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Patients and Families

Collaboration between critical care doctors, patients and families is essential to managing critically ill patients. Promoting open communication, shared decision-making, and emotional support is essential to ensure a patient-centred approach in critical care settings.

Communication plays a crucial role in a critical care setting. Critical care teams are trained to manage complex medical situations in the ICU. They oversee the care of critically ill patients, coordinate with other healthcare professionals, and make decisions about treatment plans. They have the expertise and skill to manage life-threatening conditions by utilising advanced medical technologies and coordinating a multidisciplinary team. The patient must be actively involved in their care decisions. Informed consent, communication about treatment options, and understanding the implications of medical interventions are essential aspects of their participation. At the same time, patients are often unable to decide for themselves, and their relatives are their substitutes in the decision-making process. The relatives provide emotional support, may have to make decisions on behalf of the patient and serve as a bridge between the critical care team and the patient. They often become part of care discussions, especially if the patient cannot communicate.

With so many players involved in the care of critically ill patients, effective communication becomes critical between critical care doctors, patients, and families. Doctors need to explain medical conditions, treatment options, and potential outcomes in an understandable way to the patient and their families. When needed, decisions about treatment plans, life-support measures, and end-of-life care should be made through shared decision-making involving the patient, their family, the doctors and the entire team. The critical care team also needs to provide emotional support to patients and their families. Coping with critical illness can be extremely challenging, and empathy and understanding are essential components of care.

In this issue, our contributors discuss strategies for clinicians and researchers to work with patients and families to advance clinical care, the rationale for patient and family engagement in the ICU, and opportunities to strengthen this engagement and promote patient and family involvement in care delivery.

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

Jean-Louis Vincent

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Bringing Back the Forgotten Puzzle Piece: Family Empowerment in the Care of the Critically Ill Patient

This article aims to address patient-family-centred care programmes, starting from their origins and discussing new protocols.

Critically ill patients entail a great complexity of care. ICU staff has focused on their care, with family members and surrogates put aside for decades. In recent years, we are witnessing a paradigm shift led by nursing teams (Clark and Guzzetta 2017; Davidson 2009) and professionals dedicated to the paediatric patient (Griffin 2006; Lee et al. 2014; Wratney 2019): patient and family-centred care (PFCC) is here to stay.

The Dawning of PFCC

In 1993, the Picker Institute introduced the concept of "patient-centred care" as a response to growing concerns about disease-centred or clinician-centred care. Attempts to change this disease-focused care (and paternalistic model) earmarked six dimensions of healthcare improvement: (1) respect for patient's values, preferences, and expressed needs; (2) coordination and integration of care; (3) information, communication, and education; (4) physical comfort; (5) emotional support; and (6) involvement of family and friends (Gerteis et al. 1993; Todres et al. 2009; Tzelepis et al. 2014). A respectful ICU requires recognition of fundamental human needs (physical, emotional, and psychological safety), acknowledgement of patients as unique individuals, and attention to the critical status and vulnerability of patients and families in the ICU (Azoulay and Sprung 2004; Bidabadi et al. 2019; Brown et al. 2018; Gazarian et al. 2021).

Critical illness of a loved one has enormous effects on family members, with approximately one-quarter to one-half of family members experiencing significant

psychological symptoms, including acute stress, generalised anxiety, and depression both during and after the critical illness (impact termed as post-intensive care syndrome family; PICS-F) (Davidson et al. 2012; Lautrette et al. 2007; Needham et al. 2012). Families become essential caregivers, and we must support them: we must help mitigate the impact of the crisis of critical illness, prepare them for decision-making and caregiving demands, facilitate ethical shared decision-making, and promote their engagement during the ICU stay. High-quality family-centred care should be considered a fundamental skill for ICU clinicians (Gerritsen et al. 2017; Kang 2023). Increasing awareness of the vital role of family members in the ICU (and their continuous support) has shown improved outcomes for the family caregivers and patient outcomes (Adelman et al. 2014; Alonso-Ovies and Heras la Calle 2020; Lynn 2014). This trend has led to the "ICU humanisation movement" (de la Fuente-Martos et al. 2018; Nin Vaeza et al. 2020).

Starting Point: Guidelines 2007 and 2017

In 2007, the "Clinical practice guidelines for support of the family in the patient-centred intensive care unit" were published (Davidson et al. 2007). By 2017, the same group performed a new and more rigorous analysis, publishing new guidelines representing the current state of international science in family-centred care and family support for family members of critically ill patients across the lifespan (Davidson et al. 2017).

Within the guidelines, patient- and family-centred care is a model of providing care in which the patient and family ally with the care team. **Table 1** summarises the most relevant points.

A little later, (Goldfarb et al. 2017) published a systematic review and meta-analysis assessing the outcomes of PFCC interventions. They found that over three-quarters of PFCC interventions were associated with improvements in at least one outcome measure (increased patient and family satisfaction, improved mental health status, and decreased resource use,

including decreased ICU length-of-stay (LOS)). In contrast, by 2022 (Bohart et al. 2022) concluded that it was uncertain if PFCC, compared to usual care, reduced post-traumatic stress disorder (PTSD), delirium days, anxiety, and depression in patients due to limited and low certainty evidence. There is, therefore, a need for randomised controlled trials (RCT) on the effect of multi-component PFCC interventions on core outcomes for longer-term recovery in patients and families after ICU admission.

Barriers to Achieving PFCC

According to Kiwanuka et al. (2019), barriers to achieving PFCC across studies could be classified into four categories (**Figure 1**). For patient-centred care to become truly embedded in the healthcare system, it must depend on reliable systems rather than individuals. Organisational and teamwork factors profoundly impact quality and care outcomes, particularly in the ICU, where administrative and teamwork factors are central to daily operations (Long et al. 2016; Ludmir and Netzer 2019).

Domain	Item	GRADE *
Family presence in the ICU	Flexible family presence at the bedside, working in partnership with ICU staff	2D
	Participating in interdisciplinary team rounds	2C
	Present during resuscitation efforts (staff member assigned to support them)	2C
Family support	To be taught how to assist with care, improving confidence and competence (specific to neonates)	2B
	Family education programmes	2C
	Peer-to-peer support in NICUs	2D
	Leaflets with information about the ICU setting	2B
	ICU diaries	2C
	Validated decision support tools (optimising communication and medical comprehension): interactive movie regarding ICU environment and procedures, informative website, video-based education, etc.	2D
	Written bereavement brochure	2C
Communication with family members	Interdisciplinary family conferences	
	Structured approach (VALUE mnemonic)	2C
	ICU clinicians receive family-centred communication training	2D
Specific consultations and ICU team members	Proactive palliative care consultation	2C
	Ethics consultation for whom there is a value-related conflict between clinicians and family	2C
	Psychologist's intervention to incorporate a multimodal cognitive-behavioural technique-based approach (NICU)	2D
	Social workers as part of the interdisciplinary team	2D
	Family navigators (care coordinator or communication facilitator)	2C
	Spiritual support	2D
Operational and environmental issues	Protocols for standardised use of sedation and analgesia during withdrawal of life support	2C
	Nurses involved in decision-making about goals of care	2D
	Environmental hygiene practices (e.g. noise reduction)	2D
	Family-support zone: family lounge, family nourishment area, meditation area, and a family sleep area (whether it be inside the patient room or near the ICU)	2D

Table 1. PFCC recommendations

*GRADE = Grading of Recommendations, Assessment, Development, and Evaluations. VALUE = Value family statements, Acknowledge emotions, Listen, Understand the patient as a person, Elicit questions

What is Brewing Within the ICU Programmes?

Input from the Paediatric ICU (PICU)

Addressing children's social and emotional needs during hospitalisation was initially acknowledged in the 1920s and 1930s and formalised in the 1950s. Child life providers focus on helping both the child and family cope with illness through the following: (a) providing play experiences, (b) presenting developmentally appropriate information about events and procedures, and (c) establishing therapeutic relationships with children and parents to support family involvement in each child's care (Bruce and McCue 2018). Based on child life providers, adult life providers may provide family support based on an adaptation of the following three core child life principles (Figure 2).

Other developments coming from the PICU are the use of virtual family-centred rounds (Rosenthal et al. 2021), involving the family in the daily care of the patient (Verma et al. 2017; Zhang et al. 2018) and focusing efforts on family members with long-stay ICU patients (Erçin-Swearinger et al. 2022).

Strengthening communication

Many articles regarding PFCC stress the importance of information and communication. The lack of fluid communication between the two sides of the clinical relationship forces families to seek answers from unreliable sources. Without adequate communication, decision-making, so necessary for the critically ill patient, may be based on misunderstood or incomplete information. It is, therefore, indispensable to improve communication skills through training, identify possible barriers, create a calm environment that favours communication and dedicate the necessary time so that they can raise any doubts they may have (Azoulay and Sprung 2004).

As conceptualised by Seaman et al. (2017), effective communication requires multiple communication platforms. Optimal commu-

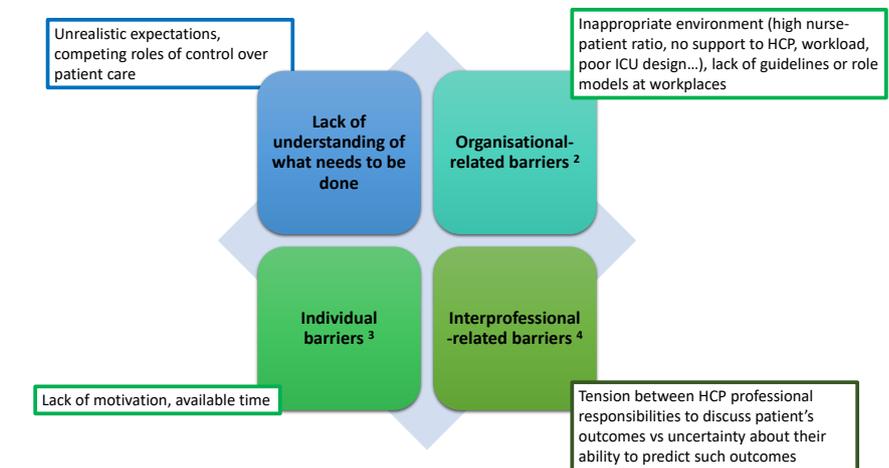


Figure 1. Barriers to achieving PFCC

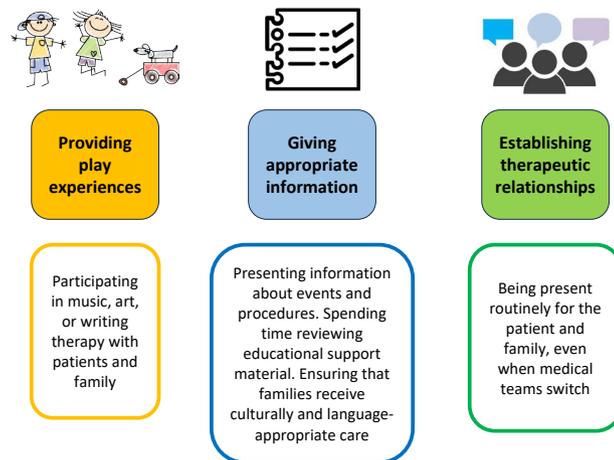


Figure 2. Adult life providers

nication is enabled when family-centred rounds, daily updates, patient portals, and interdisciplinary family meetings are combined (Scheunemann et al. 2011; Valls-Matarín and Del Cutillo-Fuente 2022). This allows their strengths to complement and their weaknesses to offset each other. In a recent trial of a comprehensive family support intervention in the ICU, surrogate decision-makers in the intervention group reported a higher quality of communication and a degree of patient-centredness and family-centredness. However, there was no difference in surrogates' symptoms of anxiety or depression six months after ICU

discharge (White et al. 2018). Additionally, protocolised family support interventions demonstrated improved communication, enhanced shared decision-making with family, and reduced ICU length of stay (Lee et al. 2019).

Lastly, we must not forget that all communication must occur in an environment of respect and empathy. ICU-CORE (Beach et al. 2018) and EDMCQ (Ethical Decision-Making Climate Questionnaire) (Van den Bulcke et al. 2018) are self-assessment instruments used to measure the overall environment and climate of respect in the ICU. Ultimately, the DISPROPRICUS

study group published a comprehensive multicentre study showing an independent association between clinicians' intent to leave and the quality of the ethical climate in the ICU (Van den Bulcke et al. 2020). Therefore, interventions to reduce the plan to leave may be most effective when they focus on improving mutual respect and interdisciplinary reflection.

Engaging families in patients' care

For relatives, the opportunity to actively participate in ICU care may diminish feelings of powerlessness and decrease the chance of developing PICS-F after discharge. A recent paper (Dijkstra et al. 2023) included studies on family participation in essential care activities during ICU stay (participation free of obligation and left to the relatives' discretion). Identified themes on needs and perceptions were relatives' desire to help the patient, a mostly positive attitude among all involved, stress regarding patient safety, perceived beneficial effects, and relatives feeling in control. Patient and family opinions have even been considered when designing and implementing a weaning trial (Burns et al. 2017).

Nonetheless, research on relatives actively participating in essential care is limited (Olding et al. 2016), and how family participation should be performed is unknown. Furthermore, identified factors influencing active family engagement in care among critical care nurses (Hetland et al. 2017) were age, degree earned, critical care experience, hospital location, unit type, and staffing ratios. In this case, nursing workflow partially mediated the relationships between the intensive care unit environment and nurses' attitudes and between patient understanding and nurses' perspectives.

Visitation policies

Visitation policies in ICUs have evolved from very restrictive in the 1960s to more open (Milner 2023). Visitation allows patients to stay in touch with their family members and friends and be aware of events outside the hospital, positively affecting their condition (Escudero et al. 2016). During the pandemic, we also learned

that using new technologies within the ICU is possible, bringing the virtual visit to the daily ICU work (Rose et al. 2021). Video communication is also helpful for information sharing and brief updates, aligning clinician and family perspectives.

An important issue regarding visitation is that the ICU is an emotionally taxing environment. Family members experience difficult emotions alongside their ill loved ones due to the intimidating and complex nature of the ICU, its restricted access, and the limited ability to interact with patients. Patient care is challenging, and the added demand to attend to the social needs of patients and their families may contribute to staff burnout (Ning and Cope 2020). For these reasons, facilitating the paramount role of visitation while simultaneously minimising any added burden on healthcare workers is crucial. An excellent example in this regard is the ICU bridge programme (Petrecca et al. 2022), which assigns volunteers (university students) to families. Volunteers acted as the bridge between families, staff, and patients, supporting both ends by representing the hospital staff (within the realms of their training) while keeping the non-medical needs of the patients and families.

