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REVIEW ARTICLE

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Outcomes after Critical Illness

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THE SPECIALTY OF CRITICAL CARE HAS ACHIEVED IMPORTANT ADVANCES in survival for many patients with the most complex disorders. Along with these advances, however, there has been an increasing awareness of the complicated and persistent morbidity that follows critical illness. Episodes of critical illness result in multidimensional acquired or exacerbated conditions that may persist for years after the critical illness and may not be wholly reversible. Health inequities may worsen these outcomes. The coronavirus disease 2019 (Covid-19) pandemic, which has resulted in the largest cohort of critical illness survivors and families in history, heightened awareness of the ubiquity of multidimensional disability after critical illness. A continuum of care for patients and families after critical illness, extending from the intensive care unit (ICU) to community or primary care, must become the standard of care and be developed concurrently with a prioritization of basic science inquiry to elucidate the multiple mechanisms of morbidity. Transparent and public reporting of long-term ICU outcomes is fundamental for obtaining informed consent to initiate and continue ICU treatment, aligning care with patient and family values, and ensuring accountability for the high human and financial costs of these outcomes.

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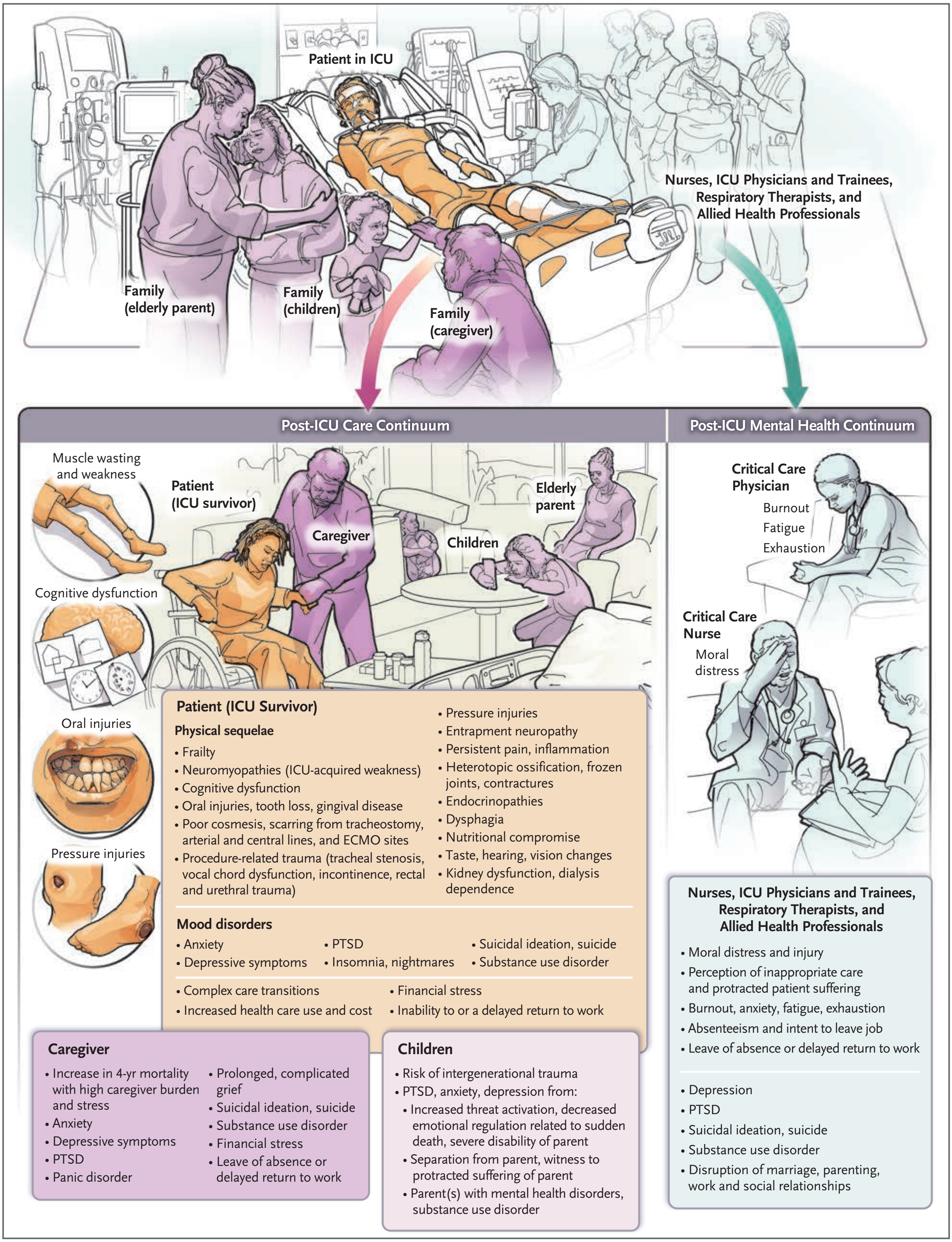
PATIENT OUTCOMES AFTER CRITICAL ILLNESS

