occurs early, it becomes easier for the family to organise themselves to remove the patient from the institution. Medical discharge efforts begin when the patient is admitted to the hospital and include the preparation and dissemination of a booklet for families guiding the discharge process and providing instructions regarding schedules, means of transportation and medical advice. The expected day of discharge must be widely publicised among family members and staff so that there is a certainty that all issues have been adequately addressed, such as pending exams, medications for continuous use and instructions for home. It should be noted that most of the time, the failure to meet the expected discharge date is related to family issues, and therefore, opportunities to guide the patient's family are important. Social cases in which the family claims to be unable to care for the patient must receive special attention, as they often result in very prolonged hospitalisations.

The Role of the Clinical Leader in the Bed Management Process

A gain of a few hours in the patient discharge process has a significant impact on the number of effective beds in a hospital. A 6-hour reduction in the average length of stay for patients in a 300-bed hospital is similar to adding 12 beds to the institution (**Table 2**). If the average length of stay is reduced by one day, the impact is similar to the addition of 49 beds in the hospital (Clinical Operations Board Advisory Board International 2009).

There is no doubt that the role of the clinical leader becomes important, as it will implement evidence-based medicine, seeking to streamline clinical processes. Each sector of the hospital must have a medical leader responsible for seeking answers to the following questions pertinent to each patient: (1) what is the patient's clinical status? (2) what is the patient's functional status? (3) what is the goal to be achieved for the patient's discharge? (4) what is the plan and goal to be achieved today? (5) what is the expected date of hospital discharge? Discharge efforts begin at the time of admission; therefore, such questions should be asked from the first day of hospitalisation.

Associating a management vision with clinical care is a differentiating factor for good clinical leaders and is not something that is actively taught in most medical schools. This managerial and proactive vision regarding HBM is much more integrated with nursing than with doctors (Soares et al. 2016). It is urgent that notions of hospital management are part of the medical curriculum, associated with better knowledge in urgency and emergency, in addition to intensive care. The clinician who makes the biggest difference in the hospital environment is the one who knows how to recognise and act in high-risk situations for the patient, which in itself is already a challenge. However, it is necessary to go further: the doctor needs to have a comprehensive view of the functioning of the hospital and how his actions impact its functioning. Poor management of hospital beds "shrinks" the hospital, reducing the number of beds available to the population. The responsibility for an adequate HBM lies with everyone who works in the institution, from employees linked to bureaucracy to those who process and carry out exams to professionals linked to assistance. A good clinical leader will lead these processes.

It is necessary for discharge but with safety and quality. Precipitous hospital discharges increase hospital readmission rates and worsen the view that the population and professionals have of the institution. In the ICU, hasty discharges also increase the rate of readmission to the unit, in addition to increasing mortality

Number of hospital beds / Reduction in hospital length-of-stay time	200 beds	300 beds	400 beds	500 beds	600 beds
0.25 day	8	12	16	20	25
0.50 day	16	25	33	41	49
0.75 day	25	37	49	61	74
1.00 day	33	49	65	82	98
1.25 days	41	61	82	102	123
1.50 days	49	74	98	123	147

Table 2. The number of hospital beds gained through the reduction of hospital length-of-stay is proportional to the hospital in number of beds. Adapted from Next Generation Capacity Management: Collaborating for Clinically Appropriate and Efficient Inpatient Throughput (Clinical Operations Board 2009).

and the risk of events such as falls and cardiorespiratory arrests in the ward.

Other Bottlenecks That Increase Hospital Stay

Ancillary services support general hospital operations but are not directly related to patient care. We can cite as examples the laboratory, radiology service, pharmacy, nutrition, social services, cleaning, sterilisation of materials, maintenance and IT services (Information Technology). Delays in releasing laboratory results can significantly delay a patient's discharge, as well as lead to errors in the treatment of the patient's pathology.

In relation to radiology, much of the efficiency of this sector is related to the speed at which reports of the exams are released. Even if there are no doctors available to discuss or release reports, ideally, they should be released remotely online. It is important to emphasise that the radiology service also depends on the internal transport of patients so that they can be taken to their sector, as many exams, such as CT scans and MRIs, will not be carried out at the bedside.

The release of medicines by the pharmacy is also a relevant factor, and there are organisational details that make a difference. The pharmacy must be decentralised and close to the location it intends to serve, such as the ICU and emergency room. Each hospital unit has its own specific demand, which will be met by the pharmacy subunit in its sector. Maintaining a centralised service in a single pharmacy will result in employees having to travel long distances to obtain medications, delaying care and treatment.

Offering a diet to the patient has an impact on the length of stay, particularly in relation to post-operative patients. When recovering from major abdominal surgeries, acceptance of the prescribed diet and administration at the correct time is a factor in speeding up discharge, benefiting both the patient and the hospital. On the other hand, when a diet is inadvertently offered to patients who are fasting for surgery, the day of the procedure and the time in the operating room are lost, resulting in multiple losses. Failures in the material sterilisation service can also delay surgeries and other procedures due to a lack of sterile surgical drapes, gowns and surgical material.

Cleaning the beds is also part of the discharge process in the final phase. It is important that it begins without delay, aiming to make beds available early for new admissions. The cleaning team's response time, once called, must be less than 20 minutes, and the time actually spent cleaning the bed must be less than 40 minutes, with a total time of less than 1 hour (Brown and Kros 2010). Once completed, the time involved in transporting patients to their bed after admission must be assessed, which should not take more than 15 minutes. It is expected that the employee responsible for transporting patients will be able to carry out an average of 3 to 4 transports per hour.

Social cases in which the family claims to be unable to care for the patient must receive special attention, as they often result in very prolonged hospitalisations. There are cases in which hospitalisation lasts for years. A proactive social service is necessary to seek solutions for these patients, whether by actively contacting the family or helping them obtain resources that facilitate patient care.

Proper maintenance of equipment avoids delays due to machinery failures. The maintenance service will take care of this, as well as repairs to the hospital's physical structure, allowing the institution to operate at its full capacity. Failures in the hydraulic system, infiltrations, and malfunctions in the oxygen and vacuum systems are examples of problems that can render a bed or entire hospital wards unusable and must be prevented and resolved quickly.

The IT service resolves problems related to operating systems, such as electronic medical records, image viewing and laboratory exam systems, and internet network maintenance. Failures in any of these systems directly impact care and all hospital sectors. The lack of operation for just one day of any of them can generate chaos. Therefore, it is necessary to use contingency plans when problems arise so as not to freeze assistance activities. Manual filling forms must be available in order to alleviate the lack of electronic systems. Another problem related to IT that impacts the speed of processes is updating machinery, as outdated computers can make operating systems extremely slow or even lead to failures when using them. Hospitals with poor internet networks or obsolete machines often make it difficult for staff to complete electronic medical records. The impact of this obstacle should not be underestimated, as healthcare professionals usually spend up to 40% of their time in the hospital recording their care.

The Most Common Root Causes

In a systematic review of the causes of patients remaining in hospitals for a long time, Ahlin et al. (2022) listed process delays, insufficient capacity, inefficient coordination of available resources and high variability in capacity utilisation as the root causes of all barriers to adequate bed rotation.

The time taken to start or end an activity in the hospital, such as surgeries, diagnostic tests, sector transfers and test results, affects the time the patient remains in the hospital (Johnson et al. 2020). It takes time to start the discharge process for patients who are already able to being released is also an example of delay in processes.

Innovative management of hospital capacity and efficient processes will not always be able to resolve the fact that the hospital does not have enough beds or well-designed staff to deal with a given demand. In Brazil, it is common for both factors to be far from what is necessary. The lack of triage nurses, doctors, clerks, flow coordinators, pharmacists, and employees in the sectors responsible for exams is an important cause of delays. Lack of machinery is also a reason for wasted time in processes (for example, lack of available computers).

High variability in capacity utilisation is a factor that is independent of the service but can significantly impact bed turnover. The recent COVID-19 pandemic generated a major resource crisis, with many hospitals needing to make emergency hires and a spatial relocation of their sectors, notably the ICUs. Although the poor results in the treatment of intubated patients are closely related to a lack of human resources (Batista et al. 2022), the impact caused by the lack of physical space and equipment should not be underestimated. Several discussions about the real space that ICUs should occupy in hospitals were initiated, with arguments for and against the increase in these units (Valley and Noritomi 2020; de Lange et al. 2020; Phua et al. 2020). Modern hospitals must have flexible and adaptable bed sizing in the face of possible emergency situations. Unfortunately, recurring viral pandemics are a global reality (Cheng et al. 2007), and other emergencies will arise.

Use Of Indicators: Making a Diagnosis of Hospital Bed Turnover

Hospital Length of Stay

Hospital length of stay (HLS) is defined by the period that a patient remains in the hospital from the day of admission until discharge. A high proportion of patients remain in the hospital excessively, generating low productivity per bed. The health system has become increasingly competitive, and there is a growing demand for reducing hospital stays and care costs (Ministério Da Saúde 2013). Length of stay is a marker of bed turnover and, therefore, the number of patients treated in the hospital in a given period of time. The period of time covered must be longer than the length of stay; otherwise, there will be no bed turnover and turnover assessment. There are several ways to calculate this indicator.

In short-stay hospitals, the calculation must involve the number of hospital entries and exits and is done as follows:

HLS=(number of patients who were admitted in the period)/(number of patients who left the hospital in the same period)

Long-stay hospitals can be calculated as follows:

HLS= (sum of days of hospitalisation for each patient in the period)/(number of patients in the same period)

The interpretation of the results is important, and the type of procedure performed, the disease profile of the patients, and their social status must be taken into account. It will be up to the manager to carry out an adequate reading of the numbers, as a hospital in which many patients are hospitalised beyond the necessary time because they cannot obtain external resources quickly (for example, haemodialysis clinics, performing coronary angiography or obtaining heart surgery) will certainly have this indicator highly impacted by the delay. Patients with a fragile social situation in more impoverished areas also end up spending long periods hospitalised in health institutions, as they cannot find caregivers at home or are homeless.