Multi-component family support interventions

One of the main problems of PFCC is its implementation. PFCC programmes require multidisciplinary coordination beyond health professionals and must involve the hospital organisation and social policies at local and national levels. Recent studies (Wang et al. 2023; White et al. 2018) have assessed interventions delivered by the interprofessional ICU team that address both the affective and cognitive challenges that surrogate decision-makers experience. In the multicentre PARTNER trial, a low-cost intervention did not significantly affect the surrogates' burden of psychological symptoms at six months. Still, the surrogates' ratings of the quality of communication and the patient- and family-centredness of care were better, and the ICU LOS was shorter with the intervention than with usual care.

Wang et al. (2023) systematically reviewed randomised family-centred interventions with family-centred outcomes in the adult intensive care unit (ICU). 67.3% of studies found improvements in at least one family-centred outcome, and 60% showed improvement when assessing the impact on mental health outcomes.

Currently underway, the FICUS trial (NCT05280691 (Naef et al. 2022) will test the clinical effectiveness and explore the implementation of a multi-component, nurse-led family support intervention in ICUs. The primary study endpoint is quality of family care, operationalised as family members' satisfaction with ICU care at discharge. Secondary endpoints will include quality of communication and nurse support, family management of critical illness (functioning, resilience), and family members' mental health (well-being, psychological distress) measured at admission, discharge, and after 3, 6, and 12 months.

Within multi-component family support interventions, we may also find strategies to mitigate PICS-F, especially on the caregiver burden (Torres et al. 2017). Family caregivers report impairments in quality of life during the first year after the patient's admission to the ICU (Alfheim et al. 2019; Milton et al. 2022). Moreover, greater severity of PTSD symptoms, explicitly numbing and re-experiencing symptoms experienced by patients and caregivers during neuro-ICU admission, was predictive of worse 3-month quality of life (Presciutti et al. 2021). It is imperative to consider screening and follow-up of caregivers for mental health problems, especially within the post-ICU programmes. Examples of studies focused on decreasing PICS-F are the assessment of psychological interventions on the mental health of ICU caregivers (Cairns et al. 2019; Ricou et al. 2020), the feasibility of implementing an app-based delivery of cognitive behavioural therapy to family members (Petřinec et al. 2021) or the development of a nurse-led intervention to support bereavement in relatives (van Mol et al. 2020).

What About Once Discharged?

One of the most critical limitations of the PARTNER trial was that it did not address events after discharge from the ICU that may have contributed to psychological distress, such as grief, financial strain, and the demands of caregiving. While family engagement throughout an ICU stay is central for patient healing, family members must also prepare to transition to post-discharge care. Caregivers face significant challenges, including the need to quit or change jobs and substantial economic hardships. Around 50-60% of caregivers of critically ill patients show depressive symptoms on patients' hospital discharge, and 43% reported symptoms one-year post-discharge (Cameron et al. 2016; Griffiths et al. 2013; Lobo-Valbuena et al. 2021). While many communication techniques mentioned above may mitigate the risk of developing PICS-F, families still need the emotional strength and skillset to care for their loved ones.

Active participation in care during the ICU admission may ease the transition

home and make it less stressful for family members acting as the primary caregivers. Future interventions should be developed with much closer family member input, designed by considering key features such as involvement outcomes (communication, decision-making and satisfaction), health outcomes (family trauma and family well-being) and patient outcomes (Figure 3). The choice of intervention should be informed by a baseline diagnostic of family members' needs, readiness, and preparedness for involvement (Xyrichis et al. 2021).

What Remains to be Done?

Healthcare systems must engage patients and families primarily through patient and family advisory councils. We must foster a humanised environment for patients and families and value and respect our healthcare workers, addressing the burnout syndrome in ICU clinicians. Further attention is needed in three areas:

- Disparities in healthcare delivery: By being responsive to the preferences,

needs, values, and cultural traditions of patients and families, PFCC may reduce inequities in critical care. We must study how healthcare disparities influence PFCC and explore how PFCC can promote health equity.

- Patient and family engagement: We must consider engagement as a continuum, occurring at different levels and influenced by multiple factors that affect the willingness and ability of patients and families to engage.
- Intentional efforts to humanise the ICU workplace environment for the betterment of patients, families, and staff.

The ICU environment of the future will be designed to support the needs of patients and family members and mitigate their risks for PICS and PICS-F. Wearable technologies and home-based rehabilitation programmes will identify and alleviate these syndromes better. Future ICU design will distinguish between clinical and non-clinical areas to better integrate humanistic objects; the utmost setting will optimise physical, emotional, and mental well-being for the patient, family, and critical care team, shifting from a hostile environment into a home-like environment through architectural and interior design modifications. Mapping the impact of ICU design on patients, families, and the ICU team will be a challenge for future generations (Kesecioglu et al. 2012; Kotfis et al. 2022; Saha et al. 2022; Thompson et al. 2012; Vincent et al. 2017).

Finally, data regarding the experience of critically ill patients at high risk of death are scant. In a recent multiple-source multi-centre study (Kentish-Barnes et al. 2023), a list of fifteen concerns was identified, encompassed in seven domains: worries about loved ones; symptom management and care (including team competence, goals of care discussions); spiritual, religious, and existential preoccupations (including regrets, meaning, hope and trust); being oneself (including fear of isolation and of being a burden, absence of hope, and personhood); the need for comforting experiences and pleasure; dying and

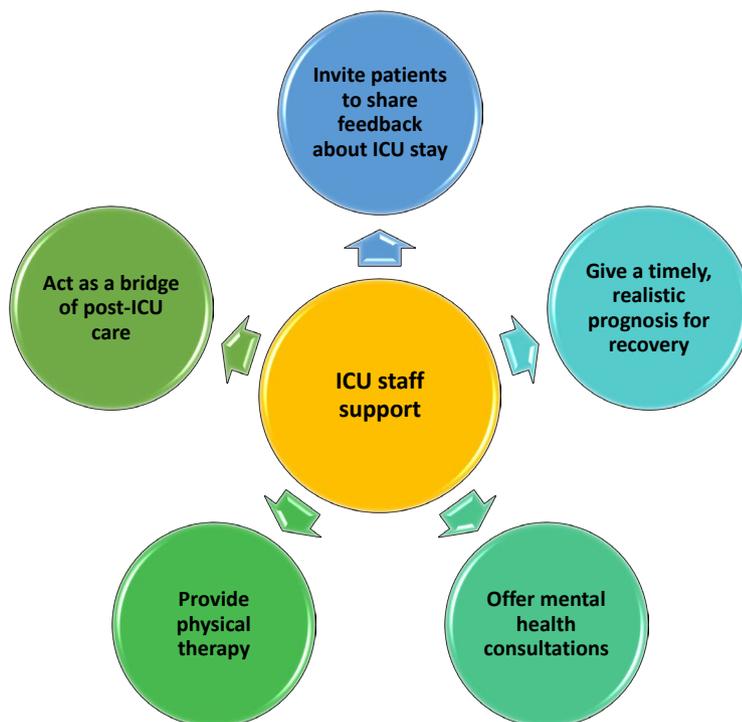


Figure 3. ICU staff responsibilities within PFCC

death (covering emotional and practical concerns); and after death preoccupations. Identifying problems could allow clinicians to meet their needs better and align their end-of-life trajectory with their preferences and values.

Final Thoughts

The COVID-19 pandemic has once again highlighted the need for multidimensional care for the patient and the family and essential support for the healthcare professional.

PFCC is integral to high-quality health care and benefits patients, families, and clinicians. The highly technical nature of critical care puts patients and families at risk of dehumanisation and renders the delivery of PFCC challenging. Deliberate attention to respectful and humanising

interactions with patients, families, and clinicians is essential. Optimal PFCC requires authentic engagement with patients and families of diverse backgrounds and experiences to inform quality improvement and research initiatives.

A better understanding of (1) the patient's needs and perceptions regarding family participation in essential care and (2) barriers that hinder a patient- and family-centred environment can help. Insights into these aspects can guide interventions to implement or improve PFCC in the ICU. Besides, education and training of relatives and ICU healthcare providers are necessary to address safety and quality of care concerns, though most studies lack further specification. In addition, randomised controlled studies are needed to improve our understanding of the impact of PFCC in the intensive care setting.

We must work together to create a humanistic ICU environment for our patients and ourselves. It is time to include bioethics in our daily practice. It is time to transform the ICU into a friendly and respectful environment.

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Our work as professionals dedicated to critically ill patients would not be what it is without the unconditional support of relatives and patients. They are why we wake up daily ready to care, learn and improve (albeit in tiny steps).

Conflict of Interest

F Gordo has performed consultancy work and formation for Medtronic. The other authors have no competing interests.

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*We shape our tools, and thereafter, our
tools shape us.*

-Marshall McLuhan

Introduction

In ancient times, the Oracle of Delphi was believed to be the greatest source of knowledge, wisdom and prophecy. In modern times, it is the internet, and in the future, it will be artificial intelligence (AI). In ancient times, one had to make an arduous trek. Nowadays, we merely access any connected computer, tablet or phone. The internet, free online medical education (FOAMed), and AI are increasingly the dominant sources for medical data, medical education, medical opinion, and medical predictions. Unfortunately, the same is true regarding medical disinformation. We now all – patient and provider alike – live in a digital age. This means we all need a degree of digital literacy; perhaps even a degree in digital literacy.

The Internet and the Rise of Artificial Intelligence in Critical Care Medicine: Opportunities, Threats, and the Practitioner-Patient Relationship

This article explores how pervasive and persuasive the internet is in current critical care practice, offers insights into how healthcare professionals, patients and families can critically appraise where information comes from and its content producers and discusses the opportunities and threats posed by AI on the physicians/team-patient/family relationships.

The use of the internet and AI is a massive and increasingly important topic. The internet is both pervasive and persuasive, and yet accessing information and opinion is not the same thing as knowledge or wisdom. At the very least, we healthcare providers (HCPs) need to direct our patients and students (and ourselves) towards higher quality resources and away from half-truths and nonsense. This also should engage reflection on our own online presence: what is expertise vs mere opinion, and how might this influence our current and future relationships with patients and families.

Patients, families and HCPs want fast access to reliable information, and the internet has certainly revolutionised our collective ability to do so. AI has the potential to dramatically increase both the speed and the access to information and appears set to revolutionise how we care for patients and families. Yet, above all, humans want to be seen, heard and cared for. There is an ever-present danger that, as technology grows, it becomes master rather than servant. The goals of this article are therefore: 1) to discuss how pervasive and persuasive the internet is in current critical care practice, 2) to offer insights into how HCPs, patients and families can critically appraise where information comes from and its content producers and 3) to explore the opportunities and

threats posed by AI on the physicians/team-patient/family relationships.

Consulting Dr Google: Medical Information on the Internet

The enormous increase in online medical information can make it difficult for everyone to distinguish signal from noise. This digital revolution is especially profound and disruptive because there now is a single, albeit vast, portal for education, opinion, information, and disinformation. Unless there are internet firewalls and restricted journal access, we also have a single portal for HCPs, patients and families. When compared to traditional medical forums (i.e. textbooks or journals), online material can be disseminated faster, wider and cheaper. The downside is that there is often less time for expert review and contemplation.

While the old ways of disseminating medical information (textbooks, peer-review, expensive journals) were far from perfect, there are dangers with relying solely upon internet searches. For example, it is unclear who or how information is filtered and who or how they are monetising the process. In short, most search algorithms are proprietary, and many revenue streams are opaque. In the 1960s, the philosopher Marshall McLuhan argued that “the

medium is the message” (McLuhan 1964). Accordingly, part of being a modern human - a member of “homo digitalis” - is understanding how the digital medium not only spreads messages but morphs them.

Health is one of the most searched topics online. There are at least 500 million daily tweets (Twitter Stats 2023) and four billion daily Google searches (Internet Stats 2023). This single search engine constitutes nine out of every ten searches, and the company is valued at over \$1.5 trillion. We live in an attentional economy, where more profit is made by keeping our attention rather than ensuring the truth. Moreover, anybody with a laptop, tablet or smartphone can now promote their ideas, regardless of whether these are grounded in science or mere opinion and regardless of whether or not they have any expertise.

Nowadays, medical information is less owned by HCPs or medical journals. Producers can game the algorithm using techniques like keyword stuffing and link-building, thereby making content look more relevant and more accurate than is warranted. An example during the pandemic was the Frontline Covid-19 Critical Care Alliance (FLCCC) website. This site promoted unproven, potentially harmful, therapies. The issue is that its professional appearance likely worsened relations because patients and families expected to receive harmful therapies such as ivermectin and hydrochloroquine. In the same vein, Google’s algorithms recently shifted from quality content to content optimised for advertising. The move from organic content to paid advertisements can make it harder to find useful, unbiased information. Search engines can also diminish diversity of opinion, given that over three-quarters of us never scroll past the first page of suggested sites. In short, if a source is not ranked on the first page, then it is unlikely to be read or to influence the debate.

The internet not only makes it quicker to find resources but also easier to criticise and dismiss (Wilkinson et al. 2019). Medical

information has been democratised, but the cautious, iterative, scientific method is under threat. Traditional crucibles of medical debate have less of a monopoly over what is considered mainstream or trustworthy. Journals also have fewer paid subscribers and, therefore, face unpredictable futures. Digital publication is now associated with over 30,000 journals on PubMed alone. This makes it harder for most of us to remain current or claim broad competence.

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Anyone with a significant online presence can have an influence disproportionate to their scholarly standing or clinical expertise (Cameron et al. 2017). Moreover, social media is playing an ever-increasing mainstream role. Accordingly, Facebook™, WhatsApp™, Wikipedia™, YouTube™ and X™ (formerly Twitter) are increasingly important sources of medical information for the public. Importantly, however, the same is true for HCPs. Blogs, podcasts and websites are increasingly recommended over textbooks and journals for teaching and learning (Cadogan 2014; Eysenbach 2011; Thoma 2015).

Because of the deluge of information, readers, HCPs or patients/families are, nowadays, more likely to scan, rather than fully engage, absorb and reflect. There may be less patience for nuance or interest in ideas that challenge bias. Virtual communication also makes it easier for humans to be anonymous, rude, and dismissive. Accordingly, traditional publishers and academic institutions face an existential dilemma. Namely, to what degree should they embrace digital media to be popular or stay relevant? Websites,

blogs and videos can receive thousands more views than journal articles and reach previously untapped audiences. In contrast, an excessive online presence can also tarnish standards, reputation and brand. Universities also face uncertainty regarding how best to recognise and reward non-traditional scholarly output from their faculty and whether they can (or should) censure online heretics. In other words, we must be cautious not to equate worth with ease of access or popularity (Cameron et al. 2017).