The description of the acute respiratory distress syndrome (ARDS) in 1967 initiated a cascade of studies that evolved from reports on short-term mortality and pulmonary outcomes to the current literature on multidimensional ICU outcomes.[1] Figure 1 outlines the patient outcomes and their effects on caregivers, children, and the interprofessional ICU team. An extended overview of the most prevalent sequelae, briefly outlined below, is provided in Table 1.

In early case series evaluating outcomes in ARDS survivors, mild restrictive or obstructive deficits were reported on pulmonary-function testing, with a reduction in diffusion capacity,[2] but subsequent studies did not directly implicate pulmonary function in observed decrements in health-related quality of life.[3-5] In 1998, Schelling et al. highlighted the prevalence of post-traumatic stress disorder (PTSD) after ARDS, associated with traumatic ICU memories.[7] The following year, Hopkins and colleagues reported neurocognitive and psychological dysfunction, including persistent cognitive dysfunction in 30% of ARDS survivors at 1 year and impaired memory, attention, or concentration or decreased mental processing speed in 80%.[6]

In 2003, the Toronto ARDS Outcomes Program extended this emerging description of the post-ARDS syndrome to include multidimensional disorders and long-term functional disability associated with persistent muscle wasting and weakness, in the context of normal–to–near-normal pulmonary function. A decrease in the distance walked in 6 minutes was linked to impaired health-related quality of life and increased health care use at 1, 2, and 5 years of follow-up after ICU discharge.[8-10] As with earlier observations from De Jonghe and colleagues on paresis in a general ICU population,[11] decreased post-ICU walking distance in 6 minutes was



Patient (ICU Survivor)

Physical sequelae

- Frailty
- Neuromyopathies (ICU-acquired weakness)
- Cognitive dysfunction
- Oral injuries, tooth loss, gingival disease
- Poor cosmesis, scarring from tracheostomy, arterial and central lines, and ECMO sites
- Procedure-related trauma (tracheal stenosis, vocal chord dysfunction, incontinence, rectal and urethral trauma)
- Pressure injuries
- Entrapment neuropathy
- Persistent pain, inflammation
- Heterotopic ossification, frozen joints, contractures
- Endocrinopathies
- Dysphagia
- Nutritional compromise
- Taste, hearing, vision changes
- Kidney dysfunction, dialysis dependence

Mood disorders

- Anxiety
- Depressive symptoms
- PTSD
- Insomnia, nightmares
- Suicidal ideation, suicide
- Substance use disorder

- Complex care transitions
- Increased health care use and cost
- Financial stress
- Inability to or a delayed return to work

Caregiver

- Increase in 4-yr mortality with high caregiver burden and stress
- Anxiety
- Depressive symptoms
- PTSD
- Panic disorder
- Prolonged, complicated grief
- Suicidal ideation, suicide
- Substance use disorder
- Financial stress
- Leave of absence or delayed return to work

Children

- Risk of intergenerational trauma
- PTSD, anxiety, depression from:
  - Increased threat activation, decreased emotional regulation related to sudden death, severe disability of parent
  - Separation from parent, witness to protracted suffering of parent
  - Parent(s) with mental health disorders, substance use disorder

Nurses, ICU Physicians and Trainees, Respiratory Therapists, and Allied Health Professionals

- Moral distress and injury
- Perception of inappropriate care and protracted patient suffering
- Burnout, anxiety, fatigue, exhaustion
- Absenteeism and intent to leave job
- Leave of absence or delayed return to work

- Depression
- PTSD
- Suicidal ideation, suicide
- Substance use disorder
- Disruption of marriage, parenting, work and social relationships

Figure 1 (facing page). Overview of the ICU Care Continuum Construct for Patients, Family, and the Health Care Team after Critical Illness.