Hospitals with an eminently surgical and low-complexity profile will have a shorter average length of stay than those in which the patients admitted are mostly clinical and highly complex, with multiple comorbidities. It should also be noted that the occurrence of in-hospital complications (such as nosocomial infections, falls, and other adverse events) also negatively impacts this metric, inadvertently expanding the length of stay. It can also be calculated in patient days as follows:

HLS=(number of patient-days in the period)/(number of departures in the period)

Patient-day is the unit of measurement representing the service or assistance offered to the patient who stayed overnight in the hospital. Therefore, the number of patient days will correspond to the number of patients staying overnight in the hospital each day. The final number of patient days in the month, for example, will be the sum of patient days for each day over the 30 days. To count departures, we must add the number of discharges, deaths, and external transfers that occurred in the hospital over that period of time. According to the National Supplementary Health Agency, in hospitals for acute patients, the average length of hospitalisation should be between 3 and 5 days, and it will be highly influenced by the complexity of the patients (age, number of comorbidities, severity, and complexity of resources necessary). Psychiatric and pulmonology hospitalisations tend to have a significant impact on these patients, as these patients are hospitalised for a prolonged period of time. Three large institutions on the outskirts of São Paulo and Salvador (Hospital Municipal de Cidade Tiradentes, Municipal Health Secretariat of Diadema and Hospital do Subúrbio de Salvador) presented between 2011 and 2012 a hospital length of stay estimated between 3.5 and 6.4 (Ministério Da Saúde 2013). In the Brazilian public health system, the delay in obtaining some medium and high-complexity resources, such as haemodialysis or heart surgery, ends up greatly increasing this indicator. It is not uncommon for patients to remain in hospitals for weeks due to the delay in obtaining these resources.

Occupancy rate

This is a fundamental indicator for evaluating the hospital's turnover and service capacity (Ministério Da Saúde 2012). It can be applied to the hospital as a whole or to each sector individually, allowing a specific analysis of a given department. It is even possible to compare the value obtained for the entire institution with that of a sector, allowing adjustments in the number of beds according to demand. It is calculated by dividing the number of patients treated on a given day by the number of beds available on that same day, as described below:

Occupancy Rate = (number of patients occupying beds in one day)/(number of beds available in the same day) x 100

The result will be expressed as a percentage.

Patients who are under observation and who will be released quickly should not be taken into account. However, in the Brazilian reality, where several patients remain inadequately hospitalised in emergency beds that should be for observation, these patients must be included in the count, as they remain in the hospital for several days. The situation in public hospitals in Brazil shows a large number of patients on stretchers and other temporary beds, and these beds should not be included in the calculation as they are not official beds with adequate infrastructure, or a multidisciplinary team designed to care for these patients. Therefore, these institutions most likely also have fully occupied wards and Intensive Care Units, which would constitute an occupancy rate greater than 100%, compatible with the overcrowding they experience. As extra beds are not included in the calculation and patients are, there are more patients than beds.

On the other hand, if we have a certain sector with an occupancy rate of 50% and the hospital's general rate is 70%, it would be appropriate to resize beds and resources, reducing them for the sector with the lowest occupancy rate. However, it is necessary to assess whether this trend is confirmed in other periods of time (following days, weeks, or months). There is a seasonality in the occupancy rate and patient flow in emergency rooms, for example. School vacation periods tend to reduce the number of emergency room visits and, consequently, the number of hospitalisations. On the other hand, viral pandemics such as COVID-19 can greatly increase this same flow in the opposite direction. It is necessary to take this data into consideration when resizing.

Return on Investment

Return On Investment (ROI) is a calculation that will quantify how much a given investment was worth within the context of the hospital (AHRQ). For example, if the hospital carries out an expansion process, aiming for an increase in revenue, the ROI will be able to assess whether the cost-benefit ratio of the investment was good or not. It is possible to apply this calculation to procedures performed on patients, care provided by healthcare professionals, profitability of departments, or the implementation of protocols and educational measures. The idea is to calculate how much each of these interventions generated in expenditure and return for the institution as follows:

ROI= (revenue - initial investment)/(initial investment)

ROI, for example, can be decisive in the evaluation of a renovation in a certain sector of the hospital, with the aim of increasing the number of visits and revenue. However, it must be interpreted according to the period of time in which it was applied. Revenue may be low initially but increase over a longer period of time. Alluding to the purchase of equipment, a new tomography device can present a negative ROI in the first month but evolve into a highly positive metric over the course of one year. This indicator can be applied to almost any intervention, such as hiring new professionals or meeting new health insurance plans at the hospital.

Average Length of Stay in the Emergency Room (ALSER)

It is the measurement of the average time, in hours, spent in the emergency department of patients admitted to this sector, from the time of arrival until the end of care. It can be calculated by the following formula:

ALSER=(∑the length of stay of each patient treated in the emergency in that period)/(number of visits to the emergency in that period)

The length of stay in the emergency room must be optimised to avoid excessive patients in this sector. In general, the stay of patients for prolonged periods in the emergency department is associated with worse outcomes, especially when dealing with patients with organic dysfunctions (Machado et al. 2023). Emergency, in general, does not have professionals accustomed to the continuous management of critically ill patients or even trained in the clinical management of complex cases. It also does not have appropriate resources to adequately monitor critically ill patients in most cases due to a lack of adequate machinery and beds. Therefore, it is not recommended that patients remain in the emergency room for long periods and should be directed to hospitalisation units with adequate support for the case, such as wards and ICUs.

In Brazil, unfortunately, it is common to see a large number of patients admitted to the emergency room, mainly in the Brazilian public health system. The causes for this inadequacy are many, from the hospital's lack of efficiency in releasing hospital discharges to the lack of beds to meet the demand imposed by a large population in need of care. When we think about the reality of Brazilian hospitals, ICU beds are scarce, which makes the flow of patients in the hospital extremely difficult, especially in the emergency room. However, there is also often a lack of trained professionals to care for critically ill patients, which undoubtedly favours the worsening of outcomes and the occurrence of delays in the turnover of beds in the units. A study carried out by the Federal Court of Auditors (Tribunal de Contas da União) in 2014 showed that the overcrowding of hospitals in Brazil is a reality for the majority of hospitals (Matoso 2014). This fact leads to an overload of work for the professionals involved in emergency room care and even worse outcomes.

The Inefficient Surgical Centre

Contrary to what many people imagine, the surgical centre is not always a source of profit for hospitals. There is often a poor dimensioning of the sector, which has excessive rooms to meet peak needs, but in practice, they remain idle for too long (Business & Health Consultoria e Auditoria em Saúde). Inadequate management of the surgical schedule can end up increasing this idleness, as well as the number of cancellations. Operating room reservations, which often wait hours for the most renowned surgeons, accumulate delays and only increase this loss. Delays in cleaning and preparing beds for the next procedure are other sources of losses. A survey in 2021 (Medicina S/A) estimated the average cost/hour of the surgical centre of 112 hospitals at 783 BRL, and this value tends to increase, given the high fixed costs associated with the growing technology involved in the procedures.

The Future: Use of Artificial Intelligence in Hospital Bed Management

The use of artificial intelligence in hospitals is already a reality. Medical decision support programmes already exist and allow professionals to make diagnoses and take actions more based on scientific evidence (Magrabi et al. 2019). In the near future, it is expected that a large part of medical decisions will be assisted by artificial intelligence (Filho 2021), including the discharge process. Through a machine learning process, data relating to the patient will be crossed, including vital signs (Rush et al. 2019), laboratory tests, and image exams, allowing the programme to suggest the correct time for hospital discharge (van de Sande et al. 2022). At a more advanced stage, this discharge will enter the hospital bed management system, and the programme itself will manage beds intelligently, according to the demands existing at that time. This way, time will be saved, avoiding possible losses both at the time of discharge and in bed management. The use of algorithms will allow automation and consequent acceleration of processes by incorporating protocols established by human beings. Programmes will even be able to estimate the number of beds needed in certain sectors of the hospital to meet demands (Ortiz-Barrios et al. 2023). Some algorithms are already in the validation phase and will very soon be incorporated into daily practice. Nexar Flow (Nexar Systems), for example, is under development to facilitate the transfer of care in an automated way, increasing the efficiency of clinical processes.

Conclusion

HBM is an important marker of quality in the management of healthcare institutions and a fundamental part of their functioning. Its importance will grow increasingly in the coming decades, and the use of artificial intelligence will facilitate this task, being inexorably incorporated into management. There are many challenges for clinical staff in the years to come, as it will be necessary to incorporate management notions into the institutions' clinical leadership, as well as some proficiency in handling automated algorithms for clinical practice.

Conflict of Interest

None.

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Beyond the Monitors: Redefining Connection in Intensive Care Family Meetings

Family dynamics in ICU meetings are complex and often affected by emotions, stress, and differing perspectives. Effective communication and collaboration amid family members and healthcare professionals are crucial for steering these dynamics, facilitating shared decision-making, and assuring the best feasible patient care.

Introduction

Intensive care unit (ICU) teams often face various challenges when caring for critically ill patients in addition to direct patient care. Equally important is communication with families to provide support and information. Family meetings become fundamental platforms for bridging the gap between healthcare providers and families. They offer a space where complex details about a patient's condition, treatment modalities, and prognosis can be articulated with clarity and empathy. Informed decision-making depends on understanding, and these meetings provide a context for families to comprehend subtle differences, weigh potential outcomes, and actively participate in decisions that profoundly impact their loved ones.

It is not merely about information dissemination but a recognition of families as important partners in the care process. Through transparent and compassionate communication, healthcare providers empower families to navigate the complexities of critical care. This empowerment extends beyond the immediate decisions to build up a sense of resilience, a vital component in facing uncertain medical trajectories.

Moreover, family meetings in the ICU can be seen as a proactive measure in aligning medical interventions with the values and preferences of the patient. By engaging families in open discussions, healthcare providers not only respect the autonomy of the patient but also enhance the likelihood that treatment plans resonate with the individual's wishes. Gambhir et al. (2021) discussed the impact of a proactive and structured approach to conducting interdisciplinary family meetings with patients and their families, which led to improved patient understanding of their care and satisfaction.

Our Argument

Family meetings in the ICU are not mere procedural checkpoints but ethically necessary. They create a synergy between medical expertise and familial insights, fostering an environment where decisions are not imposed but shared—a collaborative approach that honours the dignity of patients and the profound role of their families in the journey through critical care. Among critically ill patients and their surrogates, a family-support intervention delivered by the interprofessional ICU team did not significantly affect the surrogates' burden of psychological symptoms, but the surrogates' ratings of the quality of communication and the patient- and family-centredness of care were better. The length of stay (LOS) in the ICU was shorter with the intervention than with usual care (White et al. 2018).

While it is challenging to maintain routine formal family meetings for every patient in the ICU due to clinical workload, it is crucial that junior and senior ICU doctors, as well as bedside nurses, should be involved in family discussions to formulate proper informative family meeting updates. Meetings and discussions with the family should be appropriately recorded and updated for the purpose of being adherent to the international and local standards of the best ICU practice when using electronic medical records (EMR), which would ensure quality improvement in ICU (Elkhonezy et al. 2023).