Returning to Marshall McLuhan, the digital revolution has affected not only how we report medical ideas but also whether they persist. Ideas (i.e. packages of information) can now spread like viruses (i.e. packages of genetic information). Similarly, memes (units of cultural information) compete like genes (units of genetic information). Regardless, the internet has dramatically affected how ideas are birthed, raised, and matured. It has also affected how we interact as humans.

Families Searching Doctors; Doctors Searching Patients

Many families of critically ill patients turn to internet searches when someone they care for is admitted to the ICU. They go online to better understand the disease and to seek out support. However, many also search for their physicians to understand who they are, their expertise (or lack thereof), their publications, and their ratings. Upon being introduced, it is not infrequent - though it can be disconcerting - to have family members inform HCPs that they have ‘read all about them’. Being the subject of internet searches by patients feels, well... awkward. Even if we have posted the information ourselves, it can feel like starting a conversation with a person whose name you have forgotten, or, once met but cannot place.

What is less well-known is that many physicians also “Google” their patients (Belisomo 2015; Brown 2019). Sometimes searches are performed at the patient’s

request to understand their career (e.g. artist, photographer), to determine if that patient is delirious, or, more controversially, to look up details of their lives (Belisomo 2015; Brown 2019). Regardless, the reciprocal nature of these online searches shows how internet searches have profoundly affected how modern humans interact.

HCPs might go on ward rounds without a stethoscope now, but few of us are ever far from an internet connection. Along with looking up patient records and journals, HCPs also search the internet to better understand behaviours, fads or health crazes. These could range from beliefs in alternate drugs (e.g. ivermectin in COVID), dietary cleanses (e.g. high dose baking soda), or new illicit drugs (i.e. carfentanyl, xylazine) or eccentric practices (e.g. ingesting Tide pods). Of note, these Google searches usually yield faster results than traditional medical searches. They also show exactly what people are reading and exploring.

It can be challenging to answer every internet-related question a family has. Regardless, it is a way to show that we are eager to partner, maintain dialogue, and build trust. For patients and families, it is a way to feel empowered, but it can also result in misinformation, anxiety, and, at times, an exaggerated sense of understanding. The challenge for both parties is to navigate this landscape with trust, transparency, integrity, and patient-centredness. It starts with a basic understanding of what is quality online information and what is not.

Online Medical Information: It's Popular, But Is It Any Good?

The term "Free Open Access Medical Education", aka "FOAM" or "FOAMed", reportedly originated in an Irish pub. Apparently, a doctor was preparing a talk and stared at a half-emptied beer glass. This individual wanted to encapsulate the proliferation of free online open access medical education, and FOAM was coined (Shaw 2013). These online resources include blog posts, podcasts,

online videos, Facebook groups, Twitter feeds, and Google Hangouts. To date, the largest proportion of FOAM comes from emergency medicine, with lesser amounts from critical care medicine and anaesthesiology. North American sources currently predominate.

While some have raised concerns with FOAMed and emphasised the need to wait for qualified experts, others argue that online medical material is now unavoidable. If so, the focus should be on whether digital resources are higher versus lower quality and higher versus lower influence.

patients and HCPs want reliable information, but above all, humans want to be seen, heard and cared for

Ways to gauge the quality of online work include the Medical Education Translational Resources Impact and Quality (METRIQ) study collaboration (<https://metriqstudy.org/>) and the Critical Care Medical Education Website Quality Evaluation Tool (CCMEWQET) (Wolbrink 2019). Many scoring systems also exist and include the Social Media Index, the ALiEM AIR score, and the Revised METRIQ Score. Others (Ting et al. 2020) have also identified ten tools, categorised into those that help readers and those that rate producers.

In addition to assessing the quality of online products, we can assess producers (i.e. authors). The h-index is a traditional metric used to estimate the productivity of an individual scholar. It is the maximum value where a given author has published h-papers each cited h-times (Hirsch 2005). Albeit slightly tongue-in-cheek, a similar index was developed for the social media age. The Kardashian Index (KI) (Hall 2014) refers to Kim Kardashian, someone with innumerable online followers but no official scientific credentials. The serious point is that in the digital age "influencers" (whether celebrities or academics) can have a greater impact- or lesser impact-

than their academic standing warrants (Brindley et al. 2022).

AI and Big Data in Critical Care Medicine: Servant, Not Master

AI refers to computer systems that perform tasks that would otherwise require human intelligence. These include, but are not limited to, pattern recognition and decision-making. These are usually powered by big data, namely huge data sets that can be analysed computationally to reveal trends and associations. Critical care medicine is on the cusp of an AI explosion (Hong et al. 2022; Saqib et al. 2023; van de Sande 2021). Potential AI applications are currently limited only by our human imagination and programming power. In time, however, AI holds the prospect of devices updating their own algorithms and generating their own searches.

AI already has the ability to predict patient deterioration (Chen et al. 2022; Cho et al. 2020), diagnose/predict the development of sepsis (DeCorte et al. 2022; Pai et al. 2022), predict the development of surgical site infections (Hopkins 2022), prognosticate ICU outcomes from a variety of critical illnesses, predict the effectiveness of triage, determine the best time to initiate intubation (Im et al. 2023; Nopour et al. 2023; Siu et al. 2020), and predict weaning from mechanical ventilation, extubation and safe ICU discharge (Abad et al. 2021; de Vos et al. 2022; Fabregat et al. 2021; Liu et al. 2022). It can predict the impact of ICU surge on patient mortality (Greco et al. 2022), the time to death after withdrawal of life support, and the success of organ transplantation (Yu et al. 2022). It may soon be able to anticipate the factors that create ICU physician/team stress and strain, identify training needs and predict future outcomes. The potential implications for patient care and the HCP-patient/family relationship could be staggering.

Rather than blindly accepting everything AI purports to offer, we should embrace our traditional academic scepticism. In other words, we should insist on

high-quality research and wise reflection before implementation. We should accept that AI's potential is virtually unlimited and, therefore, both exciting and scary. The anxiety surrounding AI includes what data it accesses/includes/excludes, and what algorithms are used. It matters what AI deems to be important/irrelevant (cost, quality of care, quality of life, etc.) in arriving at its results/predictions; an opacity often called its 'black box'. As with any decision-making algorithm, whether human or machine, there is concern regarding bias and discrimination (Hong et al. 2022; Lorenzini et al. 2023; Mittelstadt 2021). The ability of AI to predict and its quality of output depends on the quality of its input. Without good quality research (input) the effect of internet popularity may impair its usefulness (output).

There is also anxiety about how human values, beliefs and lived experiences will be taken into account, if at all (Hong et al. 2022; Lorenzini et al. 2023; Mittelstadt 2021). To date, relatively few research studies have explored the lived experiences of critical illness. While some are now including patients and families as co-researchers to better understand their needs and priorities (Douma et al. 2021; Douma et al. 2023), AI risks moving us further from such considerations due to the dearth of such research and the speed of its own development. The concern is that CCM will see an erosion of patient-centred care and a loss of its humanity.

Many have argued that HCPs do not need to fully understand how AI works to use it as a tool. We disagree. This is because AI may provide more than just data that we can choose to ignore. It may guide decision-making and be far more determinative, especially if used to prognosticate, and especially if/when AI exceeds human intelligence.

AI's Potential Effects on HCP-Patient/Family Relationships

While the potential of AI is not yet realised, discussions of its potential impact on HCP-

patient/family relationships (Mittelstadt 2021; Nagy and Sisk 2020; Saqib et al. 2023; Sauerbrei et al. 2023) have begun. These have focused on AI's ability to expand knowledge and understanding of health and illness. It has also been suggested that AI may enhance HCP-patient/family relationships by freeing up HCPs from more administrative tasks, allowing them to spend more time with patients, though whether this is realistic is not clear.

AI could supplant physicians in core knowledge, could be better at generating differential diagnoses, and could be quicker with decision-making. It is anticipated that physicians who use AI as an assistive tool will outperform those who do not. In time, we may even be mandated to use AI. Its enhanced ability to prognosticate may also have implications for how we triage scarce resources. Families currently, and understandably, raise concerns if they believe physicians are making decisions based on imperfect prognosticators. They are not likely to be any happier when algorithms and computers decide, even if the prognostications are more informed. Fears have already been raised about a return to more paternalistic care, this time governed by machines (Lorenzini et al. 2023).

Alternatively, AI offers many putative advantages. For example, with better prognostication, we could spare families weeks of organ support if we know the outcome will be bad or increase their resolve if we know there is a good chance. For those wrestling with whether to offer organ donations after cardiac death, they could be spared the distress if we knew that the patient would not die in the necessary timeframe. AI predictions of survival post-transplant could also result in better matching of donors and recipients, thereby improving both the likelihood and quality of survival.

Whether its benefits will ultimately outweigh its risks, it seems certain that AI could challenge how trust is earned and kept within HCP-patient/family relationships. To maximise the potential of AI, perhaps

the best way forward is to learn from our past. Rather than wait for patients and families to come to us, we should accept they will have searched the internet and are likely to have questions. This means that -like it or not- part of our modern job includes reviewing AI searches/data together, translating what it means, and ensuring it is discussed in human terms.

Conclusion

AI's opportunities and its risks to the doctor-patient relationship were explored in the report, "The Impact of Artificial Intelligence on the Doctor-Patient Relationship"; commissioned by the Steering Committee for Human Rights in the field of Biomedicine and Health. In brief, these included: (1) Unequal access to this technology; (2) Insufficient transparency regarding inconclusive and misguided evidence; (3) The risk of social bias; (4) Diluting the patient's account of well-being; (5) The risks of automation bias, de-skilling, and displaced liability; and (6) A loss of privacy (Mittelstadt 2021). The report also questions what standards AI will be held to in relationship to professionalism and duty of care.

The use of machines and computers is central to critical care medicine, and these devices are becoming increasingly smart in their nature. While exploring technology's cutting edge, it is crucial to keep the focus on the relationship between provider and recipient. AI is a remarkable tool we should harness, yet its ultimate benefit or harm rests with how we control it. Patients and HCPs want reliable information, but above all, humans want to be seen, heard and cared for. We cannot forget that healthcare is, and should always be, about human connections, not just online connections. We just need to remember that with the tremendous power of AI comes great responsibility, and we need to apply it wisely.

Conflict of Interest

None.

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Administering Care to Critically Ill Patients with FAST HUGS IN BED PLEASE - Revisited Mnemonic

In the ICU, providing better care with less is the holy grail. This mnemonic tries to resume a list of the key interventions for human, evidence-based and patient-centred care.

Background

In 2005, Prof Jean-Louis Vincent introduced the mnemonic "FAST HUG," advocating for a comprehensive approach to patient care encompassing seven key components: Feeding, Analgesia, Sedation, Thromboembolic prevention, Head-of-bed elevation to 30-45°, stress Ulcer prophylaxis, and Glucose control (Vincent 2005). This paradigm shift has had a profound impact within the critical care domain, fostering a patient-centred approach that prioritises mental well-being, reduces invasive interventions, and promotes judicious fluid management.

Subsequently, in 2009, William Vincent and Kevin Hatton refined the mnemonic to "FAST HUGS BID", tailoring it for surgical patients. This expanded version incorporates additional elements: Fluid management, consideration of Spontaneous breathing trials, meticulous Bowel care, timely removal of Indwelling catheters, and prudent De-escalation of antibiotic use (Vincent and Hatton 2009).

In a more contemporary context, 2021 saw Chris Nickson's contribution through the "Life in the Fast Lane" blog, wherein the mnemonic was further enhanced to "FAST HUGS IN BED Please". This iteration takes into account the intricacies of care in the emergency department, encompassing Fluid therapy and Feeding; Adequate Analgesia, administration of Antiemetics, and provision of Diphtheria booster/vaccine; thoughtful Sedation and consideration of Spontaneous breathing trials; Thromboprophylaxis measures;

Tetanus prophylaxis; Head elevation (30°) for intubated patients; proactive Ulcer prophylaxis; vigilant Glucose control; thorough Skin and Eyecare, along with proper suctioning; management of Indwelling catheters; Nasogastric tube maintenance; meticulous Bowel care; Environment optimisation (including temperature control and conducive surroundings for delirium management); De-escalation strategies (pertaining to end-of-life decisions and cessation of unnecessary treatments); and comprehensive Psychosocial support for patients, families, and staff (Nickson 2021). This updated rendition provides a more encompassing framework, rendering it a highly practical tool. Within our medical practices, it has been embraced across the spectrum - from the intensive care unit to the emergency department and hospital wards.

Administering Care to Critically Ill Patients with FAST HUGS IN BED PLEASE

We present a revised iteration of the mnemonic, incorporating often overlooked aspects:

F: Feeding

Conduct a thorough nutritional assessment and provide support as required. Emphasise the importance of adequate nourishment, as prolonged fasting can detrimentally impact outcomes. Even in surgical scenarios, short fasting is the prevailing practice. In the emergency department, proactive measures can be

taken to ensure meal provision and, if necessary, consultation with nutrition specialists for patients with specific needs such as diabetes, hypermetabolic conditions (e.g., burns, hyperthyroidism), or malnutrition (Compher et al. 2022). Comprehensive nutritional evaluation and suitable oral or enteral diets are advantageous for critically ill and most hospitalised patients, with parenteral routes reserved for select cases (Weimann et al. 2021; Singer et al. 2019).

A: Analgesia and Antiemetic Agents

Pain management ranks among the prime concerns for patients seeking medical attention. Systematic pain assessment, regardless of intubation status, should be undertaken employing validated scoring systems such as the critical care pain observation tool (CPOT) or the behavioural pain scale (BPS). Effective analgesia markedly influences the perception of care quality and enhances outcomes across a spectrum of cases, ranging from minor bruises to postsurgical and critically ill ventilated patients. Optimal approaches encompass a blend of opioid and non-opioid agents, including acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), antineuritic medications, and, where applicable, interventional analgesic techniques (Devlyn 2018). Antiemetic agents such as ondansetron or alcohol in cotton swabs can be contemplated for patients grappling with nausea triggered by analgesic use or underlying medical conditions.

S: Sedation and Spontaneous Breathing Trial

Administer sedation only as necessary and strive for prompt withdrawal. Prioritise optimal analgesia and anxiolysis, favouring short-acting medications over benzodiazepines. Caution should be exercised with agents like propofol and dexmedetomidine (Escamilla et al. 2022; Narayan and Petersen 2022). Incorporating awakening and spontaneous breathing trials into the care regimen is pivotal, especially for mechanically ventilated patients whose intubation cause is controlled. These interventions contribute to a judicious

balance between patient comfort and their progression towards self-regulated respiration.