The critical illness episode (patient) and intensive care unit (ICU) experience (family and health care team) are inciting events that propagate a cascade of longer-term, multidimensional physical and mental health consequences that may result in durable disability, compromised health-related quality of life, job disruption or loss, and increased health care utilization and cost over time. These consequences vary for the patient, family, and health care team members. ECMO denotes extracorporeal membrane oxygenation, and PTSD post-traumatic stress disorder.

associated with female sex, a high burden of comorbidity, and exposure to systemic glucocorticoids. Similar outcomes and determinants of the 6-minute walking distance were validated by the Johns Hopkins Improving Care of Acute Lung Injury Patients (ICAP) group[12] and by the multicenter ARDSNet Long-Term Outcomes Study (ALTOS).[13] Pfoh and colleagues also observed durable physical impairment in ARDS survivors up to 5 years after ICU discharge and a continued functional decline over that period in a substantial proportion of patients.[14] Similar observations were reported by Cuthbertson et al. in a 5-year follow-up in a general ICU population[15] and by Lone et al. in a Scottish population-based study.[16]

ICU-acquired weakness is prevalent among ICU survivors[17] and encompasses a critical illness myopathy (myosin-depletion myopathy), polyneuropathy (axonopathy), or a combination of these disorders. Modifiable risk factors (immobility, hyperglycemia, and treatment with glucocorticoids and neuromuscular blockers) and nonmodifiable risk factors (multiple organ dysfunction, severe illness, and prolonged duration of illness or ICU stay) have been well described previously. ICU-acquired weakness accounts for an increased number of days of mechanical ventilation, a

Table 1. Sequelae of Critical Illness.*

Disorder	Consequences
ICU-acquired weakness	Multidimensional functional disability (prolonged mechanical ventilation, compromised ambulation, impaired ADL, pharyngeal muscle weakness, swallowing difficulties and increased risk of aspiration, employment difficulties, reduced health-related quality of life for ≥5 yr)
Nutritional compromise	Compromised physical and neurocognitive recovery
Entrapment neuropathy	Foot or wrist drop, compromising rehabilitation and functioning
Frailty	Functional disability, new nursing home admission, increased post-ICU mortality
Cognitive dysfunction	Decrease in attention, concentration, processing speed, memory, executive dysfunction for ≥5 yr; employment and health status affected
Mood disorders	Depressive symptoms, anxiety, PTSD, suicidality, substance misuse for ≥8 yr
Pressure injuries	May persist beyond 1 yr and impede return to work; increased post-ICU mortality
Oral complications	Gingivitis, dental caries, tooth injury or loss, need for longer-term dental follow-up
Endocrinopathies	Derangement of thyroid, adrenal function, and hypothalamic–pituitary axis, disrupting endocrine homeostasis, sexual function
Musculoskeletal disorders	Frozen joints, contractures, and heterotopic ossification
Changes in appearance	Alopecia, scarring, and disfigurement, complicating social reintegration
Taste changes	Difficulty with feeding and nutrition
Hearing or vision changes	Delayed recovery, return to home and work
Procedure-related trauma	Rectal and urethral injury, vocal cord dysfunction with altered phonation, tracheal stenosis, impeding ADL, rehabilitation, and return to home and work
Renal dysfunction	Chronic impairment of the glomerular filtration rate, need for renal-replacement therapy, compromised health-related quality of life, and increased health care use and 1-year mortality

* All post–intensive care unit (ICU) coexisting conditions have been qualitatively or quantitatively associated with long-term impairments in health-related quality of life, disruption of community integration, return to work, and increased health care costs. A list of resources supporting the information shown is available in the Supplementary Appendix. ADL denotes activities of daily living, and PTSD post-traumatic stress disorder.

prolonged ICU stay, a complex transition to post-ICU care, an increased number of emergency department visits or hospital and ICU readmissions, and increased long-term disposition and health care costs. This condition may be permanent.

ICU outcomes data highlight myriad coexisting conditions including frailty; oral and dental complications; swallowing difficulties; taste changes; vision or hearing loss; a new need for renal replacement therapy; procedure-related trauma (incontinence, rectal or urethral trauma, vocal cord dysfunction, or tracheal stenosis); entrapment neuropathies; endocrinopathies; heterotopic ossification; frozen joints and contractures; rotator cuff injuries from a prolonged prone position; cosmetic concerns related to alopecia, nail changes, scarring, and disfigurement from tracheostomy, placement of arterial or central lines, or extracorporeal membrane oxygenation (ECMO) sites; and complicated pressure injuries. Traumatic memories, unremitting stress from the ICU experience, and ICU-acquired disability may have a profound effect on caregivers and other family members, including children, and may represent an antecedent for intergenerational trauma.[18]

Frailty is defined by diminished strength and endurance and reduced physiological functioning, which increase the risks of dependency and death. When frailty occurs or worsens after ICU admission, it is associated with increased in-hospital and long-term mortality, increased functional dependency, a reduced health-related quality of life, a lower likelihood of a return to community-based living, and a greater likelihood of hospital readmission.