An intensive communication system within five days of ICU admission and weekly thereafter tested the effect of regular,

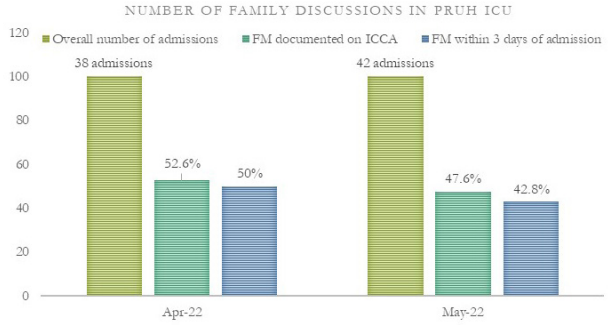
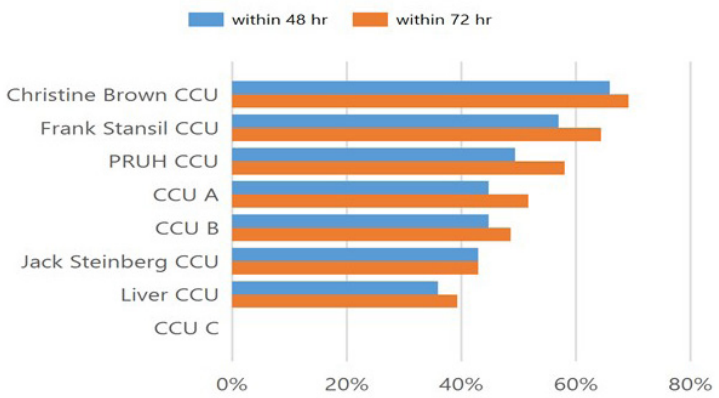


Figure 1. Number of ICU patient admission in DGH ICU over two months and percentage of family meetings documented on EMR during this period. The figure shows around 50% family meetings have been documented in April and around 40 % of family meetings in the month of May despite all patients' families were updated bedside when needed. This reflects how the ICU team members always have high workload to adhere to formal family meeting documentation on EMR.

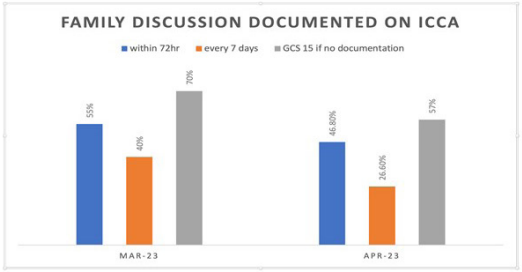


Live dashboard from EMR showing performance of ICU units between March 2023-May 2023

Figure 2. Live dashboard showing all ICUs at teaching tertiary hospital family meeting documentation on EMR system used in ICU. The graph shows the performance between March and May 2023. The highest documentation percentage in the first 72 hours was around 70%, and 65% in the first 48 hours of admission in one of the general ICUs, while the lowest percentage of documentation of family meetings on the EMR was less than 40%. This was due to the high workload in the liver ICU, which makes ICU team members unable to maintain full records on EMR as the vast majority of those patients are more critically ill than others admitted to general ICUs.

clinical Unit Label	Admissions	Still in ITU after 48 hr	meeting within 48 hr	48hr %	Still in ITU after 72 hr	meeting withing 72 hr	72hr %
CCU A	109	96	39	41%	87	45	52%
CCU B	93	83	35	42%	78	38	49%
CCU C	1	1	0	0%	1	0	0%
Christine Brown CCU	109	99	60	61%	91	63	69%
Frank Stansil CCU	125	115	61	53%	107	69	64%
Jack Steinberg CCU	109	98	40	41%	93	40	43%
Liver CCU	244	105	32	30%	89	35	39%
PRUH CCU	116	99	46	46%	93	54	58%
Totals in period	906	696	313	45.0%	639	344	53.8%

FM live Dashboard showing number of FM by ICU unit March 2023- May 2023



FM within 48 & 72 hours of admission

Figure 3. The table on the left shows the total number of admissions in different ICUs, the number of patients still in ICU after 48 hours, the number of family meetings correlated to this time period, and the percentage of family meetings documented on EMR in the same time frame (blue column). The table also shows the number of patients remaining in the ICU after 72 hours of admission and the number and percentage of family meeting documentation correlated to the same period as well (orange column). The graph on the right shows the percentage of family meeting documentation on the EMR system between March and April 2023 after 72 hours and 7 days of admission to ICU and GCS of the patients if no family meeting documentation has been documented.

structured family meetings on patient outcomes and reduced use of ineffective resources in the ICU. 135 patients from 5 ICUs were enrolled as the control group, followed by enrolment of intervention patients (n = 346). There were no significant differences between control and intervention patients in LOS, indicators of aggressiveness of care or treatment limitation decisions (ICU mortality, LOS, duration of mechanical ventilation, treatment limitation orders, use of tracheostomy or percutaneous gastrostomy). The analysis found that in the medical ICUs, the intervention was associated with a lower prevalence of tracheostomy among patients who died or had do-not-attempt-resuscitation orders in place (Daly et al. 2010).

Counterargument

While acknowledging the importance of communication with families in the ICU, it's valuable to consider the practical challenges and potential drawbacks associated with routine formal family meetings for every patient. There are multiple factors contributing to the challenges faced by the ICU team in maintaining formal and documented family meetings. These include but are not limited to overwhelming workload constraints and time sensitivity in ICU, as critical care situations often demand immediate decision-making and interventions. Routine formal family meetings might introduce delays in providing timely care. Individualised patient and family needs and documentation while recording family meeting discussions are essential for adherence to guidelines. Mandating extensive documentation for every patient may divert valuable time and resources from direct patient care. Emotional cost and burnout of healthcare providers and constant involvement in emotionally charged family meetings can take a toll on healthcare providers. Individual preferences for communication can vary as families come from diverse cultural backgrounds. A rigid approach to routine formal family meetings might lead to less effective communication. Hence, the affirmation should be on the quality rather than the quantity of family meetings.

Ensuring that when family meetings occur, they are well-prepared, focused, and responsive to family-specific needs can be more effective than achieving routine formal meetings. Nelson et al. (2009) described a simple toolkit and prototypes

to promote more successful implementation of family meetings in the ICU, which include a family meeting planner, a meeting guide for families, and a documentation template. There is a need to standardise family meeting tools to help family members effectively engage in the process (Singer et al. 2016).

Importance of Family Discussion in the ICU

Imagine a scenario in the ICU where a critically ill and unresponsive patient is facing complex treatment decisions. In this situation, open and honest family discussions become instrumental in formulating the trajectory of care and the expected future outcome. A transparent conversation with the family about the patient's condition, potential interventions, and expected outcomes allows them to comprehend the gravity of the situation. By engaging the family in the decision-making process, healthcare providers not only provide crucial information but also create an environment where the family feels valued, heard, and included.

With such an approach, families can share insights into the patient's values and preferences. This information becomes invaluable, especially when deciding on treatment plans that align with the patient's wishes. Moreover, the shared decision-making process creates a sense of agency in the family, attenuating feelings of powerlessness often associated with critical care situations. When families are actively involved in decisions, they are more likely to understand the rationale behind treatments, potential risks, and realistic expectations for the patient's recovery.

Ethical Challenges Related to Family Discussion in the ICU

Navigating family discussions in the ICU presents healthcare professionals with various ethical challenges and dilemmas. Balancing the duty of truth-telling with the ethical imperative to maintain hope can be challenging. Respecting the autonomy of the patient and including the family in decision-making may be a challenge when conflicts arise as family members have differing opinions. Cultural or religious considerations may impact decision-making. Ensuring culturally competent communication poses an ethical challenge. Cultural sensitivity means what may be considered appropriate disclosure in one culture might be perceived differently in another. Deciding when to initiate discussions about the patient's condition and prognosis is ethically complex. Waiting too long might infringe on the family's right to be informed promptly while introducing discussions too early could cause undue distress.

Ethical challenges arise when deciding to withdraw life-sustaining treatments. Balancing the obligation to preserve life with the ethical principle of not prolonging suffering requires careful consideration. Subsequently, navigating end-of-life discussions and decisions presents ethical challenges. Determining when to transition from curative to palliative care involves balancing the duty to provide comfort and alleviate suffering with respecting the sanctity of life. Determining who has the authority to make decisions on behalf of the patient, particularly when the patient lacks decision-making capacity, poses ethical challenges, especially in families with conflicting opinions.

The family meeting is considered the best practice for achieving patient- and family-centred palliative care by involving palliative care specialists to engage patients and their families in a serious illness discussion and clarify the values of patients and caregivers, provide information, determine care preferences and identify sources of illness-related distress and burden (Glajchen et al. 2022).

The emotional toll on healthcare providers who engage in these discussions is an ethical concern. Balancing empathy with professional detachment, ensuring honest communication without causing emotional harm, and addressing the emotional needs of the healthcare team are all complex aspects. Allocation of resources in the ICU can pose ethical challenges, especially when discussing treatment options that might have financial implications. Striking a balance between providing the best care and considering the overall healthcare system's resource constraints requires ethical discernment. Ensuring continuity of care and consistency in cohesive and coherent communication when multiple healthcare professionals are involved might pose ethical challenges., especially in complex medical situations.

Addressing these ethical challenges in family discussions requires a thoughtful and patient-centred approach, emphasising open communication, cultural competence, and respect for the values and autonomy of both patients and their families.

Multi and Interdisciplinary Role in Family Meetings and Discussion

The ICU team plays a crucial role in family meetings and discussions, with each member contributing unique skills and perspectives. The team collaborates to provide not only medical information but also emotional support and guidance to the family. The ICU physician takes a central role in leading family discussions by providing medical information, explaining the patient's condition, discussing treatment options, outlining the prognosis and ensuring that medical details are conveyed in a clear and understandable manner.

Nurses are often the primary point of contact for families. They provide emotional support, answer questions, and ensure the family's needs are communicated to the broader team. They also play a crucial role in conveying the patient's day-to-day condition, which can help families understand the ongoing trajectory of care.

Social workers address the psychosocial aspects of critical care. They can assist families in coping with stress, provide support resources, and help navigate any non-medical challenges the family may face. Chaplains provide spiritual and emotional support. They can assist families in addressing existential concerns, facilitate rituals, and offer comfort during difficult times, mainly for those with religious or spiritual needs.