T: Thromboprophylaxis

Thromboembolic occurrences persist as significant contributors to morbidity and mortality within the inpatient setting. Utilising scoring systems such as Caprini and Padua offers insights to tailor optimal prophylactic strategies for each individual. From early mobilisation to employing parenteral thromboprophylactic agents like enoxaparin or compression pneumatic stockings, tailored approaches are pivotal. Specialised evaluation considering orthopaedic, cancer, autoimmune, critically ill, and surgical contexts play a pivotal role in averting thromboembolic complications. Recognising that a universal approach doesn't suffice, it becomes imperative to individualise interventions for enhanced efficacy (Sebaaly and Covert 2018; Amer et al. 2023).

H: Head Position and Humanised Care

Adapting the head position to suit individual needs is paramount. Varied positions offer unique benefits, and even a single patient can derive advantage from different orientations at distinct phases of care. Meticulous assessment and adherence to guidelines not only enhance patient comfort but also ensure their safety. Individuals vulnerable to or exhibiting cranial hypertension, particularly those on mechanical ventilation, may find positioning at an incline of 35-45° advantageous (Maschmann et al. 2019; Dabrowski et al. 2021). Humanised care and improving communication can empower the patient and family and promote personal care and hygiene. The use of hearing aids, glasses, and dentures are feasible and established recreation strategies (Wilson et al. 2019).

U: Ulcer Prophylaxis

Gastrointestinal ulcer prophylaxis, while not linked to reduced mortality, effectively mitigates the risk of gastrointestinal bleeding. Indications for commencing prophylaxis should encompass patients enduring positive pressure ventilation exceeding 48

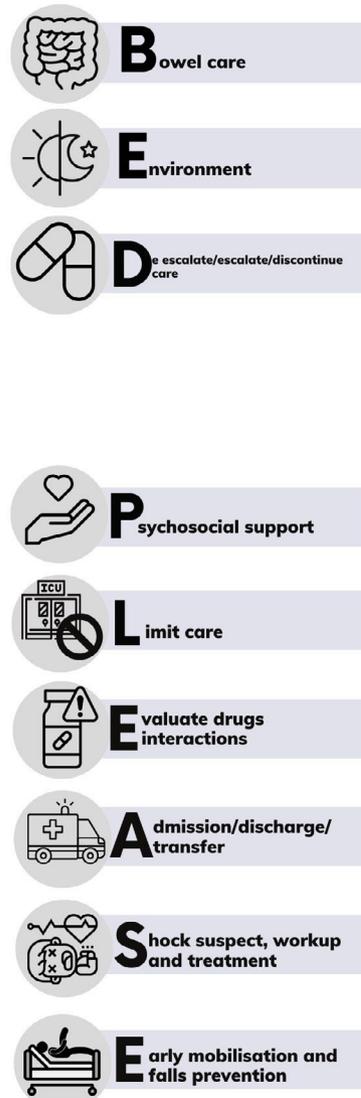
hours, those reliant on extracorporeal life support, individuals with a platelet count below $50 \times 10^9/L$, INR surpassing 1.5, aPTT exceeding twice the norm, history of recent gastrointestinal bleeding within the past year, acute traumatic brain injury or spinal cord injury, and substantial thermal injuries covering more than 35% of total body surface area (Saeed 2022). The early initiation of enteral nutrition, even in the presence of significant risk factors, contributes to reducing the likelihood of gastrointestinal bleeding, while the incorporation of proton pump inhibitors (PPIs) brings benefits to the aforementioned patient groups (El-Kersh et al. 2018).

G: Glucose Control

The ADA annually publishes guidelines that outline glucose thresholds for hospitalised patients. These recommendations categorise patients based on their vulnerability to hypoglycaemia and hyperglycaemia. Adherence to these guidelines, combined with vigilant management of glucose fluctuations, places significant emphasis on preventing hypoglycaemia while concurrently addressing hyperglycaemic episodes. This approach yields positive outcomes by substantially reducing the risks of morbidity and mortality, including conditions like decompensation, infections, and electrolyte imbalances. Integrating nutritional and rehabilitative interventions further enhances control by considering energy provision and anticipated expenditure (American Diabetes Association 2023). It's noteworthy that while insulin is commonly used to manage hospital hyperglycaemia, euglycaemic agents such as metformin and GLP-1 receptor agonists can also prove valuable.

S: Skin/Eye Care

Dermatological complications often emerge during hospitalisation, contributing to significant morbidity even if not typically life-threatening. Manifestations like pressure sores, intertrigo, and symmetrical peripheral gangrene underscore the importance of skin and eye care. Additionally, careful skin evaluation can aid in the identification of adverse drug reactions (Bromley et al.



2023). Particularly noteworthy are pressure ulcers, which pose a significant challenge for immobilised patients. Implementing standardised prevention protocols involving healthcare professionals across the spectrum, from doctors to auxiliary staff, is essential to mitigate this concern (Mervis and Phillips 2019). Simultaneously, ocular health demands attention, with corneal epithelial defects occurring in 20-42% of ICU patients. Impaired tear production

and reduced blinking heighten the risk of eye injury. The adoption of standardised eye care protocols has demonstrated efficacy in reducing complication rates and safeguarding ocular health (Hearne et al. 2018).

I: Interdisciplinary Care

Specialised care administered by interdisciplinary teams comprising doctors, nurses, pharmacists, physical therapists,

and nutritionists yields improved patient outcomes. Contrasting the multidisciplinary approach, where specialists operate within their defined domains, the interdisciplinary model orchestrates comprehensive patient assessment and synthesis of information to devise a unified and cohesive care strategy (Choi et al. 2006). Central to this approach is the collaboration of diverse specialists who collectively scrutinise patient cases. This cohesive teamwork enables the creation of a comprehensive care plan, encompassing inputs from all relevant disciplines (Giusti et al. 2017). The value of early engagement with suitable specialists cannot be overstated. Prompt consultations expedite interventions when required. For instance, infectious disease consultations have demonstrated their capacity to reduce mortality rates in both critically ill and non-critically ill patients within the intensive care unit (Jiménez et al. 2019). Similarly, oncology team involvement coupled with general surgery consultations has proven instrumental in enhancing long-term outcomes for patients newly diagnosed with cancer (Hujits et al. 2021; Butt et al. 2015). By embracing an interdisciplinary approach, healthcare teams synergise their expertise to provide holistic, timely, and tailored care, thereby augmenting patient well-being and treatment efficacy.

N: NEWS2 Score

The implementation of early warning systems, exemplified by the NEWS2 score, holds a pivotal role within hospital settings, functioning akin to a triage mechanism. As patients traverse their hospital journey, these systems adeptly detect shifts in their clinical trajectory, facilitating timely adjustments in the level of care, including potential transfer to the ICU. Moreover, they serve as triggers for rapid response teams to promptly address critical situations, thereby substantially elevating patient safety and overall outcomes (Scott et al. 2020). The integration of specialised rapid response teams, accompanied by tailored protocols, emerges as a cornerstone for

bolstering adherence to standardised procedures. This concerted effort yields a marked enhancement in clinical outcomes across a spectrum of medical domains. Illustrative examples encompass sepsis, myocardial infarction, obstetric emergencies, paediatric crises, respiratory complications, and both ischaemic and haemorrhagic strokes (Girotra et al. 2022). Through such deliberate implementation, hospitals cultivate an environment characterised by efficient and coherent responses, culminating in a pronounced enhancement of patient well-being.

B: Bowel Care

Comprehensive bowel care necessitates evaluating the suitability of oral or enteral routes for medication and diet tailored to individual needs and circumstances. Rigorous monitoring of bowel movements and assessment of stool characteristics are paramount, accompanied by proactive management of constipation or diarrhoea. Should concerns arise regarding intrabdominal pressure, its measurement assumes significance while mitigating the potential risks associated with bacterial translocation (Bowel Care in Critical Care 2020).

E: Environment

Crafting a conducive environment holds pivotal importance in ensuring patient comfort. Sustaining an appropriately warm room temperature fosters well-being. Meticulous modulation of light and noise, aligned with circadian rhythms, alongside regulated exposure to natural sunlight, establishes essential day-night routines. Frequent reorientation, active family engagement, and accessible critical care spaces coalesce to avert delirium, resulting in heightened patient perception of quality and enhanced clinical outcomes (Saran et al. 2020; Horsten et al. 2018).

D: De-escalate/Escalate/Discontinue Care (Chronic and Acute Treatments)

The timely initiation of antibiotics, especially in cases of sepsis, is paramount. Innovative microbiological molecular diagnostics implemented within the initial

hours can inform judicious antibiotic use, given their ability to provide insights into resistance genes. Swift and aggressive control of the infection source significantly enhances patient outcomes. Subsequent adjustment or discontinuation, guided by culture antibiograms and protein C and procalcitonin levels, facilitates the reduction of antibiotic usage, consequently diminishing the risk of resistant infections and overexposure. This approach leads to a reduction in ICU and hospital stays (Honda et al. 2010; Butt et al. 2015). For vasopressors, mechanical ventilation, sedation, and all therapeutic agents, a careful evaluation is imperative to determine the continuation, adjustment, or discontinuation of IV lines based on the patient's clinical status and prognosis. Peripheral lines can often suffice for patients who require IV treatment, while peripheral-inserted central catheters (PICCs) are suitable for prolonged therapies. Central venous access, which is reserved for specific cases, serves as an option for drugs that can damage vessels or involve high osmolarity solutions. The use of ultrasound guidance should be emphasised for both central and peripheral venous access. It's critical to limit unnecessary central access, as even peripheral lines benefit from ultrasound-guided insertion. Implementing catheter clinics specialising in complications prevention not only enhances outcomes but also curtails morbidity, underscoring the importance of prompt line removal (Lakbar et al. 2020). Invasive devices, including extracorporeal support, Foley catheters, and nasogastric tubes, should be promptly removed once their necessity diminishes. This approach aligns with the principle of minimising unnecessary interventions, a practice that improves patient outcomes and reduces complications (Benjamin et al. 2017; Nollen et al. 2023).

P: Psychosocial Support

Providing comprehensive psychosocial support, encompassing patients, families, and staff, is a fundamental aspect that extends to the implementation of a standardised suicide protocol. The hospital

environment frequently witnesses challenges of anxiety and depression among patients, particularly those facing prolonged stays, issues such as stomas, limb amputations, disabilities, and chronic or catastrophic diseases. Swift intervention from mental health specialists proves pivotal, enhancing patient outcomes and well-being. For critically ill patients, vigilant depression screening is essential, considering its significant prevalence (Fernando et al. 2022). The establishment of a suicide protocol represents a crucial step towards rendering holistic care for individuals with suicidal tendencies. This protocol should extend its reach to encompass the mental well-being of the patient's family. Regrettably, such events can also impact hospital staff, making their mental health equally relevant. The comprehensive approach underscores the interconnectedness of well-being within the hospital environment, embracing patients, families, and staff alike (Liao et al. 2020).

L: Limiting Care

In some instances, patients may reach a stage where the benefits of ICU or hospital care are limited. Acknowledging this juncture is crucial, enabling open discussions among the medical team and family to navigate end-of-life considerations. At this stage, palliative measures such as benzodiazepines and opioids can be employed to provide comfort and ease symptoms associated with the advanced disease stage. This compassionate approach encompasses the physical and emotional well-being of the patient, ensuring a dignified and supportive transition (Nieto et al. 2015).

E: Evaluate Drug Interactions and Avoid Potentially Inappropriate Medications

Vigilantly assessing drug interactions and steering clear of potentially inappropriate medications is a critical aspect of patient care. Conducting medication reconciliation yields multifaceted benefits, not only curbing secondary hospital-related morbidity but also curtailing the length of stay and associated costs. Continuation of chronic drug regimens serves to

prevent decompensation in patients with chronic illnesses, further underlining its significance (Bosma et al. 2018). Medication reconciliation is pivotal in averting drug interactions and potential adverse effects, translating into a reduction in secondary hospital-associated complications, thereby curbing the length of stay and expenses. Ensuring the continuation of chronic medications is instrumental in preventing the exacerbation of chronic illnesses (Nieto et al. 2015). In specific circumstances, the ongoing use of chronic treatments may be deemed appropriate, while in other cases, adjustment might be necessary even if the treatment isn't directly linked to the primary cause of hospitalisation. For example, anticoagulation drugs, antibiotics, immunosuppressants, antihypertensives, and thyroid medication could necessitate adaptation when a patient is dealing with severe illness or undergoing major surgeries. Similarly, diabetes medication generally remains suitable for most patients, although it may require modification to ensure optimal management during the hospital stay. This tailored approach to medication management ensures that patient health and safety are upheld in diverse clinical scenarios. Detecting medications that are contraindicated for a patient is feasible, particularly in the geriatric population. Beer's criteria, STOPP/V2, or EU(7) protocols can be referenced to identify inappropriate medications (Wilson et al. 2019). This conscientious approach to medication management enhances patient safety and well-being.

A: Admission/Discharge/Transfer

The emergency department often presents an environment conducive to delirium, characterised by noise, constant illumination, high activity levels, and occasional chaos. Timely admission is crucial as delaying it can heighten the risk of delirium, especially in predisposed patients. Similarly, delaying discharge can lead to anxiety and discomfort due to the same environmental

factors while also potentially congesting patient flow within the emergency department. Transferring patients to specialised units promptly has been shown to enhance outcomes, particularly evident in cases of acute myocardial infarction, stroke, cerebral haemorrhage, or severe trauma (Rosa et al. 2020; Yang et al. 2016; Escamilla et al. 2022).

S: Shock (Suspect, Workup, and Treatment)

Early detection of severe conditions is pivotal to ensure optimal care delivery. Adhering to current treatment recommendations not only improves outcomes but also curtails hospitalisation days and resource utilisation. The various types of shock—septic, hypovolaemic (haemorrhagic and non-haemorrhagic), obstructive, cardiogenic, and distributive (metabolic, toxic, medullary, neurogenic, anaphylactic)—all necessitate specific workups and tailored treatments. However, accurate suspicion and confirmation of shock are imperative to initiate these targeted interventions. (Narayan et al. 2022).

E: Early Mobilisation and Falls Prevention

Commencing early rehabilitation from day one proves instrumental in bolstering muscle strength and facilitating early mobilisation. This practice not only diminishes the risk of delirium but also mitigates the likelihood of deep vein thrombosis (DVT), thereby contributing to reduced ICU and hospital stays. Furthermore, it aids in facilitating successful weaning and enhancing discharge outcomes (Menges et al. 2021). Implementation of standardised protocols for fall prevention is pivotal. This encompasses comprehensive patient and family education, provision of anti-slip shoes, execution of transfer protocols involving specialised technicians, and even the incorporation of bed sensors for high-risk patients. Such a multifaceted approach effectively minimises the risk of falls, spanning from the emergency

department to the discharge phase (Benjamin et al. 2017).

Conclusion

The critical care unit demands a patient-centred approach that extends beyond addressing the disease itself, encompassing the holistic well-being of the individual. Embracing the key principles highlighted in this mnemonic aids in streamlining care, minimising unnecessary interventions, and maximising beneficial outcomes. Keeping these essential pearls in mind during medical rounds serves to curtail oversights and avoid undue interventions. In today's medical practice, the adage "less is more" rings true, underlining the significance of discontinuing treatments and removing invasive devices once they no longer contribute to patient well-being. By adhering to this principle, positive outcomes are paralleled in their impact to that of timely interventions. Refraining from initiating unnecessary treatments bears the potential to avert complications, shorten ICU or hospital stays, and enhance patient recovery. It is essential to recognise that this mnemonic functions not as a prescriptive "to-do" list but as a gentle reminder to consider the unique needs and circumstances of each patient. The aim is to foster a comprehensive and personalised approach to care that optimises patient outcomes and well-being.

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Conflict of Interest

None.

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Introduction

The progressive improvement of neonatal intensive care (NICU) and paediatric intensive care (PICU) over the last two decades, as well as new surgical procedures for complex congenital malformations, has improved the survival of paediatric

Long-Term Home Ventilation in Children: Facing the Challenge

Discharging ventilated children home is a difficult challenge in which the training of families is essential. We present our hospital's transition programme for ventilated children going home, which is based on a family-centred model.

patients. However, some of these patients remain reliant on technology, especially those with ventilator-dependent chronic respiratory failure. According to the British guidelines set out by Jardine and Wallis (1998), long-term ventilation is defined in "any child who, when medically stable, continues to require a mechanical aid for breathing, after an acknowledged failure to wean, or a slow wean, three months after the institution of ventilation". U.S. guidelines published by Sterni et al. in 2016 stated that "the well-being of a technology-dependent child is best placed with family/caregivers in the community, and all aspects of health care should be family-centred, coordinated, and integrated with the community services". Nevertheless, ventilator dependence is often a major impediment to early discharge in many countries, leading to lengthened hospital stays in critical care units.

The financial burden associated with the equipment needed for home ventilation is not limited to the initial cost of the ventilator since the pertinent materials, maintenance and correction of malfunctions must also be considered. However, in countries where families have the option of receiving support from health personnel at home, most of the associated budget will be allocated to this. It is important to note that the discharge process can look totally different depending on the national health resources available in each country to support families with insufficient funds. For example, the current Australian clinical guidelines strongly recommend a publicly funded system to facilitate family-centred care for all patients (Nixon et al. 2021).

Below, we describe the main problems and barriers to discharging these patients in

order to ease the learning curve for future home ventilation teams. The challenge of transferring ventilator-dependent children, comprising those who depend on ventilation for life support, such as tracheotomised and invasively ventilated patients, and those on non-invasive support for more than 16 hours a day, is completely different than that posed by patients receiving elective non-invasive support for health maintenance and disease prevention. Due to time and space limitations, we will focus on the former.

At our centre, Barcelona's Hospital Sant Joan de Déu, a paediatric home ventilation programme has been under development over the past 25 years. Today, this programme supports 150 children who mainly live in the region of Catalonia. Looking back at the programme's historical data, it is apparent that the population requiring respiratory support has evolved through the years. Although neuromuscular patients are still frequent users of nocturnal respiratory support, the generalised use of non-invasive ventilation and CPAP has facilitated the improved management of patients suffering from breathing-related sleep disorders; thus, these individuals are currently the predominant population. In addition, the number of patients requiring a tracheostomy is increasing, but proportionally speaking, it remains below 10% of the total number.

The Process of Transferring a Baby on Long-Term Ventilation From the NICU to the PICU

The key point in this section is that most home ventilators are not approved to ventilate patients weighing less than five

kilograms. Therefore, the question of when to transfer these young patients to the PICU depends heavily on the hospital's policy. If the NICU cares for the patient until discharge, the neonatal team, together with the home ventilation team, must be adequately prepared. This includes using hospital ventilators that can meet the patient's needs and introducing ventilation modes and/or parameters that are not common in premature infants but are sometimes required in PICU patients, such as the NAVA mode and higher PEEP levels. In our opinion, it is important to involve the members of the home ventilation team in the decision-making process from the beginning, even before deciding whether the patient can continue on non-invasive ventilation or should opt for tracheostomy ventilation. If a transfer to the PICU is required, this must either involve an experienced intensivist or working with a reference centre with extensive experience in home transfer.

It is equally important for the neonatal team to have knowledge regarding the management of tracheostomies and the proper training of parents to care for them and prevent their associated complications.

Generally speaking, premature babies or newborns with severe malformations that require postoperative management and prolonged ventilation require a long stay in the NICU. Logically, an emotional bond is established with the NICU team, which sometimes makes it difficult to find the optimal time for the transfer.

Both the NICU and the PICU are departments where intensive care is performed, but even in the same hospital, small differences can be observed in many aspects, such as mechanical ventilation, medication management, and more. These differences, which may be of little relevance to the patient's evolution, can be viewed as radical for families, generating additional stress during the discharge process.

Handling the Transfer From the PICU to Home

Before transitioning to home care with chronic ventilation, the medical team should

ensure that the patient has demonstrated medical stability for a period of at least one week prior to discharge, using unchanged home equipment and ventilator settings.

Thus, the equipment and supplies designed for home use must be tested before the patient is released. Such evaluation over a period of time ensures the effectiveness of ventilation, the patient's tolerance for it, and the family's understanding of how to manage it. For further information, the American Thoracic Society guidelines for chronic invasive paediatric ventilation at home provide insights on the necessary home supplies (Sterni et al. 2016). The delivery of monitoring devices such as pulse oximeters and backup devices like electric oxygen concentrators, as well as emergency supplies such as a self-inflating resuscitation bag, must be confirmed.

Transitioning to the home respirator

In infants weighing close to the five-kilogram limit, switching to a home ventilator must involve a careful selection of the ventilator mode and will also require meticulous adjustment of the parameters. The choice of tubing is also important, as it determines different critical aspects, including the response of the ventilator algorithms to leaks, the incidence of technical problems, and even comfort when travelling.

In connection with this, asynchrony is a common phenomenon in infants, with inspiratory asynchrony being the most prevalent. Ineffective effort is clinically relevant and will usually hinder patient progress. Each ventilator offers different capacities that can be evaluated and compared by looking at the data provided by the manufacturer. The key points in inspiratory synchrony are the activation delay and the 0.3-second area. Trigger delay is measured in milliseconds, and values greater than 150 milliseconds are not considered appropriate. Some devices improve trigger sensitivity by offering alternative flow sensors near the patient's mouth or even sophisticated algorithms. It is common to see formerly premature patients who are only able to activate the inspiratory trigger 20% to 30% of the time.

Thus, to avoid patient fatigue, it is common for these patients to be put back on a conventional ventilator, usually prolonging their stay in the Critical Care Unit.

Based on randomised studies in premature neonates, which show the superiority of unsynchronised IPPV over CPAP in preventing reintubation, a similar ventilatory strategy can be used. Therefore, an assisted pressure control mode can be used by setting a respiratory rate close to the patient's respiratory rate and setting an adequate inspiratory time (Ti). We recommend calculating the patient's Ti by dividing the duration of a full breath by three. This way, the patient can synchronise with the ventilator by receiving a controlled breath very close to the time they initiate a new breath. A correct Ti duration is important to avoid expiratory asynchrony which would increase the patient's work of breathing.

With regard to flow asynchrony, even if the patient correctly activates the ventilator trigger, the presence of leaks can affect the performance of the ventilator. The ability to pressurise varies from ventilator to ventilator, so flow asynchrony can be a major problem. Nowadays, tracheostomy tubes with low-pressure cuffs are commonly used to minimise leaks and consequently reduce this problem.

It is worth mentioning that there is a minority of patients who do not have inspiratory asynchrony and may benefit from the use of pressure support.

Training for family caregivers

Standards for training and assessing the proficiency of family caregivers vary among institutions. Families and their medical teams should agree on safety preparation and outline the number of responsible people available to help at home. For patients requiring invasive mechanical ventilation, it is recommended that at least two family caregivers be fully trained in all aspects of the child's care prior to discharge. The patient's reference nurse is responsible for training the parents or guardians during their stay in the PICU (**Image 1**).



The picture is published with the consent of the family

In addition to practical bedside training, family caregivers may often require additional education, especially to address scenarios that have not occurred during

the child's hospitalisation. Simulation sessions can be very useful in improving the management of situations such as cannula obstruction or bronchoaspiration.

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As part of this family training process, it is important to consider having the patient remain at the hospital, outside of the PICU, for a period of time, during which the family progressively takes control of the situation under supervision. At our centre, this is currently carried out in the paediatric ward or in an intermediate care centre called Casa Sofia, located a few minutes from the hospital.

The Future of Home Transfer

Intermediate Respiratory Care Units (IRCUs) or mechanical ventilation weaning centres have demonstrated their effectiveness and are already a reality for adults in many countries and for paediatric patients in a few Western countries. Their expansion into the medical mainstream will allow for shortening lengthy stays in the NICU and PICU and could also potentially shorten overall hospital stays. This kind of programme is poised to ultimately improve the experience of patients and their families.

Conclusion

The transfer of a ventilated child from the PICU to home is a complex process that includes a transition to a home respirator and the training of family and caregivers. The benefit of being discharged home is clear for the family, but some aspects related to childcare must be taken into account. A home ventilation programme is essential to help support families during this difficult process and ensure they get the training they need.

Conflict of Interest

None.

Sterni LM, Collaco JM, Baker CD et al. (2016) An Official American Thoracic Society Clinical Practice Guideline: Pediatric Chronic Home Invasive Ventilation. *Am J Respir Crit Care Med*. 193(8):e16-e35.



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Treating the Whole Human in Intensive Care – Patient-Centred Outcomes in Sepsis, Surgery and Trauma

Intensive care impacts more than the patient, with ripple effects for families, employers and wider societies. Patient-centred outcomes reiterate the need for clinical therapies targeting the biological circuitry of the big-hitting syndromes like ARDS, sepsis, delirium, renal failure and recognising they persist beyond the veil of discharge.

The human experience is a rich panoply of highs and lows, an emotional sinusoidal journey that attracted even the meddling of gods in the ancient world. There is no human that will not die and no family that will not experience loss. Yet in the developed world, these experiences and conversations have become hurried clinical conversations corralled within breeze block walls and concrete struts, veiled from view until we are biologically, scientifically convinced this is an irreversible descent.

As physicians to the sickest patients, it is our role to guide them and their families/loved ones on this path and help them expect and adapt to new realities. The losses are not just physical; a day in an intensive care follow-up clinic – still not the standard – will leave your mouth dry and your heart thudding. Their sleep, dreams, memories, jobs, and relationships are shattered. No man is an island, and the stormy waves of survival beat against their spouses, friends and children, too.

What we may not realise is that we bear some responsibility for what we do to patients in our care, even as it is vital for their organ perfusion and intracellular chemistry. What was poignant in our experience of follow-up clinic was the delusion, fully realised, that an addled brain would devise to make sense of the wider world. Overwhelmingly, rolling and transferring

patients made them feel they were being kidnapped, smuggled, abducted and trafficked. Drapes for central lines made them feel smothered. Needles and procedures in the neck made them feel they were being decapitated or murdered. Even without these delusions, orientated patients had to fear for their lives, day in, day out, sometimes for weeks, as did their families. These are the precise series of events that leave many with post-traumatic stress. Many still cannot work, care for young children, or have ongoing sexual-emotional travails with their spouse – sexual dysfunction alone is significant in men after intensive care.

Morally, we are not fulfilling all that a human life is if they cannot re-integrate into society, even if we can wean them off a ventilator or treat their VAP (ventilator-associated pneumonia).

Here we will explore what is known about 12-month outcomes in intensive care, how we should design studies, and what interventions have proved successful in fully realising the human and financial cost-benefit of critical care.

Outcomes in Sepsis

One 2019 study in North Carolina found that. When it comes to COVID-19, 12-year outcomes include 40% were still experiencing symptoms (Morgan 2021). COVID-19

has highlighted the prevalence of the post-intensive care syndrome, and more interest and data have been delivered as a result.

Up to five years of outcome data were summarised nicely by A Morgan (2021). Tracheal stenosis can occur in as many as 30% of those with tracheostomy, pulmonary function tests are still reduced 12 months after ARDS in 2/3 of patients, 20% of muscle mass can be lost in the first week alone of ICU, and genitive outcomes 12 months post admission are stark – 1/3 report cognitive function as severe as moderate traumatic brain injury and ¼ those akin to mild Alzheimer's (Morgan 2021).

Socioeconomic data following ICU is scarce, but a striking U.K. audit (Griffiths et al. 2013) demonstrated that 12 months after discharge (after being ventilated for 48+ hours), 1/5 are not independent on ADL, more than 1/5th of those requiring 50 + hours a week, 80% of which was provided by relatives – with a huge ripple of impact beyond the patient admitted. Those needing such care had to obliterate savings, sell their homes/remortgage, and use charities. In the 40% of patients previously employed before admission, 1/3 were no longer working or had reduced hours, with 1/3 reduction in family income and increased state benefit requirements.

Outcomes in Surgical Emergencies

An audit of emergency laparotomies in a hospital in Northern England found a 12-month readmission rate of 40% and 12-month mortality of 40% - 2/3 had been previously independent (Vilches-Moraga et al. 2020).

ICUdelirium.org is a website dedicated to exploring the 'survivorship' of intensive care. Patients may share their experiences. For example, *"I had septic shock four years ago from urosepsis, and I'm in my 50s. I am writing because I have never felt like myself again. I can't think clearly; my memory has suffered, and I am fatigued like never before. Before sepsis, I was active, hiking, biking, rock climbing, and running, and now I am sedentary with no sex drive (also new) and a great marriage plus 40 lbs. It's been two years, and I'm still trying to sort out what was real and what wasn't. I still think about it several times a week and continue to ask questions of my family. I have a compelling need to know what happened to me. The final diagnosis was ARDS and Encephalopathy, however; they never determined the cause"*.

Outcomes in Trauma

There exists heterogeneity not only in the physiology - both in health and disease - of the major trauma patients in whom we expect to exact clinical benefit but also in their emotional, cognitive and aspirational priorities once they leave the hospital. Practically, the data capture of these subtleties may be too complex to distil into binary figures or simple linear gradation systems. If so, we must be meticulously cognisant of this before ascribing unmodulated success to the discharge of a patient with a modified Rankin score of 1 whose intrusive thoughts, hypervigilance and short-term memory loss slip through the coarse net of performance status indices.