Pharmacists play a role in explaining medication regimens, potential side effects and interactions. They contribute valuable information regarding the pharmacological aspects of treatment and address any concerns related to medication. Occupational

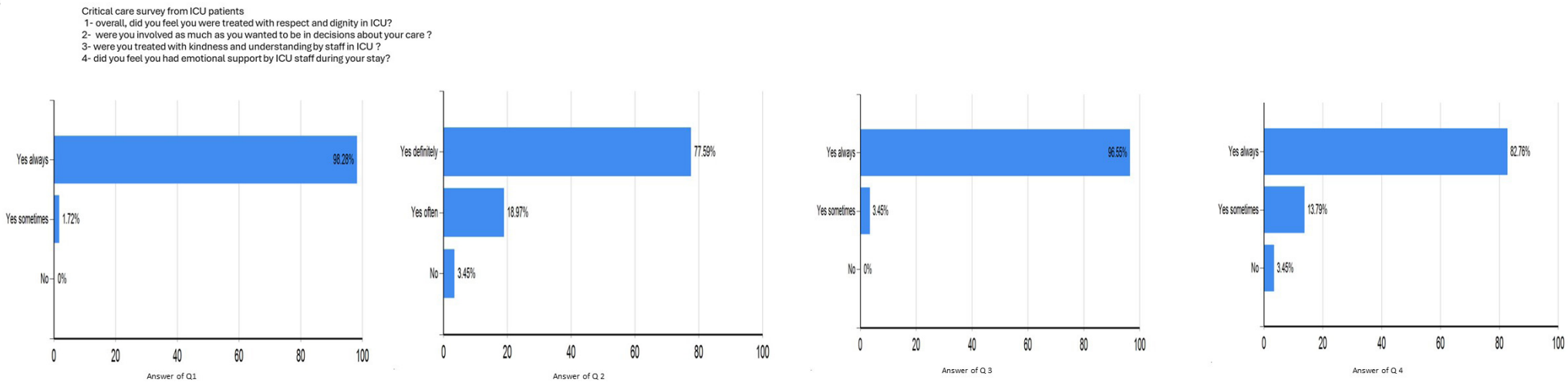


Figure 4. The top graph on the left shows feedback from ICU patients after being treated in ICU. They reflect if they were treated with respect and dignity (Q1). The percentage of those who answered 'yes always' was>98 %. The top graph on the right shows feedback from ICU patients as to whether they were involved as much as they wanted in decision making (Q2). Those who answered 'yes definitely' were>77%, 'yes often' >18%, and 'no' was 3.5%. This shows that ICU team members involve patients in the decision-making process and treat them with dignity and respect most of the time.

and physical therapists provide insights into the patient's physical condition and potential for rehabilitation. They discuss the patient's ability to perform activities of daily living and provide information on long-term functional outcomes.

Trainees, such as residents or fellows, may be involved in family meetings under the supervision of attending physicians to learn effective communication skills and understand the holistic aspects of patient care. A coordinated approach supports comprehensive care for the patient and their family. Multidisciplinary team collaboration among all team members is crucial. Regular interdisciplinary meetings ensure that everyone is informed about the patient's condition, reducing the risk of miscommunication.

Informed Decision-Making

It is a vital process that requires a comprehensive and compassionate approach. There are key elements contributing to informed decision-making:

- **Clear and transparent communication** about the patient's condition, diagnosis, and treatment options by using plain language and avoiding medical jargon helps ensure that family members can comprehend the information.
- **Honest discussion about prognosis and sharing realistic expectations about the patient's prognosis** is crucial. This includes potential outcomes, chances of recovery, and possible complications. It provides the family with a foundation for making decisions aligned with the patient's likely trajectory.
- **Discussing the available treatment options and presentation of alternatives,** including the benefits, risks, and potential side effects, allows families to understand the implications of each choice. This enables them to actively participate in decision-making.

Informed decisions should align with the patient's values, wishes and preferences. Discussions about the patient's previously expressed wishes should be encouraged, including any advanced care directives or living wills. Presenting a balanced view of the risks and benefits of treatment options helps families weigh potential outcomes. Understanding the potential benefits and burdens allows families to make decisions that align with the patient's best interests.

Furthermore, offering a structured opportunity for family members to ask questions and express concerns fosters an environment of trust. It provides clarity on any uncertainties and allows time for reflection before making decisions. If appropriate, healthcare professionals should support families in seeking second opinions. This ensures that families have access to diverse perspectives and can make decisions with more comprehensive information. The ICU team must understand and respect the cultural and spiritual values of the family. This includes considering beliefs about life, death, and medical interventions, which can significantly influence decision-making. Recognising the emotional impact of critical illness and treatment decisions should be highlighted throughout acknowledging the family's

feelings, offering counselling services or involving pastoral care. Establishing a plan for follow-up discussions and regular updates ensures ongoing support and an opportunity to revisit decisions if circumstances change.

Informed decision-making in family discussions is not a one-time event but a process that evolves as the patient's condition changes. It requires ongoing communication, empathy, and a commitment to supporting families through the complexities of critical care decisions.

Emotional and Compassionate Support

This is a critical aspect of family discussions in the ICU, which could be achieved through:

- **Active listening** to family concerns, fears, and questions without interrupting. Empathy, expressing understanding and compassion build a trusting relationship.
- **Acknowledging emotional distress** that families may be experiencing, validating their feelings creates a safe space for open communication by using empathetic language and avoiding medical jargon to ensure that family members can comprehend the information without feeling overwhelmed.
- **Acknowledge the complexities of grief and hope** that families may be experiencing simultaneously. The collaborative approach facilitating shared decision-making empowers them and helps reduce feelings of powerlessness.
- Being mindful of **cultural and spiritual considerations,** understanding and respecting diverse beliefs contribute to more compassionate care. We should Work collaboratively with support services such as social workers, counsellors, or psychologists hence these professionals can provide specialised emotional support tailored to the family's needs. In situations involving spiritual considerations, involve a chaplain or spiritual advisor. They can provide comfort and guidance aligned with the family's spiritual beliefs.
- **Offering physical gestures** such as a reassuring touch or offering a tissue can convey compassion. "Non-verbal cues can speak volumes in moments of emotional distress". Ensure that the physical environment is conducive to supportive discussions. Arrange seating in a way that encourages open communication and maintain privacy when needed.
- After a family meeting, **follow up** with families to offer ongoing support. This demonstrates a continued commitment to their emotional well-being.

Challenges to Conduct Family Meetings in ICU

Anxiety, grief, and fear are common emotional distresses. Language barriers or cultural differences may impede effective communication. Critical illnesses often involve uncertain prognoses and complex medical information in many ICU cases. Family members may have conflicting perspectives, values, and expectations, which may be highly challenging. It is sometimes difficult to determine the appropriate time to initiate family meetings, for which starting discussions too early may overwhelm families, while waiting too long may lead to frustration and anxiety. In some situations, this could be affected by time constraints and rotating medical teams. Privacy and space constraints can be a common challenge in the often crowded and bustling environment of the ICU.

End-of-life discussions can be emotionally charged and difficult, and balancing hope with the reality of the patient's condition requires sensitivity and skill. Moreover, healthcare professionals may not receive extensive training in communication skills; hence, it can affect the quality of discussions. It is worth understanding that multifaceted choices with ethical, medical, and emotional dimensions usually affect decision-making. Providing adequate grief and bereavement support to families may be challenging due to time constraints and resource limitations. Finally, one of the challenges impacted by time constraints in the fast-paced environment of the ICU is adequate documentation of family discussions and ensuring timely follow-up.

Patient-Centred Care

It is an approach to healthcare that places the patient at the centre of the decision-making process and emphasises the importance of meeting the individual needs and preferences of each patient. Family meetings are an essential part of the treatment of seriously ill patients. Using a structured approach throughout these meetings is key to achieving patient- and family-centred care for seriously ill patients (Widera et al. 2020). Patient-centred care (PCC) includes showing respect for patient values, empathy and compassion, using a holistic approach (viewing the patient as a whole person including psychological, social and medical needs), shared decision-making, effective communication, individualised care plans (tailored to the individual needs and preferences of each patient), respect for patient autonomy, timely and accessible care, continuous coordination of care, support for caregivers and involving them in the care process when appropriate, patient education through empowering patients with the knowledge to actively participate in their care and measuring patient satisfaction and outcomes using patient feedback to assess the quality of care and essentially respecting privacy and dignity.

Current PCC efforts focus on patients' personhood, patient-centred and family-centred communication, and interventions to improve family presence, support, and participation (Secunda et al. 2022).

How to Improve Family Meeting Communication and Documentation Skills in the ICU

In a multi-centre study, participation in an hour-long ICU communication and palliative skills workshop was associated with significant improvement in trainees' knowledge and attitudes toward family meetings (Munger et al. 2023).

Improving family meeting communication and documentation skills in the ICU involves a combination of training, practice, and a commitment to patient-centred care using variable tools. Communication skills improvement can be achieved via training

programmes by attending workshops focused on communication skills in critical care settings, including simulated scenarios and role-playing exercises. Simulate family meetings by conducting regular role-playing sessions. This helps healthcare professionals practice effective communication in a controlled environment. Members of the healthcare team in communication training should attend interdisciplinary training, which fosters a multidisciplinary approach and improves coordination during family meetings.

Communication skills assessment and feedback together with continuous learning through literature, webinars, and educational resources would hugely improve family meeting communication. Consideration should be given to establish mentorship programmes where experienced members mentor those who are newer to family meetings. Conduct debriefing sessions after family meetings to discuss what went well and areas for improvement.

Specific training on empathy can enhance healthcare professionals' ability to understand and address the emotional needs of families. Utilising documentation skills improvement can be achieved via establishing clear protocols for family meetings, supplying standardised templates that guide healthcare professionals on what information to document during family meetings, training on documentation software if using EMR systems and ensuring proficiency in using the documentation software by providing training sessions. Using standardised language in documentation ensures clarity and reduces the risk of misinterpretation. Development of checklists for key points that need to be documented during family meetings ensures comprehensive documentation. Perform regular audits to identify areas for improvement with constructive feedback to the ICU team based on audit findings. Familiarise healthcare professionals with legal and ethical considerations in documentation to ensure accurate and compliant record-keeping.

Future Directions to Improve Family Meetings and Discussion in Intensive Care

As face-to-face communication with the family and visiting their patient was a huge challenge during the COVID-19 pandemic, the ICU staff has had to innovate and develop new communication strategies to address the barriers brought about by it. Elements such as ICU family liaison service, videoconferencing, hands-free communication devices, team roles and name labels were used as new strategies to improve communication in ICU during the pandemic (Chua 2022)

During the pandemic period, there were visitor restrictions, and few family meetings occurred in person. However, statistically significant fewer changes in patient goals of care occurred following video meetings compared to in-person meetings, providing support that limiting in-person meetings may affect patient care (Piscitello et al. 2021).

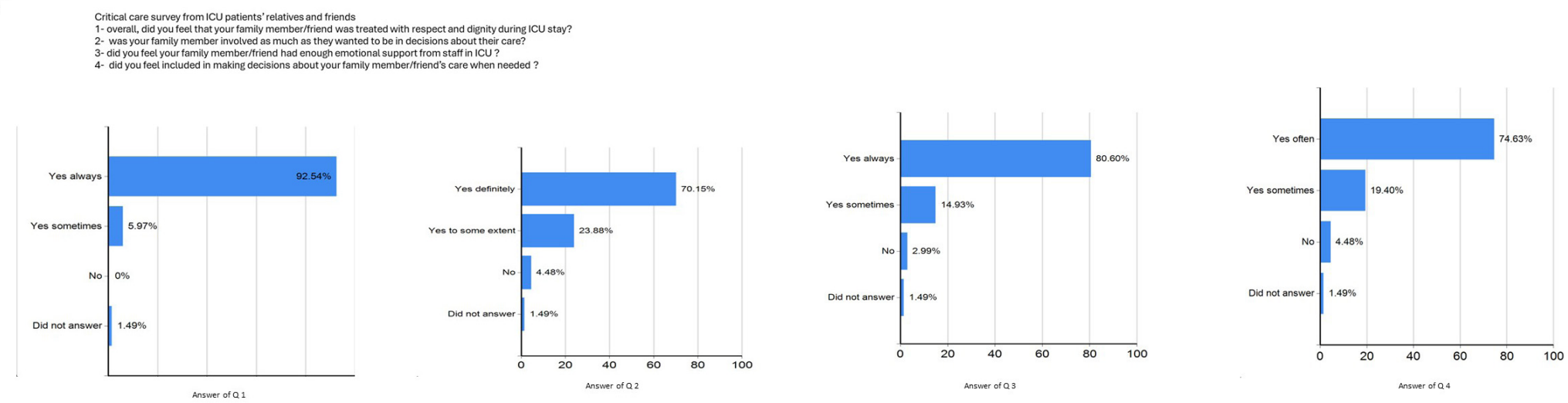


Figure 5. The top left graph shows feedback from families and friends if their patients were treated with respect and dignity (Q1). Those who answered 'yes' were >92 %. The graph on the top right shows whether families were involved in decision-making for their ICU patients (Q2). Those who answered 'yes definitely' was >70%, 'yes to some extent' was >23%, and 'no' was 4.4%. This feedback was collected during the same period when the ICU team members were not able to adhere to formal family meeting documentation on EMR, which reflects that communication is not just a tool but a bridge for empathy, information, and support.

A U.K. survey studied ICU visiting and family communication during the COVID-19 pandemic. Significant changes were observed across NHS ICUs in how ICU teams interact with families. Many units adapted and moved towards distant and technology-assisted communication (Boulton et al. 2022).

Integration of technology such as telemedicine or virtual communication tools can enhance family meetings, mainly in remote healthcare delivery or during pandemics, as seen during the COVID-19 outbreak. Structured communication protocols may include guidelines for information disclosure, decision-making processes, and addressing emotional needs. Interdisciplinary training should focus not only on medical communication but also on emotional intelligence, empathy, and cultural competence.

Patient and family education about ICU can help facilitate more informed decision-making during family meetings. Earlier advance care planning discussions engage patients and families in conversations about their values, goals, and preferences regarding end-of-life care before crises occur.

Psychosocial support services, including counselling and chaplaincy, can help families cope with emotional challenges together with tools that facilitate shared decision-making between healthcare professionals and families. Decision aids and informational materials can help families understand complex medical information. Cultural competence training can help better understand and address the diverse needs and perspectives of families from different cultural backgrounds. Long-term follow-up and support can include post-ICU clinics or resources for coping with the aftermath of critical illness. Continuous quality improvement initiatives and regular feedback from families can be invaluable in refining communication practices.

Conclusion

This was an overview of an influential emotional narrative where the art of communication consolidates with the complexity of critical care. We advocate for the inclusivity of the entire ICU team, recognising the vital roles played by junior and senior doctors, alongside bedside nurses and interdisciplinary teams, in achieving patient-centred care. Communication is not just a tool but a bridge for empathy, information, and support, recapitulating through the corridors of uncertainty that characterise critical care. Despite the aspiration for structured family meetings, we urge an accurate understanding of the challenges within the ICU. Rather than a rigid adherence to routine formalities, we encourage flexibility, allowing healthcare providers to tailor their communication to the unique needs of patients and families. We found that it is all about the paradox of necessity and burden by underestimating the role of meticulous record-keeping and calling for a delicate balance that prevents administrative demands from eclipsing the human touch that defines pitying care.

Conflict of Interest

None.

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Anti-Inflammatory Therapies for Severe Community-Acquired Pneumonia

Emerging evidence highlights the potential advantages of employing anti-inflammatory therapies like macrolide antibiotics and corticosteroids in managing severe community-acquired pneumonia (CAP). Although their use remains a subject of debate, recent findings indicate improved clinical outcomes, and support the adoption of a tailored approach that emphasises personalised medicine strategies to optimise treatment efficacy and minimise adverse effects.

Introduction

Community-acquired pneumonia (CAP) remains a significant healthcare challenge and contributes substantially to patient morbidity and mortality worldwide (GBD 2017 Causes of Death Collaborators 2018). It stands out as a prevalent cause of respiratory failure and admissions to intensive care units (ICUs) (Cavallazzi et al. 2020). Within the spectrum of CAP, a subset of the population experiences severe disease, classified as severe CAP based on criteria established by the American Thoracic Society and Infectious Disease Society of America (ATS/IDSA) (Metlay et al. 2019; Dremsizov et al. 2006). Notably, patients meeting severe CAP criteria could face in-hospital mortality up to 17%, with a 1-year mortality rate as high as 50% (Cavallazzi et al. 2020; Marrie and Shariatzadeh 2007; Riley, Aronsky, and Dean 2004).

The treatment approach to CAP is focused on early identification, triage to appropriate levels of care, and prompt administration of effective antibiotics (Metlay et al. 2019). However, controversies persist regarding the optimal choice of therapy and the role of adjunctive anti-inflammatory treatments, such as the addition of macrolide antibiotics and systemic corticosteroids.

Given that pneumonia, a common cause of sepsis, is associated with a dysregulated immune response leading to systemic inflammation—a cornerstone of sepsis pathobiology—the consideration of anti-inflammatory agents is logical.(Angus and van der Poll 2013) Despite ongoing debates fuelled by varying evidence, refining the role of macrolides and corticosteroids in CAP management is crucial for advancing treatment strategies and improving clinical outcomes. Nonetheless, in the transition towards an era of personalised medicine, it is important to acknowledge that therapies may not follow a "one-size-fits-all" approach, emphasising the need for individualised treatment strategies.

In this review, we delve into the specific roles of macrolide antibiotics and systemic corticosteroids in addressing severe CAP. We examine the most recent guidelines and evidence regarding their use and highlight individual considerations crucial in the decision-making process when contemplating the administration of these therapies.

The Role of Macrolide Antibiotics

Macrolide antibiotics have been a recommended component of combination therapy in the treatment of both CAP and severe CAP for over a decade (Mandell et al. 2007; Metlay et al. 2019; Martin-Loeches et al. 2023). Despite accumulating evidence supporting their clinical efficacy, their usage remains a topic of debate. In 2019, the ATS and IDSA issued updated guidelines advocating for the empirical administration of beta-lactam antibiotics combined with macrolides or fluoroquinolones for patients with severe CAP (Metlay et al. 2019). Similarly, the most recent guidelines released by the European Respiratory Society (ERS), the European Society of Intensive Care Medicine (ESICM), the European Society of Clinical Microbiology and Infectious Diseases (ESCMID), and the Latin American Thoracic Association (ALAT), also recommended the combination of beta-lactams with either a macrolide or fluoroquinolones with a preference for macrolide antibiotics, for those with severe CAP (Martin-Loeches et al. 2023).

Mortality and Clinical Benefits

The recommendations for macrolide antibiotics in guidelines are largely informed by observational studies demonstrating survival benefits when they are added to beta-lactams (García

1. Anti-inflammatory and Immunomodulatory Effects
• Macrolides exhibit diverse mechanisms of action, including suppression of pro-inflammatory cytokines and promotion of anti-inflammatory cytokines.
• They facilitate phagocytosis by alveolar macrophages, mitigate neutrophil response, and reduce inflammatory processes.
• Macrolides influence adaptive immunity, enhancing apoptosis in T-lymphocytes and suppressing proinflammatory cytokine production.
• Clinical studies show alterations in serum inflammatory biomarkers, potentially reversing immunoparalysis phenomena.
2. Biological Effects on Host-Pathogen Interaction
• Macrolides fortify airway epithelium, influence mucus composition, and alter biofilm structure, enhancing protective barriers.
• They inhibit polysaccharide synthesis and quorum sensing, affecting various bacterial pathogens, including *Pseudomonas, Haemophilus, and Staphylococcus* species.
3. Clinical Efficacy in Pneumonia
• Despite rising resistance rates, observational studies consistently demonstrate mortality benefits with macrolide combination therapy in pneumonia.
• Clinical trials show that macrolide adjunctive therapy improves early clinical response and demonstrates trends toward mortality benefit in severe community-acquired pneumonia (CAP).

Table 1. Benefits of Macrolide Therapy

Vázquez et al. 2005; Lodise et al. 2007; Martínez et al. 2003; Metersky et al. 2007; Restrepo et al. 2009; Martin-Loeches et al. 2010; Sligl et al. 2014). In a matched case-controlled study of two prospective cohorts in Europe with 80 patients diagnosed with CAP, ICU mortality had an observed 80% reduction in the odds of mortality when combination therapy, including a macrolide, was used (Gattarello et al. 2014).

To further evaluate the clinical effects of combination antibiotics, including macrolides, randomised controlled trials (RCT) have been conducted. However, they have yielded conflicting results and faced notable limitations, with many not focusing on those with severe CAP. One study was the Community-Acquired Pneumonia - Study on the Initial Treatment with Antibiotics of Lower Respiratory Tract Infections (CAP-START) that compared beta-lactam monotherapy to beta-lactam plus macrolide, or quinolone therapy. While the study concluded that beta-lactam monotherapy was non-inferior to quinolone or beta-lactam plus macrolide therapy for 90-day mortality, important criticisms included nearly 25% of patients without radiographic confirmation of pneumonia, off-protocol macrolide therapy in the monotherapy groups (38.7%), and overall lower disease severity of the patient population, most notably the exclusion of ICU patients (Postma et al. 2015). Additionally, the incidence of atypical bacteria and resistant *Streptococcus pneumoniae* was relatively low in this population, compared to other regions of the world.