A 2012 consensus meeting acknowledged the need for more sensitive, multiparametric scoring systems in the endeavour to improve long-term patient outcomes from major trauma, a sentiment that has been echoed for both adult and paediatric

patients (Ardolino et al. 2012; Collins et al. 2022). Scoring systems referenced include the Nottingham Health Profile, the EQ-5D, the SF 36 HF, and the more recently validated and often favoured Trauma Outcome Profile (Kaske et al. 2014; Martino et al. 2020). Standardising long-term outcome metrics might help to both harmonise the lexicon in future research and serve as an intrinsic reminder of their importance.

morally, we are not fulfilling all that human life is if they cannot re-integrate into society, even if we can wean them off a ventilator or treat their VAP

Major trauma disproportionately affects younger populations compared to other critical pathology, and, therefore harbours the potential to disrupt more quality of life-years than other disease processes. While we are aware of the consequences, the solutions are either less obvious or difficult to achieve universally. Systematic reviews demonstrate that major trauma patients as a subgroup of ICU hospitalisations experience a greater magnitude of quality of life reduction than their counterparts, and higher aggregate ISS and severe head trauma are predictive of even more severe outcomes. Younger patients and those with higher ISS and SOFA scores were also more susceptible to intrusive thoughts and delusional memories during their ICU stays and, in turn, tended to exhibit higher incidences of anxiety and depression 6 to 18 months following discharge. Detriment to quality of life has been demonstrated to persist beyond two years post-injury and include PTSD, depression, loss of work, and repeated hospitalisation.

These results remind us of the interplay between clinical and sociopsychological mechanisms that underpin the efforts and the covenant of our health system. It is self-evident that survival to discharge

is a prerequisite for a favourable patient-centred outcome and that accurate and prompt intervention in major trauma maximises the potential for this. We are right to focus on these interventions if we are to give patients the best chance of recovery to a status that is meaningfully positive for them. However, critical care is not a zero-sum game, and while research and clinical interventions are—often appropriately—concentrated on early care it is imperative that robust, longitudinal attention is maintained throughout hospitalisation and extending beyond discharge to target outcomes less binary and reductive.

There remains a paucity of evidence aimed at studying nuanced long-term quality-of-life outcome data in major trauma and a need for a common language in their conveyance. The exclusion of this aspect of care from the 2007 NCEPOD review and its minimal reference in NHS Best Practice Tariffs, for example, seems at odds with our acknowledgement that they represent the fundamental goals in the care of patients subject to profound psychophysiological perturbations. Closely analysing these data may obligate us to contend that much remains to be done in this field, but it also allows us the best opportunity to formulate a coordinated approach to restore that which injury has distorted.

Clinical Trials

For pragmatic reasons in a complex and heterogeneous group, rightly so trials have focused on short-term (hours to days or weeks) outcomes in critical care because these are the windows in which our biological interventions enmesh with pathophysiology. Although the length of ventilation or MAP itself may be a binary outcome of little pertinence to patients themselves, they are piquant with associated values like survival, degree of dependency, and mobility, and to an extent, it is foreseeable that levels of inflammation and infection have tendrils of impact on the neuronal biochemistry and internal

architecture that causes ongoing skeletal and nervous system dysfunction.

We also have a moral obligation to produce trials that are statistically powered for the results they seek, find the answer out most rapidly to bring improvements to a greater number of people, and do the least harm. Therefore, we will continue to see trials of vasopressor vs mortality or length of stay rather than cognitive performance or degree of dependency. However, there is no reason that we cannot generate a hypothesis using these latter values as secondary endpoints. For example, the working memory deficit is profound in post-intensive care syndrome and striking on the day in-clinic – and noradrenaline alone is known to affect its small, spiral conduit in the hippocampus. Meanwhile, stress, inflammation, cortisol, and sedative drugs will also, of course, play their part.

There is also no reason we cannot ask patients – the stakeholders themselves – what matters and to endorse these in real time on our units, amongst our distilled catecholamines and heparin-dusted pipes. A laudable study by Scheunemann et al. (2020) identified 12 core priorities for survivors of intensive care: feeling safe, being comfortable, engaging in mobility, participating in self-care, asserting personhood, connecting with people, ensuring family well-being, going home, restoring psychological health, restoring physical health, resuming previous roles and routines, and seeking new life experiences. Many of these reported outcomes, from interviews conducted in patients' homes

across the U.K., are not purely medicinal. It is impossible to attend a follow-up clinic and not find yourself gently murmuring to your draped or packaged-for-transfer patients.

Intensive care impacts more than the patient, with ripple effects for their families, employers and wider societies

In the U.K., [NICE guidance](#) now has intensive care follow-up (for a certain severity) as a standard of care – ideally multi-disciplinary. Since follow-up has been a relatively recent innovation, protocols for RCTs on their utility in reducing morbidity and improving QoL are being published, but we have not received them as yet. A small study by Kowalkowski et al. (2022) looking at high-risk sepsis patients in the first month after discharge did show a reduction in 12-month hospital readmission but had not chosen to measure patient-centred outcomes.

A small Dutch study demonstrated that survivors with resultant psychopathology such as PTSD are in need of discharge information and would be willing to use a virtual reality module (Vlake et al. 2020). Despite efforts, a well-designed and multi-faceted nurse-led intervention, including a therapeutic ICU environment, stress support sessions, and identification of 'high-risk' patients, was not significantly superior for

prevention or poor psychological outcome at six months (Wade et al. 2019).

However, ongoing trials are designed to capture further data and test different interventions. Furthermore, as we begin to identify mechanisms behind other disorders of neuronal dysfunction, such as critical care associated neuro/myopathy or biological therapies for sepsis-associated encephalopathy (Krzyzaniak et al. 2023) we may begin to see therapies emerge for the cognitive pathology of post-intensive care syndrome.

Conclusion

Interest and data serving long-term outcomes from intensive care are conspicuously sparse, and few specialties would tolerate such poor one-year outcomes. Intensive care also impacts more than the patient, with ripple effects for their families, employers and wider societies. Patient-centred outcomes will evoke greater humanity in their carers and further realise the success of an expensive and resource-intensive critical care admission, and patient-centred outcomes also reiterate the need for clinical therapies targeting the biological circuitry of our big hitting syndromes – ARDS, sepsis, delirium, renal failure – recognising they persist beyond the veil of discharge.

Conflict of Interest

None.

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Cardiovascular Management in Septic Shock: Optimising Vascular and Cardiac Function

An overview of vasopressor management, current evidence on its use, when to initiate vasopressor therapy for best possible patient outcome and a discussion regarding the use of landiolol in septic patients with persistent tachycardia.

Optimising Vasopressin Initiation in Septic Shock

Patients with septic shock, and especially those with high vasopressor needs, are at risk for high mortality. The mortality rate of ICU patients with refractory septic shock is around 40 to 80% (Seymour et al. 2016; Annane et al. 2005; Angus et al. 2001; Vincent et al. 2006; Levy et al. 2003; Kaukonen et al. 2014). The difference in incidence of mortality is caused by the definition of refractory shock, as there is no universal definition for refractory shock in the literature.

There is also an ongoing debate about whether to start vasopressors earlier and then give additional fluids or opt for full fluid resuscitation and then start with vasopressors.

The first line vasopressor globally is norepinephrine. There is no universal definition of high-dose norepinephrine. Some doctors use 0.1 mcg/kg/min, while others say it should be 0.5 mcg/kg/min. In general, the threshold is around 0.25 mcg/kg/min in the Vasopressin Registry. In the Netherlands, this has been dropped down to 0.20 mcg/kg/min. However, a still ongoing study found that the average starting dose was 0.45 mcg/kg/min, suggesting that in the time between the decision to start a second vasopressor and the time it is actually started, the norepinephrine dose is already much higher, and the patients are already in severe septic shock.

Some studies have demonstrated that early initiation of norepinephrine is beneficial for patients with septic shock. In a meta-analysis published a few years ago, starting norepinephrine treatment early led to lower short-term mortality, faster achievement of the target mean arterial pressure, and

reduced intravenous fluid requirements within the first 6 hours. However, there was no significant difference in the length of stay in the intensive care unit between those who received early norepinephrine treatment and those who received it later (Li et al. 2020).

Considering vasopressin, the Surviving Sepsis Campaign shows mixed results as both an adjunctive treatment and as a first-line therapy. Vasopressin did not alter mortality when added to norepinephrine. A subset, however, demonstrated a survival benefit in patients with less severe septic shock. So, the concept of using a second vasopressor as a last resort should be reconsidered; instead, an early “multi-modal” vasopressor strategy should be considered. A reduced need for renal replacement therapy was noted with vasopressin compared with norepinephrine alone. A norepinephrine-sparing effect has been reported with vasopressin, leading to its recommendation as an adjunctive therapy (Evans et al. 2021).

Why not increase norepinephrine dosage? It is known that patients on high doses of norepinephrine have the highest mortality. That is not only due to the fact that they have the most severe septic shock. High-dose norepinephrine can have harmful effects itself. It can injure myocardial cells and can induce oxidative stress. There is also a negative effect on the immune system. Hence, restricted use of norepinephrine is recommended due to its multitude of adverse effects. In contrast, vasopressin does not have negative effects on the immune system (Stolk et al. 2020), and when combined, it can have a norepinephrine-sparing effect.

What about other effects? In a meta-analysis by McIntyre et al. (2020), combining vasopressin with catecholamine vasopressors reduced the risk of atrial fibrillation by 23%

compared to using catecholamines alone. Different studies found that vasopressin does not seem to constrict pulmonary arteries.

The VANISH trial compared the effects of early vasopressin compared to norepinephrine on kidney failure in patients with septic shock. Findings showed that there was a significantly lower need for renal replacement therapy in the vasopressin group than in the norepinephrine group by 55%. Patients in the vasopressin group demonstrated a lower trend of progression to renal failure or loss, more serum creatinine reduction compared with norepinephrine alone and a lower mortality rate (Gordon et al. 2016).

Regarding the timing of vasopressin, a recent study showed that the addition of vasopressin to norepinephrine within three hours of starting norepinephrine led to a significantly quicker resolution of shock, indicating the possibility of better clinical outcomes when vasopressin is added earlier in treatment (Brask et al. 2023).

Usage of Short-Acting Beta-Blockers in Septic Shock

There is a rationale for using beta-blockers in septic shock because beta-blockers have multiple useful effects. In the heart, they result in an increase in diastolic time, decrease myocardial oxygen consumption and improve metabolic efficiency. Beta-blockers are also cardioprotective and have an anti-thrombotic effect. They are also helpful in restoring downregulation of adrenergic receptors and have an anti-inflammatory effect.

When using beta-blockers, it is important to select those with very short half-lives because it's important in the Intensive Care Unit to use drugs that might disap-

pear after three or four minutes. These are mainly β_1 -selective blockers like esmolol or landiolol that have very short half-lives, are not influenced by renal and liver function and have a fast onset of action. Compared to esmolol, landiolol has a faster onset of action, faster elimination half-life and duration of effect. It can also be used at a dosage of 1-10 mcg/kg/min in patients with LVEF<40%. Furthermore, landiolol has a minimal effect on the duration of the action potential in cardiomyocytes. Systolic pressure of the left ventricle also remained unchanged with landiolol, while it was reduced dose-dependently with esmolol.

A study involving 54 hospitals examined the use of landiolol for treating sepsis-related tachyarrhythmias. They randomly assigned 151 sepsis patients with persistent tachyarrhythmia into two groups: one group received landiolol along with standard therapy, and the other received standard therapy alone (with some patients in the control group also receiving antiarrhythmics). The landiolol group had a 12% mortality rate, representing an 8% absolute reduction and a 40% relative reduction in the risk of death than in the control group. Landiolol was found to be effective and safe regardless of patient characteristics, such as septic shock, low LVEF, acidosis, and acute renal failure. Patients with respiratory infections receiving landiolol had a lower 28-day mortality rate than the control group. These results suggest that landiolol effectively controls heart rate and

reduces the risk of death in sepsis-related tachyarrhythmias (Matsuda et al. 2020).

Landiolol effectively controls heart rate and reduces the risk of death in sepsis-related tachyarrhythmias

Results from animal models show that beta-blockers improve cardiac function and vascular reactivity. They have a better metabolic profile associated with better lactate clearance. Beta-blockers decrease the pro-inflammatory state induced by sepsis, and mortality is improved. A randomised animal study by Kimmoun et al. (2015) showed that adding selective β_1 -blockade to the standard treatment for septic shock can improve the heart's pumping ability and the responsiveness of blood vessels to catecholamines. These benefits are mainly due to the anti-inflammatory properties of beta blockers.

A meta-analysis found that using ultra-short-acting β -blockers like esmolol and landiolol to treat sepsis patients with tachycardia despite initial treatment can significantly reduce 28-day mortality. This suggests a growing interest in using β -blockers like landiolol in patients with sepsis with persistent tachycardia (Hasegawa et al. 2022).

Conclusion

Early initiation of vasopressors in septic shock has been shown to have better patient outcomes in comparison to delayed initiation. The discussion and clinical evidence also highlight the benefits of landiolol in treating patients with cardiac dysfunction and sepsis patients with persistent tachycardia. Landiolol is a super-cardioselective beta blocker with a favourable safety profile for patients with renal and hepatic comorbidities.

Key Points

- A norepinephrine-sparing effect has been reported with vasopressin, leading to its recommendation as an adjunctive therapy. It often leads to a reduction of norepinephrine requirement, thus having a positive impact on the immune system and reducing the norepinephrine-induced side-effects.
- Higher vasopressin response rates and better patient outcomes are seen when the combination is started at lower norepinephrine doses, lower lactate levels and higher arterial-pH levels.
- β_1 -selective blockers like landiolol have very short half-lives, are not influenced by renal and liver function and have a faster onset of action.
- Landiolol was found to be effective and safe regardless of patient characteristics, such as septic shock, low LVEF, acidosis, and acute renal failure.
- Ultrashort-acting β -blockers like landiolol used to treat sepsis patients with tachycardia, despite initial treatment, can significantly reduce mortality.

Disclaimer

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Introduction

Acute subarachnoid haemorrhage (SAH) represents a life-threatening condition characterised by a hyperacute accumulation of blood in the subarachnoid space. Generally, blood spreads peripherally to the cerebral convexities in a diffuse manner. However, radiological evaluation of blood distribution can show a predominance of subarachnoid blood in the perimesencephalic and basal Sylvian cisterns (Perimesencephalic SAH) or in isolated cerebral convexity (Marder et al. 2014). Furthermore, secondary intraventricular haemorrhage can accompany SAH with possible implications on the prognosis (Darkwah et al. 2018; Zanaty et al. 2018).