In another non-inferiority RCT, beta-lactam monotherapy was compared with beta-lactam plus macrolide therapy in hospitalised patients with moderately severe CAP. The study did not find non-inferiority of monotherapy when compared to patients with combination therapy in terms of improvement in clinical stability at day 7. 90-day mortality, a secondary outcome, also did not differ between the two arms (Garin et al. 2014). Furthermore, patients who had microbiological evidence of atypical infection and those with a higher pneumonia severity index (PSI IV) had delayed clinical stability on monotherapy (Garin et al. 2014).

In response to conflicting evidence, a more recent multicentre RCT known as the Anti-inflammatory Action of Oral Clarithromycin in Community-acquired Pneumonia (ACCESS) trial was conducted and focused on those with severe CAP. This trial evaluated the adjunctive use of clarithromycin with beta-lactam and revealed a statistically significant improvement in early clinical response compared to placebo (Giamarellos-Bourboulis et al. 2024). Early clinical response was defined as a composite of at least a 50% decrease in respiratory symptom severity, at least a 30% decrease in sequential organ failure assessment (SOFA) score, or favourable procalcitonin (PCT) kinetics (at least an 80% decrease from baseline) on Day 4 of trial assessment. While mortality was not a primary endpoint, the study observed trends toward improvement at various time points throughout the study duration, and a post-hoc analysis demonstrated a mortality benefit in the clarithromycin group at the end-of-treatment visit. The study was meticulously designed and included patients with more severe community-acquired pneumonia (CAP) who met stringent clinical and radiographic criteria. Exclusion criteria included patients who had received macrolide antibiotics, corticosteroids, or anti-cytokine treatment, had a QTc interval greater than 500 milliseconds or had a diagnosis of coronavirus disease 2019 (COVID-19). This trial contributes robust evidence in support of combination therapy, particularly involving macrolide antibiotics, underscoring their utility in the management of severe CAP.

Beyond Antimicrobial Effects

The clinical benefits of macrolide antibiotics are multifaceted and consist of anti-inflammatory and immunomodulatory mechanisms, improved host-pathogen interactions, as well as providing antimicrobial coverage against atypical bacterial pathogens. This is exemplified in their use as adjunct immune-modulating therapies in respiratory diseases such as chronic obstructive pulmonary disease (COPD) and bronchiectasis, where they reduce the potential for exacerbations (Yamaya et al. 2012; Kelly et al. 2018).

In pneumonia, the anti-inflammatory and immunomodulating benefits are supported both clinically and biologically. Clinically, this is evident in the continued efficacy of macrolides despite the

rise in confirmed resistance in pathogens over time. For example, the prevalence of macrolide resistance in S. *pneumoniae* increased from 18% in 1998 to approximately 30% in 2019 in the United States, with higher rates of resistance in Europe and Asia (Hoban et al. 2001; Song et al. 2004). Despite this, observational studies have consistently demonstrated mortality benefits with macrolide combination therapy spanning this period (García Vázquez et al. 2005; Lodise et al. 2007; Martínez et al. 2003; Metersky et al. 2007; Restrepo et al. 2009; Gattarello et al. 2014).

To further illustrate the added efficacy of macrolide antibiotics, a study involving 237 patients diagnosed with CAP and sepsis revealed a reduction in mortality associated with the addition of macrolide in multivariate analysis, even in the presence of confirmed macrolide-resistant organisms (Restrepo et al. 2009). Furthermore, clinical benefits in the face of resistant organisms have been reaffirmed in patients with ventilator-associated pneumonia (VAP), where gram-negative pathogens predominated and would not have been expected to be treated by macrolides. In a double blinded RCT with 200 patients diagnosed with sepsis and VAP, patients who received clarithromycin 1 gram for 3 days exhibited a shorter time to VAP resolution and liberation from mechanical ventilation.

Biologically, macrolides can exert various effects. From the perspective of host interactions, they can help fortify the airway epithelium, enhancing its resilience against external injury. Studies conducted in vitro have shown that macrolide antibiotics can bolster transepithelial electrical resistance by modulating the processing of tight junction proteins; this helps prevent fluid and electrolyte leakage and reinforces protective barriers (Song et al. 2004). In addition, macrolides have been shown to influence mucus composition and promote their clearance (Asgrimsson et al. 2006; Tagaya et al. 2002). Moreover, macrolides also have the capability to alter biofilm structure by inhibiting polysaccharide synthesis and suppress quorum sensing (Ichimiya, Yamasaki, and Nasu 1994; Wozniak and Keyser 2004; Ichimiya et al. 1996) This is observed not only in *Pseudomonal* infections but also in *Haemophilus influenzae* and *Staphylococcus epidermidis* (Starner et al. 2008; Yasuda et al. 1994; Wozniak and Keyser 2004).

From an anti-inflammatory and immunomodulatory perspective, macrolides exhibit a diversity of mechanisms of action (**Table 1**). They have been found to suppress the synthesis of pro-inflammatory cytokines while concurrently promoting the release of anti-inflammatory cytokines, as evidenced by various in-vivo, ex-vivo, and in-vitro studies. At a cellular level, macrolides facilitate the phagocytosis of apoptotic cells by alveolar macrophages and mitigate the chemotactic response of neutrophils (Hodge et al. 2006; Hodge et al. 2008). Additionally, they reduce neutrophil degranulation and adhesion and may attenuate the production of reactive oxygen species, thereby dampening inflammatory processes (Postma et al. 2019; Vardakas et al. 2017; Ceccato et al. 2019). Furthermore, macrolides influence adaptive immunity by enhancing apoptosis in T-lymphocytes and exerting a suppressive effect on proinflammatory cytokine production (Williams et al. 2005; Kadota et al. 2005).

Clinical studies in pneumonia have also shown that patients treated with macrolides can undergo alterations in serum concentrations of inflammatory biomarkers. It is hypothesised that sepsis and pneumonia can be characterised by the phenomenon of immunoparalysis, where proinflammatory cytokines such as interleukin(IL)-8 can be reduced in relation to anti-inflammatory cytokines, such as IL-10, with attenuated production of tumour necrosis factor-alpha (TNF-α) (McElvaney et al. 2020). The administration of macrolide antibiotics appears to reverse these ratios. Notably, in the ACCESS trial, patients receiving clarithromycin exhibited lower IL-10 and higher TNF-α levels in peripheral blood mononuclear cells (PMNCs), along with an increased IL-8 to IL-10 ratio on day 4 compared to placebo (Giamarellos-Bourboulis et al. 2024). Collectively, these findings suggest a potential modulation of immune responses and subsequent mitigation of immunoparalysis.

Intra-Class Comparison of Macrolides and Inter-Class Comparison with Fluoroquinolones

The clinical benefits of macrolide antibiotics raise the question of whether the therapeutic potentials are comparable between the agents within this class of medications. Giamarellos-Bourboulis et al. (2024) evaluated clarithromycin versus placebo in patients with pneumonia in RCTs and demonstrated clinical benefits with clarithromycin. However, whether the same benefit can be extrapolated to other macrolides, such as azithromycin, remains unresolved. In a post-hoc analysis of the CAP-START trial, cardiac adverse event rates (defined as new or worsening heart failure, arrhythmia, or myocardial ischaemia) were compared between the beta-lactam monotherapy group and those with macrolide and fluoroquinolone exposure. The results revealed higher event rates in the macrolide group, which was attributed largely to erythromycin and less so to azithromycin and clarithromycin, which may have reflected the larger fluid load needed when using erythromycin (Postma et al. 2019).

The comparability of fluoroquinolones as adjunctive therapy to macrolide antibiotics is also a matter of debate. Current existing data favours the use of macrolides over fluoroquinolones based on prior observational studies, along with systematic reviews and meta-analyses. These sources have consistently demonstrated that macrolide antibiotics are associated with reduced mortality compared to fluoroquinolone use (Vardakas, Trigkidis, and Falagas 2017). In the context of severe CAP, a multicentre observational study focusing on intubated CAP patients with severe sepsis and septic shock found that the addition of macrolides was associated with reduced mortality but not with fluoroquinolone use (Martin-Loeches et al. 2010). These findings highlight the need for further investigation with high-quality RCTs into the relative efficacy of these antibiotic classes.

Macrolides in Specific Populations

As indicated by the currently available studies, there is a preference for macrolide antibiotics, particularly in patients with severe illness. Nevertheless, professional society guidelines currently recommend their use across all severity levels of hospitalised patients. Regarding specific patient phenotypes, those with heightened inflammatory responses may derive greater benefit from macrolide therapy. For instance, a study involving 1715 CAP patients revealed that individuals with elevated C-reactive protein levels experienced lower mortality when treated with

beta-lactams in combination with macrolides compared to fluoroquinolone combinations (Ceccato et al. 2019). This highlights the potential for individualised medicine approaches, suggesting that macrolide therapy could be tailored to patients with hyperinflammatory phenotypes rather than employing a uniform treatment strategy.

Role of Corticosteroids

The use of corticosteroids is anchored on the hypothesis that their use as an adjunctive therapy can help mitigate dysregulated immune response that can lead to disproportionate harm in the host (Heming et al. 2018). Their use has remained as a part of sepsis treatment for several decades (Schumer 1976). Previous professional guidelines did not advocate for the routine use of corticosteroids as adjunctive treatment in either CAP or severe CAP, except for refractory septic shock, where their clinical benefit, especially in terms of mortality reduction, remains contested (Martin-Loeches et al. 2023; Metlay et al. 2019). However, the latest Society of Critical Care Medicine (SCCM) guidelines now recommend corticosteroids for severe bacterial CAP (Chaudhuri et al. 9900).

Given the considerable overlap in patient populations, much of our understanding of steroid use in pneumonia can be extrapolated from sepsis studies. Several prominent RCTs have delved into the clinical effects of corticosteroids in this population, yielding conflicting results. The Annane et al. (2002) trial initially showed promising results, with corticosteroid administration reducing 28-day mortality. However, subsequent trials failed to confirm this finding consistently. For instance, the Adjunctive Corticosteroid Treatment in Critically Ill Patients with Septic Shock (ADRENAL) trial, evaluating continued hydrocortisone administration, demonstrated reduced mechanical ventilation days in shock patients but found no significant difference in 90-day mortality compared to placebo. Similarly, the earlier Corticosteroid Therapy of Septic Shock (CORTICUS) trial did not reveal a survival benefit, although it was underpowered. Conversely, the Recombinant Human Activated Protein C and Low Dose of Hydrocortisone and Fludrocortisone in Adult Septic Shock (APROCCHSS) trial showed improved overall 90-day survival with hydrocortisone plus fludrocortisone compared to placebo (Annane et al. 2018).

Turning to RCTs specific to pneumonia, one multicentre study by Torres et al. (2015) compared the efficacy of methylprednisolone versus placebo for five days, administered within 36 hours of admission. This trial focused on severe CAP patients, with 70-80% admitted to the ICU, and only included those with high levels of inflammation, as reflected by elevated CRP levels (>150 milligrams per litre) on admission. While the steroid group experienced less late treatment failure, there was no significant difference in mortality. A Cochrane review conducted in 2017 prior to this trial encompassing 17 trials showed a significant reduction in mortality among severe CAP patients receiving corticosteroids compared to placebo (Stern et al. 2017). Another study, conducted in 2022 as a double-blind, randomised, placebo-controlled trial at 42 veterans affairs (VA) medical centres in the United States, enrolled patients meeting specific modified ATS/IDSA severity criteria, admitted to ICU or step-down units (SDU). These patients received a methylprednisolone loading dose of 40 milligrams followed by maintenance infusion for 20 days with tapering, with the primary outcome assessed being all-cause mortality at 60 days. Unfortunately, the study did not show a significant difference in mortality. However, it is important to note that the generalisability of the study may be limited due to the study's highly specific population and an underpowered design.

Lastly, in a recent RCT, the Community-Acquired Pneumonia: Evaluation of Corticosteroids (CAPE-COD) trial, conducted across multiple centres in France, a significant reduction in 28-day mortality was observed for patients hospitalised with severe CAP who received hydrocortisone compared to placebo. The study consisted of a high proportion of patients on high-flow nasal cannula (HFNC), with only approximately 23% on mechanical ventilation in the treatment arm and 21.5% in the placebo arm. Hydrocortisone administration improved 28-day mortality, and additional findings included a reduced rate of intubation and vasopressor use in the hydrocortisone arm. Notably, the number needed to treat (NNT) to prevent a single death, based on the estimate of the 2017 Cochrane review, was similar, at approximately 18 patients. Furthermore, after the CAPE-COD trial, an additional meta-analysis incorporating both the CAPE-COD trial and the 2022 VA trial found an overall mortality benefit with corticosteroids (Pitre et al. 2023).

Corticosteroids in Specific Populations

While the data on corticosteroid therapy in severe CAP has presented conflicting findings, a growing body of evidence suggests potential improvements in clinical outcomes, but it is unclear if all severe CAP patients should be treated. Subgroup analyses, such as those conducted in the CAPE-COD trial, have indicated that patients with elevated serum CRP (>15 milligrams per decilitre) may derive a more significant survival benefit from corticosteroid therapy compared to those with lower CRP levels. This observation aligns with findings from studies like the one conducted by Torres et al. (2015), which demonstrated a reduced rate of treatment failure in severe CAP patients with a high level of inflammation and suggests that individuals with a hyperinflammatory profile might benefit most from targeted corticosteroid therapy.

It is also important to recognise that corticosteroid therapy carries inherent risks. Corticosteroid therapy is associated with increased mortality related to secondary infection in patients with influenza pneumonia. Prolonged administration has been linked to an increased risk of invasive fungal infections, a concern particularly relevant given the rise in multidrug-resistant species like *Candida auris* since the COVID-19 pandemic (Biran et al. 2023; Pakdel et al. 2021; Gangneux et al. 2022). Moreover, there is evidence to suggest that certain patient populations, such as those with lymphopenia, may experience harm from steroid administration (Torres et al. 2019). Therefore, while corticosteroids hold promise as a potential adjunctive therapy in severe CAP, careful consideration of their risks and benefits is essential in clinical decision-making.

Conclusion and Recommendations

In summary, the evolving evidence underscores the potential clinical benefits of anti-inflammatory therapeutics in the management of severe community-acquired pneumonia (CAP). Studies, such as the ACCESS trial for macrolide antibiotics and the CAPE-COD trial for corticosteroids, have revealed improvements in various clinical outcomes, including mortality. However, uncertainties persist regarding the optimal timing and patient selection for these treatments, alongside concerns about potential adverse effects. Recognising the importance of precision medicine, there's a growing understanding that patients with a hyperinflammatory profile may derive enhanced benefits from these therapies. This highlights the need for careful patient selection and personalised treatment strategies to maximise efficacy while minimising risks. Moreover, exploring non-antibiotic macrolides could offer an intriguing avenue for future therapeutic interventions. Nevertheless, further large-scale clinical trials are warranted to delineate the precise role of anti-inflammatory therapies in severe CAP management and refine treatment guidelines accordingly.

Conflict of Interest

Dr Di Pan has no conflicts of interest to declare. Dr Michael S Niederman has been a consultant for Pfizer and Merck.

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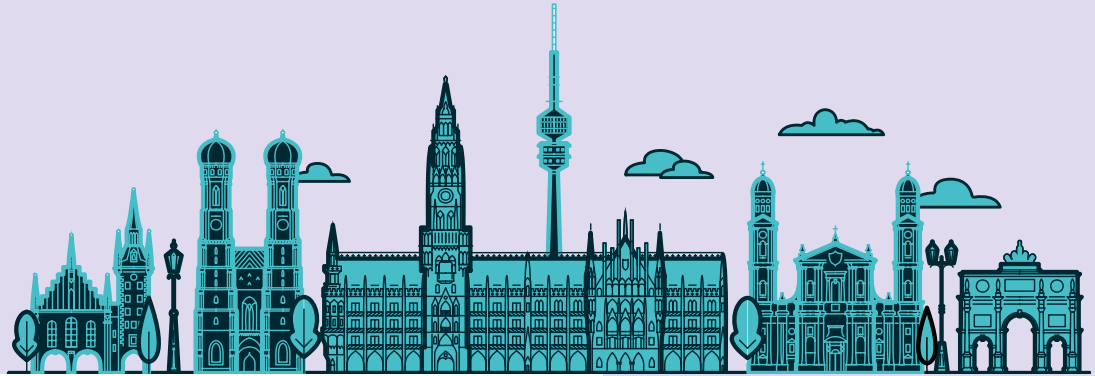

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Errors in Nursing Interventions in Critically Ill Patients: Less is More

In the treatment of critically ill patients, evidence-based nursing practices are essential, highlighting the need for precision in procedural management. This discussion identifies nine common errors encountered in clinical practice.

Introduction

Patient care is the essence of the nursing profession, focusing on the preservation, restoration, and promotion of self-care, currently based on evidence-based nursing (EBN) established through solid research from various studies, thus shifting the paradigm from traditional or experiential practice (Campo and Klijn 2011).

The implementation of EBN as the process that enables the profession the ability to make decisions based on the application of the scientific method demands nursing professionals to develop research and allows them to substantiate the care provided to patients, strengthening the profession's autonomy (Rojas et al. 2020)

We will delve into nine errors in nursing management related to the care of critically ill patients.

Routine Endotracheal Tube Secretion Aspiration

In patients undergoing advanced airway management, the placement of an endotracheal tube impedes the glottis. This interference disrupts the natural expulsion of secretions by physiological means, such as an effective cough or the mucociliary clearance mechanism. As a result, endotracheal suction becomes a critical nursing intervention, essential for maintaining airway cleanliness and preventing obstruction (Blakeman et al. 2022).

Given its invasive nature, the aspiration of secretions carries a heightened risk of complications, including hypoxemia, trauma, cardiac arrest, and potentially fatal outcomes. Therefore, a thorough assessment is paramount to determine the necessity for suctioning. This assessment should meticulously seek specific indicators that suggest the need for aspiration. Key signs include desaturation, elevated airway pressure, decreased tidal volume, a sawtooth pattern in the flow/time curve, pulmonary rales upon chest auscultation, and the presence of visible secretions within the ventilatory circuit (Pinto et al. 2020).

When implementing the suction technique, adhering to best practice guidelines ensures patient safety and effectiveness of the procedure. These include:

- Suctioning should be performed based on clinical need rather than a routine schedule to avoid unnecessary risks.
- Rigorous hand hygiene is essential both before and after the procedure to prevent the transmission of infections.
- The suctioning process should not exceed a maximum duration of 15 seconds to minimise discomfort and potential harm to the patient.
- The suction pressure for adults should be carefully regulated between 80 to 150 mmHg to ensure efficacy while reducing the risk of trauma.
- Choosing a catheter of the correct size is crucial for the effectiveness of the suctioning process and to minimise discomfort.
- Maintaining the sterility of the catheter and ensuring the suction system remains closed throughout the procedure are imperative to prevent infection.

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- Documentation of the suction procedure on the nursing sheet is vital for continuous patient care and monitoring.

Bronchial Lavages

The American Association for Respiratory Care (AARC) and the American Association of Critical Care Nurses (AACN) have advised against the routine employment of bronchial lavages (Blakeman et al. 2022). In a more recent development, Chang et al. (2023) undertook a systematic review to evaluate the advantages and disadvantages of employing 0.9% sodium chloride solution for bronchial lavage before performing endotracheal aspiration. The findings highlighted several concerns, including a reduction in oxygen saturation that notably prolonged the recovery time back to initial levels, a decrease in arterial pH, an increase in secretion volume, a rise in heart rate, and an elevation in systolic blood pressure. These results suggest significant physiological impacts from the use of bronchial lavages, underscoring the need for careful consideration of their application in clinical practice.

Oral Hygiene with Chlorhexidine as Prevention of VAP

The oral cavity serves as a conduit to the lower airways, highlighting a link between respiratory infections. Historically, chlorhexidine gluconate has been considered the benchmark for oral care and maintenance, particularly in preventing ventilator-associated pneumonia (VAP). However, recent observations have recorded adverse events stemming from its usage, including erosive oral lesions, ulcerations, and the formation of white and yellow plaques, alongside bleeding of the mucosa (Silva et al. 2021).

Oral hygiene remains a fundamental and non-negotiable aspect of patient care, applicable universally, regardless of whether a patient is undergoing advanced airway management. To ensure proper oral hygiene, recommendations include the mechanical brushing of teeth using standard toothpaste and the regular moistening of the oral cavity to maintain moisture levels (Labeau et al. 2021). These practices are critical not only for the prevention of respiratory infections but also for the overall well-being of patients.