The main cause of SAH is due to the rupture of a cerebral aneurysm. However, in up to 15% of the cases, initial neuroimaging evaluation (i.e., angiography) is not able to identify an aneurysm; condition defined as *sine materia* or subarachnoid haemorrhage of unknown origin (Bacigaluppi et al. 2022; Mohan and Tauseen

Acute Subarachnoid Haemorrhage - An Epidemiological Perspective

Subarachnoid haemorrhage (SAH) carries a high disease-specific burden. Epidemiological studies have observed a reduction in the incidence of SAH from 1990 to 2019. However, the same trend was not observed for intrahospital mortality. Several studies focusing on the evaluation of SAH management across the world have shown a high heterogeneity in care standards, with potential implications on the prognosis. Short-term and long-term outcomes need to be analysed. Besides motor disability, neurocognitive sequelae are common and deeply affect the quality of life of a person.

2020). Hyperacute accumulation of blood in the subarachnoid space can also represent a radiological feature observed in several diseases that should be considered as differential diagnosis (e.g., traumatic subarachnoid haemorrhage, arteriovenous malformations ruptures, intraparenchymal haemorrhage, dural fistula ruptures, cerebral venous infarction) (Oppenheim et al. 2005; Rasyid et al. 2022; Arévalo-Lorido and Carretero-Gómez 2015). Indeed, SAH, mostly secondary to the rupture of a cerebral aneurysm, is characterised by different and typical clinical history (Claassen and Park 2022).

According to 2020 World Health Organization (WHO) estimates, stroke, also referred to as an acute cerebrovascular accident, represents the second cause of mortality in the world, with 11% of cases, followed only by cardiovascular disease with 16% of deaths (Feigin et al. 2022; James et al. 2019). Worldwide, stroke represents the second cause of years lost to premature death and life lived with disability (Vos et al. 2020). SAH represents the third most frequent cause of stroke and although it represents only 5% of all strokes, SAH is characterised by some aspects that make it an important pathology to study. SAH carries a high disease-specific burden (Krishnamurthi et al. 2020). Considering the health, social, and economic factors that determine the cost that SAH and the consequent disability have on the individual

and on society, SAH results in high direct and indirect costs (English 2020). One-quarter of SAH patients (around 22-26%) die before arriving at the hospital, and 50% of survivors have various degrees of long-term disability (van Gijn and Rinkel 2001). This aspect is even more alarming if we consider that they are generally healthy patients in an economically active phase of life with a long life expectancy, leading to many years of reduced quality of life (English 2020). The specific burden of a disease can be calculated with disability adjusted life year (DALY), the sum of the years of life lost (YLL), and the years lived with disability (YLD) (Martinez et al. 2019; Rivero-Arias et al. 2010). In this paper, we aim to outline an epidemiological perspective on SAH.

Epidemiology of SAH

The crude incidence of SAH in the world is approximately 7.9 per 100,000 people/year (Etiman et al. 2019). There is significant variability in the incidence of SAH around the world, with the highest incidence in Finland and Japan (Figure 1) (Hughes et al. 2018). A 2019 study of the Global Burden of Disease (GBD) estimated that there were 1,018,000 cases of SAH in the world, with a reduction in age-standardised rates from 1990 to 2019 (Figure 2) (James et al. 2019). The reduction in incidence seems to be attributable, above all, to a better control of blood pressure values and a reduction

in smoking habits. Linear regression analyses showed that for every mmHg reduction in systolic blood pressure, the SAH incidence tends to reduce by 7.1%. Furthermore, every percentage reduction in smoking habits translates into a reduction of 2.4% in SAH incidence (Etiman et al. 2019). Remarkably, in the study of GBD, high systolic blood pressure was identified as the most important risk factor for SAH ((Feigin et al. 2021). World Bank low-income and upper-middle-income countries showed a lower percentage of SAH incidence in comparison with the high-income countries (7.9% versus 19.7%) (James et al. 2019). It can be speculated that prevention campaigns have played a vital part in the global reduction of SAH. Even more, against the global tendency, an increase in incidence over time has been observed in countries such as China in middle-aged people (Darkwah et al. 2018; Vos et al. 2020). This trend has been explained mainly by the changes in

lifestyles in an increasingly industrialised country (Zhang et al. 2013).

Unfortunately, epidemiological studies have not observed the same declining trend in mortality. In-hospital mortality for SAH has not changed in the last 20 years (around 13%) (Korja et al. 2016; Wahood et al. 2022). Consequently, it is necessary to focus our attention on improving our standards of care after the bleeding. Therefore, the prognosis of the patient is enhanced by correct health management based on a deeper knowledge of the physiopathological aspects of the disease. However, it is important to highlight that to better characterise a disease, it is not enough to analyse the outcome in terms of mortality or DALY (Robba et al. 2020; Herridge and Azoulay 2023). It is necessary to develop a deeper and more detailed analysis of the complications that may occur, both during hospital stay and at discharge, to fully understand the pathophysiology of

SAH and to have important feedback on our standard of care.

A further element of interest is represented by the management of the patient with an unruptured cerebral aneurysm, which generally represents incidental imaging findings on neuroimaging. It is estimated that approximately 15 million people in Europe have an unruptured aneurysm with a prevalence of 3.2% of the population (Vlka et al. 2011; Wagner and Stenger 2005). A critical element is represented by the fact that there is no unanimity on the management of unruptured aneurysms, as the risk and benefit of a neurosurgical or neuroradiological procedure must be assessed. The current literature is not conclusive regarding the possible correlation between the treatment of unruptured cerebral aneurysm and the risk of SAH (Tsutsumi et al. 1999; Etiman et al. 2022; Raymond et al. 2008). Nowadays, the decision to treat a non-

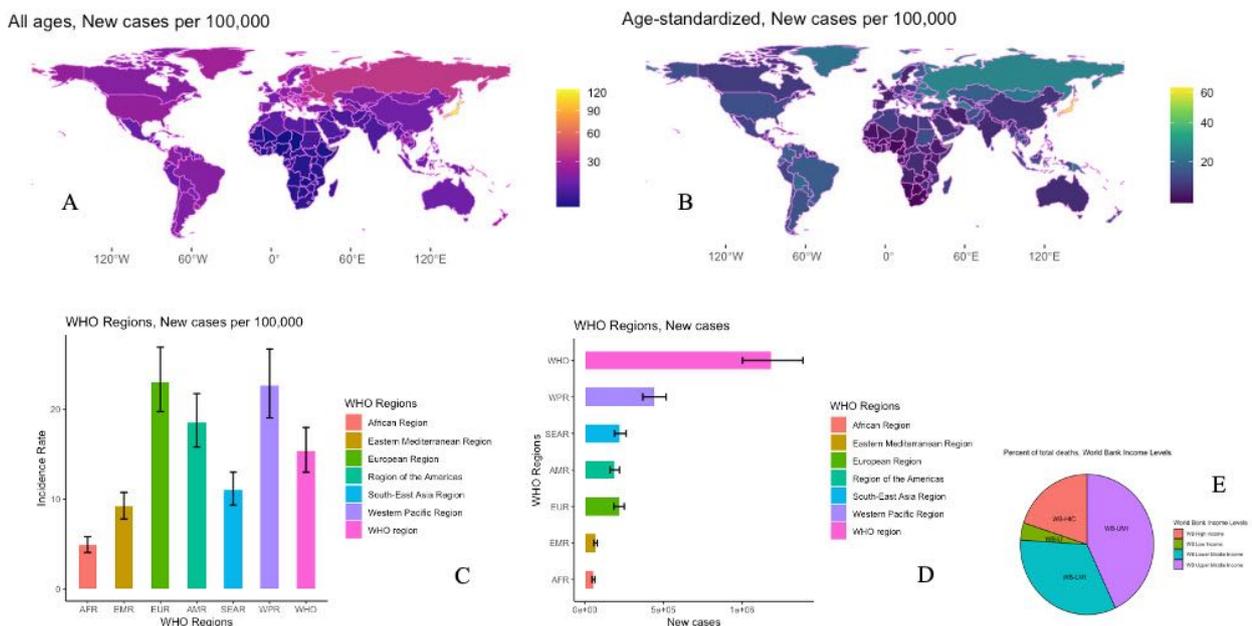


Figure 1. Epidemiological incidence and geographical distribution of SAH according to Global Burden Disease. A) World Map, Geographical distribution of SAH: Incidence Rate, New cases per 100,000, both sexes, All ages, 2019; B) World Map, Geographical distribution of SAH: Incidence Rate, New cases per 100,000, both sexes, Age-standardised, 2019; C) Bar Graph showing the new cases per 100,00 of SAH by WHO Regions, both sexes, All ages, 2019; D) Bar Graph showing the estimated new cases of SAH by WHO Regions, both sexes, All ages, 2019; E) Pie Chart showing percentage of deaths by World Bank Income Levels, both sexes, All ages, 2019. Source: Institute for Health Metrics and Evaluation. Used with permission. All rights reserved. Data were extracted at <https://vizhub.healthdata.org/gbd-results/> accessed on the 26th of October 2023. Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Results. Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME), 2020(12), <https://doi.org/10.6069/1D4Y-YQ37>. All analyses were performed using R Statistical Software (v4.1.2; R Core Team 2021). Bar graph and Pie chart were obtained via the ggplot2 R package (v3.4.4; Wickham 2016). Bar errors indicating 95% Uncertainty Intervals. World Maps was obtained via the ggplot2 R package (v3.4.4; Wickham 2016), the tidyverse R package (v2.0.0; Wickham et al. 2019), rnatualearth R package (v3.4; Massicotte and South 2023). SAH: Subarachnoid Haemorrhage; AFR: African Region; EMR: Eastern Mediterranean Region; EUR: European Region; AMR: Region of the Americas; SEAR: South-East Asian Region; WPR: Western Pacific Region; WHO: World Health Organisation; WB-HIC: World Bank High Income; WB-LI: World Bank Low Income; WB-LMI: World Bank Lower Middle Income; WB-UMI: World Bank Upper Middle Income.

ruptured aneurysm requires knowledge of its natural history and the evaluation of the risk of rupture since prophylactic treatment of intracranial aneurysm is burdened by a risk of mortality and treatment-related morbidity of up to 5% (Pontes et al. 2021). Several rupture prediction tools for asymptomatic intracranial aneurysm (i.e. UIATS, PHASES, ELAPSS scores) were developed to aid the clinician in the evaluation of the possible natural history of aneurysm rupture on the basis of aneurysm-and-patients' characteristics (i.e. hypertension, age, size, aneurysm in posterior circulation and irregularities in shape) (Greving et al. 2014; Bijlenga et al. 2017; Backes et al. 2017). Unfortunately, the current literature led to conflicting results on the correlation between these scores and the risk of rupture (Feng et al. 2021; Hernández-Durán et al. 2021).

Practice Variability

The 2023 guidelines of the American Heart Association/American Stroke Association emphasised the need to manage SAH patients throughout their entire care journey (Hoh et al. 2023). Furthermore, these guidelines highlighted some critical elements as having a decisive impact on the outcome:

- System of care characteristics (i.e. high-volume centre with a dedicated neurointensive care unit)
- Prevention of aneurysmal rebleeding
- Early detection and management of medical complications associated with SAH (i.e. early brain injury and delayed cerebral ischaemia [DCI])

Professor Claassen's seminar underlined that managing SAH patients starts before reaching the hospital by selecting a high-volume centre (Claassen and Park 2022). Healthcare centralisation plays a critical role in patients' management of the condition. To provide the best care for patients quickly, it is necessary to distribute specialised facilities evenly throughout the country. Several studies have already observed the correlation between the choice of high-volume centre and outcome (McNeill et al. 2013; Lindgren et al. 2019; Rush et al. 2017). Moreover, rebleeding and DCI are associated with worse mortality and morbidity. Consequently, minimising rebleeding and the prevention and early detection of DCI represent important goals in SAH management (Figure 3) (Huenges Wajer et al. 2019; Duan et al. 2018).

Unfortunately, several studies focusing on the evaluation of the management of SAH have shown a high heterogeneity in

the management of SAH across the world. In Winkel's survey, including 230 centres around the world, the authors observed a high variability in the timing of treatment and in the type of treatment for aneurysm repair between centres (de Winkel et al. 2021). This survey found a statistically significant difference between Europe and the USA regarding the type of treatment and timing compared to other centres in the world. In the U.S. and Europe, aneurysms were generally treated with endovascular surgery (72% and 705 vs. 51% globally) and generally within 24 h (77% and 64% vs 46%). In 2015, the European Society of Anaesthesiology published a survey on the European practice of SAH management in 268 centres (Velly et al. 2015). Statistically significant differences were observed in the ICU admission criteria, in the treatment of aneurysm and in the management of vasospasm and DCI. This heterogeneity was also confirmed in a study conducted in 22 Italian neurosurgical centres (Citerio et al. 2007). This phenomenon may be explained mainly by the fact that little evidence is available, and practice differences may be based on local policies rather than on solid scientific data.

Remarkably, in 2019, Dijkland et al. (2019) observed a difference in clinical outcome (i.e. GOS and mRS at 3 months)

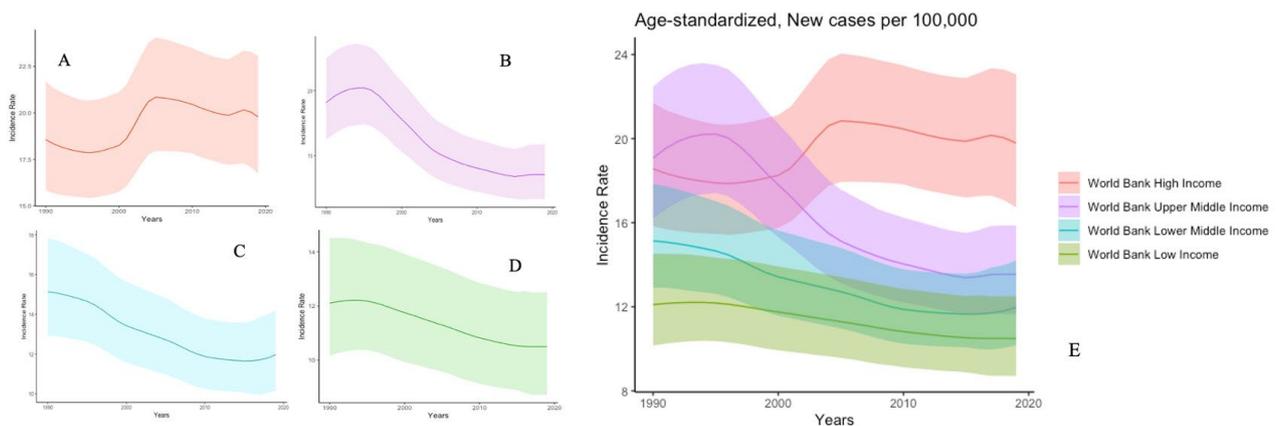


Figure 2. Trends in Incidence Rate of SAH according to Global Burden Disease. A) Trend Chart of SAH: Incidence Rate, New cases per 100,000, both sexes, Age-standardised, 1990-2020, World Bank High Income Country; B) Trend Chart of SAH: Incidence Rate, New cases per 100,000, both sexes, Age-standardised, 1990-2020, World Bank Upper Middle Income Country; C) Trend Chart of SAH: Incidence Rate, New cases per 100,000, both sexes, Age-standardised, 1990-2020, World Bank Lower Middle Income Country; D) Trend Chart of SAH: Incidence Rate, New cases per 100,000, both sexes, Age-standardised, 1990-2020, World Bank Low Income Country; E) Trend Chart showing Incidence Rate according to the four World Bank Income Level from 1990-2020. Source: Institute for Health Metrics and Evaluation. Used with permission. All rights reserved. Data were extracted at <https://vizhub.healthdata.org/gbd-results/> accessed on the 27th of October 2023. Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Results. Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME), 2020(12), <https://doi.org/10.6069/1D4Y-YQ37>. All analyses were performed using R Statistical Software (v4.1.2; R Core Team 2021). Trend charts showing 95% Uncertainty Intervals. Trend charts were obtained via the ggplot2 R package (v3.4.4; Wickham 2016). SAH: Subarachnoid Haemorrhage.

among different medical centres and different countries after SAH. The authors analysed data from 5972 patients with SAH from the SAHIT repository, including 179 centres (i.e., 20 countries). They applied logistic regression to account for a patient's characteristic (i.e. age, hypertension, WFNS, Fisher grade, aneurysm location) and timing of treatment. Consequently, the difference in outcomes observed could not be justified by these potential confounding

factors. Accordingly, further studies must be warranted on the correlation between treatment heterogeneity and outcome.