Routine Gastric Residue Measurement

The ESPEN 2023 guidelines currently recommend an early start of artificial enteral nutrition within 48 hours after patient admission with the objective of reaching 100% of caloric intake within 3-7 days from the start of feeding (Singer et al. 2023).

Enteral feeding intolerance is a common complication in critically ill patients, defined as a gastrointestinal dysfunction that interrupts the prescribed feeding. Routine monitoring of gastric residue measurement is an obsolete practice as measurements often turn out to be inaccurate, influenced by factors related to the tube, patient, or nursing professional (Yasuda et al. 2021).

Continuous monitoring is associated with a lower nutrient intake and insufficient feeding, as well as causing a tube obstruction. ASPEN guidelines recommend a nursing assessment aimed at identifying signs and symptoms of intolerance, such as abdominal pain, abdominal distension, or vomiting.

Calculation of Insensible Fluid Losses

Insensible losses refer to the water eliminated imperceptibly through respiratory (pulmonary) and skin (cutaneous) routes, typically unnoticed and difficult to measure directly. To manage patient care effectively, a meticulous assessment of fluid balance, along with accurate documentation of fluid intake and output, is essential. Inaccuracies in this evaluation can lead to unnecessary fluid administration and misguided treatment strategies, potentially increasing the risk of mortality.

In their article "Controversies in Acute Kidney Injury: Effects of Fluid Overload on Outcome," Mehta and Bouchard (2011) elucidate that the daily fluid balance is calculated by the difference between fluid intake and excretion, typically excluding insensible losses. To streamline the evaluation of fluid overload, Granado and Mehta (2016) propose several interventions, including:

- Daily Fluid Balance: The discrepancy between total intakes and outputs, usually excluding insensible losses.
- Cumulative Fluid Balance: The aggregate of daily fluid balances throughout the duration of hospitalisation.
- Fluid Overload: Often indicative of conditions such as pulmonary or peripheral oedema.
- Fluid Accumulation: A state of positive fluid balance, which may or may not coincide with fluid overload.
- Percentage of Fluid Overload Adjusted to Body Weight: The cumulative fluid balance represented as a percentage relative to body weight.

Furthermore, we recommend not attempting to quantify insensible losses in fluid balances, as doing so is associated with incorrect negative balances and unjustified increases in fluid administration. This adjustment is crucial for maintaining accurate fluid balance assessments, thereby reducing the risk of complications associated with fluid overload and improving patient outcomes.

Bladder Exercises in Urinary Catheter Removal

Bladder catheterisation is frequently used in hospitalised patients, having established insertion criteria, especially the measurement

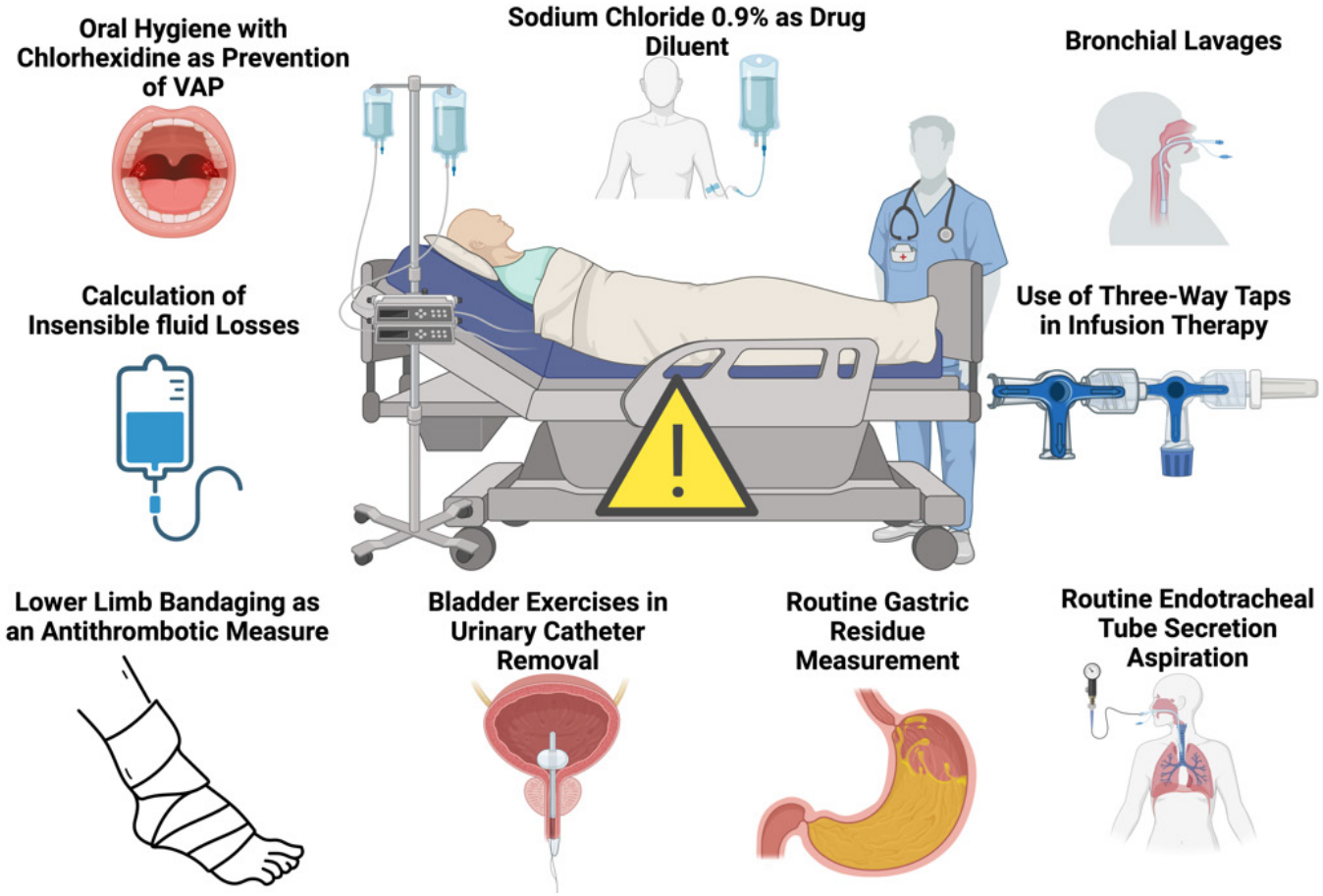

Figure 1. Errors in nursing interventions in critically ill patients

of urinary output. Bladder exercises were first described in 1936, mainly consisting of strengthening the pelvic floor muscle to recover bladder function (Wang 2016; Ellahi 2021). It is currently recommended:

1. To perform catheter removal without bladder exercises.
2. Bladder exercises for 24 or 48 hours with a frequency of four hours of occlusion and five minutes of continuous drainage do not benefit the restoration of bladder function.
3. There is no difference between occlusion and continuous drainage with the reinsertion of the bladder catheter.
4. Bladder exercises are a risky practice generating complications in the urinary tract, urinary tract infections, and urinary incontinence up to 22.5%

The insertion of a urinary catheter should be reserved for patients with a clear clinical necessity; its indications are limited to specific conditions, such as the need for precise monitoring in patients who are unable to communicate, individuals in a state of shock, or those experiencing urinary retention. Once these conditions no longer apply, it is recommended that the catheter be removed promptly, foregoing any bladder exercises.

Lower Limb Bandaging as an Antithrombotic Measure

Critically ill patients are at an increased risk of developing deep vein thrombosis (DVT) in the lower limb veins; compression stockings are effective in preventing DVT in critically ill patients but not required in patients with a low-risk (Ejaz et al. 2018; Sachdev et al. 2018).

Within the clinical practice guideline for Prevention, Diagnosis, and Treatment of Venous Thromboembolic Disease in the Obstetric Patient, as a good practice point (GPP), it is not recommended to use lower limb bandaging as equivalent or substitute for compression stockings.

Use of Three-Way Taps in Infusion Therapy

The Centers for Disease Control and Prevention (CDC) in 2011 mentioned that three-way taps represent a focus of infection and a potential entry point for microorganisms into vascular accesses and administered fluids (O´Grady et al. 2011).

Curran, in 2016, recommends the use of extensions as an alternative to three-way taps, allowing:

- Minimisation of dead space, which will avoid drug interaction.
- A closed system allows easy and effective disinfection, minimising the entry of microorganisms.
- Minimisation of biofilm formation and microbial growth.
- Manipulation further away from the patient reduces the risk of mechanical phlebitis in short peripheral vascular accesses.
- Free fluid pathway, which allows optimal flushing.

Sodium Chloride 0.9% as Drug Diluent

The nursing role in the stages of the medication process, especially in the process of drug preparation, is fundamental in the

prevention of adverse events derived from the ideal choice of diluent fluid.

Hypernatraemia (serum sodium [Na+], > 145 to 150 mmol/L) is generally caused by a positive sodium balance, often administered during infusion therapy as a diluent for parenteral drugs as well as to maintain vascular access patency using the SAS technique (Solution, Drug Administration, Solution) favouring the prevention of pharmacological incompatibilities (Choo et al. 2014).

Bihari et al. (2012) were the first to report that this could represent about 22% of the total Na+ load administered in 20 ICU patients, similar to the 22% coming from resuscitation and maintenance fluids. Indeed, diluting parenteral drugs in 0.9% saline solution and its use to keep catheters open can be modifiable risk factors for hypernatraemia because 5% dextrose in water can be used to dissolve many drugs and keep catheters open, thus partly avoiding Na+ overload.

Aoyagi et al. (2020) evaluated the impact on electrolyte imbalance, glycaemic control, incidence of kidney injury, and mortality in the adequate selection of the diluent to ensure proper intravenous therapy. The assessment of the diluent effect was performed before and after the change from sodium chloride 0.9% to glucose 5%, decreasing the incidence of hyperchloremia and hyperkalaemia without changes in glycaemic control; these changes highlight the magnitude of the problem regarding the appropriate selection of the diluent and its effects on hydroelectrolytic imbalances.

Conclusion

The importance of evidence-based nursing practices in the care of critically ill patients cannot be overstated. It encourages a shift from traditional methods to practices supported by scientific evidence, highlighting the necessity for accurate medication diluent selection, diligent oral hygiene, and effective management of respiratory secretions. This approach underscores the essential role of nursing in improving patient safety and clinical outcomes, advocating for continuous research and education to advance the quality of care and ensure patient safety in the intensive care unit.

Conflict of Interest

None.

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