Outcome

Patients who survive a critical illness and leave the hospital can develop a condition known as post-intensive care syndrome (PICS). PICS affects the physical, mental and emotional aspects of the patients.

After ICU discharge, patients may present cognition difficulties and mental health alterations with important impacts on the patients' and familial quality of life. Consequently, the detailed evaluation of all the possible complications at discharge allows practitioners to analyse the pathology itself from two points of view:

- to better understand the pathophysiology and improve in-hospital management;

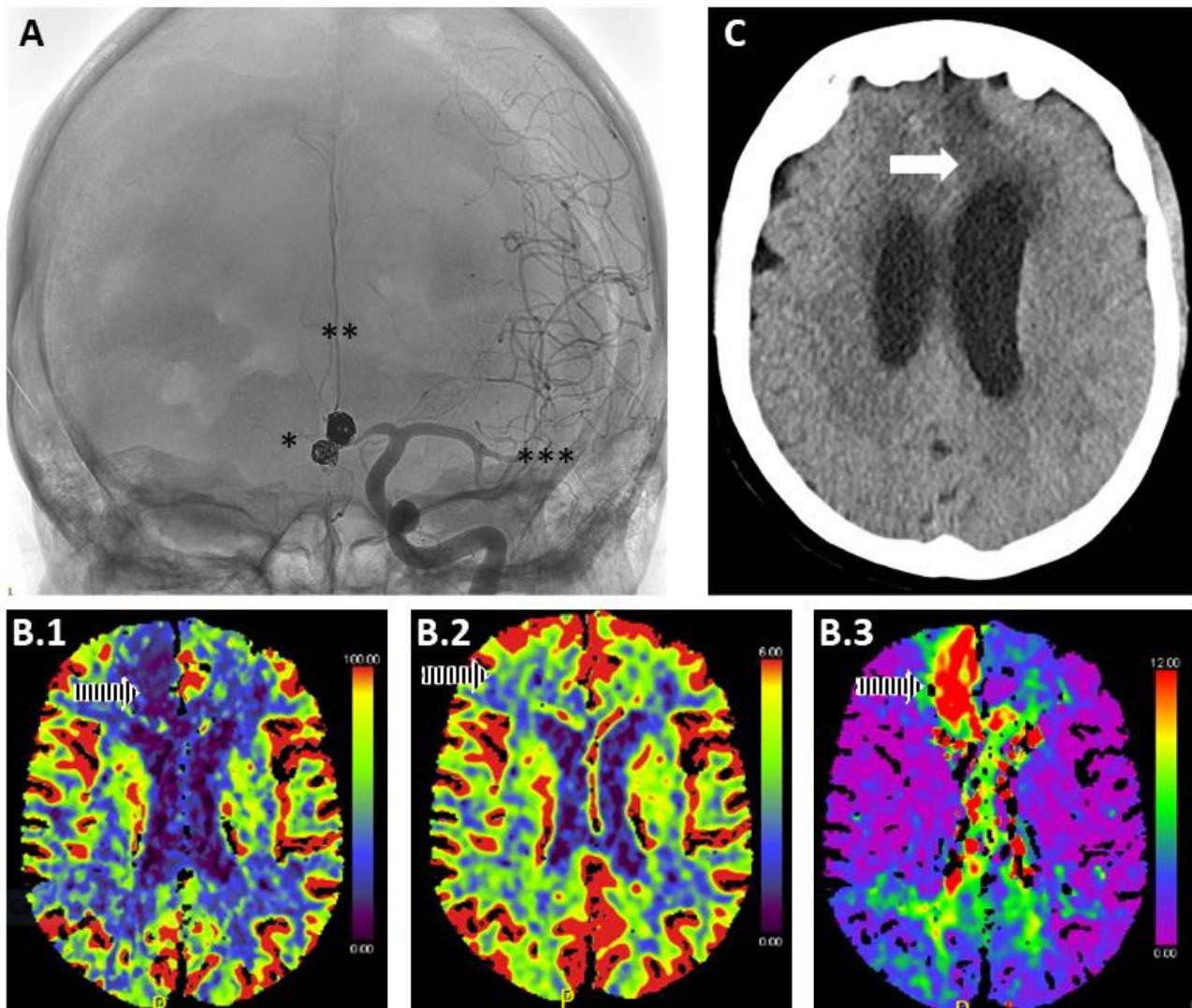


Figure 3. Integration of different imaging modalities in managing patients with SAH with vasospasm. A) Use of angiography to diagnose vasospasm (gold standard). In the image, an asterisk indicates the outcome of aneurysm coiling, two asterisks the presence of severe vasospasm of the anterior cerebral arteries (more remarkable on the right side), and three asterisks diffuse vasospasm of the left middle cerebral artery. B) Use of CT perfusion for the diagnosis of vasospasm. Reduced cerebral blood flow (CBF) is observed (B.1) in the cerebral arteries (more significant on the right side) in the presence of preserved cerebral blood volume (CBV) (B.2), although unable to provide adequate compensation, and (B.3) an increased Tmax due to increased macrovascular resistance. C) Use CT to assess secondary damage development due to DCI/vasospasm. The arrow shows the presence of an infarct-like brain lesion in the territory of the left anterior cerebral artery. In this specific case, aggressive medical and neuroradiological treatment has prevented the development of bilateral frontal ischemic injury.

- to outline the best rehabilitation trajectories.

From this perspective, there is a necessity to analyse both short-term and long-term outcomes. After SAH, it is estimated a readmission rate of around 8-10% at 30 days, 16% at 60 days, and 16-26% at 90 days (Rumalla et al. 2018; Dasenbrock et al. 2017; Liang et al. 2018). Of note, it has also been estimated that 14% of readmissions are potentially preventable (49). The analysis of the causes of readmission allows us to identify both modifiable and non-modifiable risk factors in order to plan preventive interventions for different patient subgroups.

Regarding long-term outcomes, different kinds of disability can be observed in SAH patients at discharge. Indeed, besides motor disability, neurocognitive sequels are common and deeply affect the quality of life of a person (Nwafor et al. 2023). Up to 47% of post-SAH patients have mood disorders (i.e., depression and/or anxiety) during the first year (Catapano et al. 2023; Kreiter et al. 2013; Ackermack et al. 2017). Even more, personality changes range from 32 to 59%, and post-traumatic stress disorders occurred in around 40% of the patients (Tang et al. 2022; Hedlund et al. 2011). Alongside the quality of life, neurocognitive impairment affects the return to work, resuming of social relationships, and functional outcome (Buunk et al. 2019; Kauranen et al. 2013; Saar et al. 2023). Consequently, the creation of suitable diagnostic, therapeutic and rehabilitation pathways to ensure continuity of care, as well as the best type of rehabilitation that these persons need, represent a further central element to evaluate in order to improve SAH management.

Another key aspect to evaluate is represented by the perception of the patient on his/her own abilities; i.e. not only an objective evaluation of residual functional capacity, but also the individual's own evaluation of his/her performance status. Increasing evidence has shown that a poor grade SAH is not necessarily linked to a low quality of life (Goldberg et al. 2023). Therefore, a discrepancy between disability and the patient's perception of her health

and functionality is noticed. In 1983, the sociologist Sol Levine introduced the concept of the "disability paradox" and raised the need to apply the evaluation of the quality of life to disability, moving from an objective to a subjective evaluation of disability (Levine et al. 1981). Indeed, the disability paradox refers to the discrepancy between the patients' perceptions of well-being and their disability level, evaluated objectively.

Neurorehabilitation plays a central supportive role in all of these aforementioned aspects. In 2023, Lindner et al. (2023) observed functional improvement in 57% of patients in the first 3 months and a further 16% improvement at 12 months. These findings outline that improvement was observed, especially during the first months. Indeed, rehabilitation must be seen as a continuum from hospital stay to patient's home. During hospital stay, it is preferable that rehabilitation programmes start as soon as possible, with a multidisciplinary team drawing a tailored rehabilitation pathway for the convalesce phases (Yataco et al. 2019). Indeed, there must be a transition from the hospital phase to the post-discharge phase that is already planned in the hospital. Unfortunately, there is a huge discrepancy in accessibility to rehabilitation programmes from region to region, leading to health inequality (Strickland et al. 2020).

It is important to outline that the evaluation of outcomes requires the implementation of a follow-up programme for the intensive care unit survivor. The realisation of this programme has to deal with two major issues:

- Organisation, costs and workload of follow-up programmes
- Use a standardised scale for outcome evaluation

It is noteworthy to highlight that the scales used to assess post-SAH functional outcomes were originally created for different neurological conditions (Pace et al. 2018). Consequently, there is a huge need for standardisation of prognostic evaluation using a well-validated scale at a specific time after discharge.

Conclusion

SAH predominantly affects young and healthy populations. SAH is associated with significant premature mortality and disability requiring protracted hospitalisation stays and specific rehabilitation pathways. Reduction in incident rates in the last 20 years could reflect the positive effects of prevention campaigns. Unfortunately, the same trend was not observed for intrahospital mortality. There is a wide variation in how SAH patients are managed globally, which could impact their prognosis. These findings have to be analysed, taking into account the huge heterogeneity of the availability of high-specific competency between countries and centres (i.e., neurocritical care, neurosurgery, neuroradiology, neurorehabilitation). From this perspective, comparative effectiveness research is to be encouraged, focusing on the correlation between practice variabilities and outcomes in order to improve our delivery of care.

Conflict of Interest

None.

Permission - Tables/Figure

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Abbreviations

WHO: World Health Organization
 SAH: Subarachnoid Haemorrhage
 DALY: Disability Adjusted Life Year
 YLL: Years of Life Lost
 YLD: Years Lived with Disability
 GBD: Global Burden of Disease
 UIATS: Unruptured Intracranial Aneurysm Treatment Score
 PHASES: Population, Hypertension, Age, Size, Earlier Subarachnoid Haemorrhage, and Site
 ELAPSS: Earlier Subarachnoid Haemorrhage, Location of the Aneurysm, Age >60 years, Population, Size of the Aneurysm, and Shape of the Aneurysm
 DCI: Delayed Cerebral Ischaemia
 GOS: Glasgow Outcome Scale
 mRS: modified Rankin Scale
 SAHIT: Subarachnoid Haemorrhage International Trialists
 WFNS: World Federation of Neurosurgeons
 PICS: Post-intensive Care Syndrome
 ICU: Intensive Care Unit

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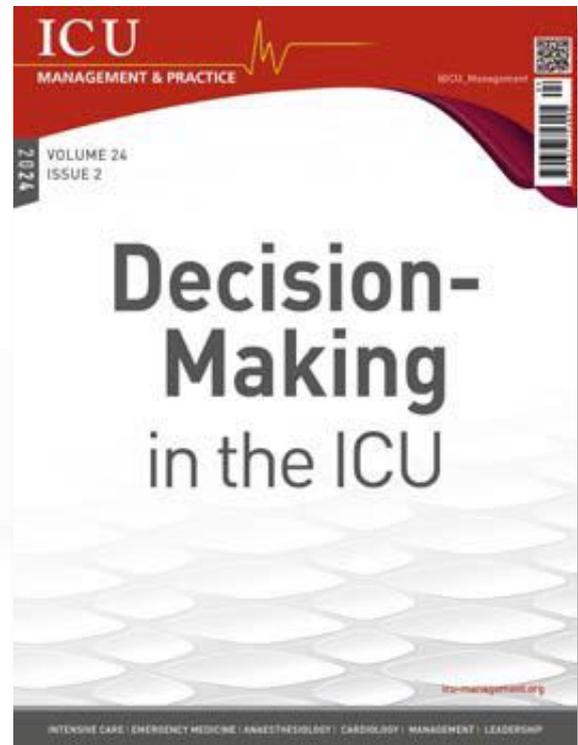
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WHAT'S COMING NEXT?



COVER STORY: Pharmacist in the ICU

Pharmacists in the ICU work with critical care physicians, nurses, and other specialists to ensure that medication therapy is tailored to each patient's needs and is administered safely and effectively. In this issue, our contributors explore the role of pharmacists in the ICU and discuss their responsibilities related to various aspects of pharmaceutical care.



COVER STORY: Decision-Making in the ICU

Critical care practitioners often have to make decisions in high-stress and uncertain situations. 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 the complex decision-making process in critical care.

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DECEMBER

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10-13 International Update meeting on Acute Heart Failure Rome, Italy
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JANUARY 2024

8-12 Blood Diseases in the ICU Paris, France
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11-14 Society for Technology in Anesthesia Annual Meeting 2024 Las Vegas, Nevada, USA
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21-23 SCCM Critical Care Congress Phoenix, Arizona
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14-19 18th ESRA Winter Week Conference 2024 Längenfeld, Austria
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26 – 28 ASA ADVANCE 2024: The Anesthesiology Business Event Las Vegas, Nevada, USA
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28 -2FEB 29th International Winter Symposium in Intensive Care Medicine Lech, Vorarlberg, Austria
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29 – 1FEB Arab Health 2024 Dubai, United Arab Emirates
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FEBRUARY

8-9 4th World Congress on Surgery, Surgeons and Anaesthesia Barcelona, Spain
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8-11 EuroAfrica 2024 Cairo, Egypt
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