The Bringing to Light the Risk Factors and Incidence of Neuropsychological Dysfunction in ICU Survivors (BRAIN-ICU) study[19] has shown that 1-year cognitive outcomes among ICU survivors are independent of age, similar in severity to mild Alzheimer's-type dementia or moderate traumatic brain injury, and related to cortical loss, white-matter injury, or both during critical illness. The duration of ICU delirium is the most potent risk factor for 1-year global cognitive dysfunction and impaired executive function. Additional risk factors include hypoxemia, blood glucose dysregulation, conservative fluid management, no statin exposure during critical illness, sepsis-induced encephalopathy, immobility, deep coma, sleep disruption, and separation from family.

Mood disorders, which are persistent and prevalent among ICU survivors, include PTSD (in 25% of survivors up to 8 years), depressive symptoms and anxiety symptoms (in 17 to 43% and 23 to 48%, respectively, at 1 year), suicidality, and substance misuse. These disorders may be related to injury of the limbic system during critical illness. Risk factors for mood disorders include previous psychiatric illness, prolonged mechanical ventilation, prolonged ICU stay, episodes of hypoglycemia, and prolonged exposure to sedative and narcotic agents.[20]

Pressure injuries are also common. The recent Decubitus in Intensive Care Units study showed a point prevalence of pressure injuries that was close to 30%.[21] The severity of pressure injuries is associated with mortality in a dose-dependent relationship, and risk factors include older age, diabetes mellitus, cardiovascular disease, vasopressor use, a prolonged prone position, prolonged mechanical ventilation, use of ECMO, and a prolonged ICU stay.

Observations of long-term multisystem disorders after critical illness are robust and reported across diverse patient populations and international studies. Dissemination of this knowledge has been limited, however, even within the specialty of critical care.[22] There is a need to move beyond illness defined by disposition, toward a continuum of patient and family care encompassing both pre- and post-ICU periods. In addition, priority should be given to educational engagement with critical care colleagues, ICU stakeholders, interprofessional team members, trainees, and primary care physicians about changing patient and family needs before, during, and after ICU care. Critical illness is only one phase of an illness and is defined not solely by the need for ventilatory or hemodynamic support but also by how preexisting health status interacts with severe illness, the effects of exposure to technological supports, and ICU-related iatrogenesis.

RISK AND TRAJECTORIES OF POST-ICU DISABILITY

Age is a fundamental marker of senescence with loss of organ reserve and is a central determinant of survival and disability after critical illness.[23] When increasing age is combined with the need for mechanical ventilation, the rates of patient illness and death rise substantially.[24] In a U.S. cohort of ICU patients over the age of 60 years, 45% of the patients died within the first year after critical illness, and depression and disability in activities of daily living were associated with decrements in health-related quality of life among the patients who survived.[25]

With increasing age and severity of illness, health status before the development of critical illness becomes a fundamental determinant of the post-ICU outcome. Social isolation, frailty, cognitive impairment, and impaired functioning before ICU admission are also associated with an increase in the risk of disability after discharge in older patients.[26,27] Frailty and an age of 80 years or older have central prognostic importance with respect to the risk of death in the ICU and at 30 days after discharge.[28]

ICU patients may be risk-stratified on the basis of the degree of weakness that develops in the ICU. ICU-acquired weakness is associated with a lower likelihood of weaning from mechanical ventilation, increased health care costs, and 1-year mortality. Severe and persistent weakness at ICU discharge further increases 1-year mortality.[29]

Rehabilitation and Recovery in Patients and Families after One Week of Mechanical Ventilation (RECOVER), a multicenter Canadian cohort study, showed that functional status 7 days after ICU discharge (assessed with the Functional Independence Measure) determined disability outcome trajectories based on age and the length of the ICU stay in a diverse sample of medical and surgical patients, transplant recipients, and patients undergoing ECMO who were mechanically ventilated for 2 or more weeks.[30] Trajectories were independent of the diagnosis on ICU admission, but determined discharge disposition, status with respect to hospital or ICU readmission, use of health care services, and survival status at 1 year of follow-up. Among patients who were older than 66 years of age and spent 2 or more weeks in the ICU, mortality was 40% at 1 year, and the survivors incurred substantial multidimensional disability. Each additional decade of age and each additional week spent in the ICU beyond 2 weeks were independently associated with increased multidimensional disability and mortality at 1 year after ICU discharge. French investigators also reported a longer ICU stay as an important independent risk factor for death within 1 year after discharge, in addition to older age, coexisting conditions, need for red-cell transfusion, and deranged clinical physiology factors at the time of ICU discharge.[31] Elevated biomarkers of cardiac and vascular failure accounted for an increase in the risk of death by a factor of almost 3.

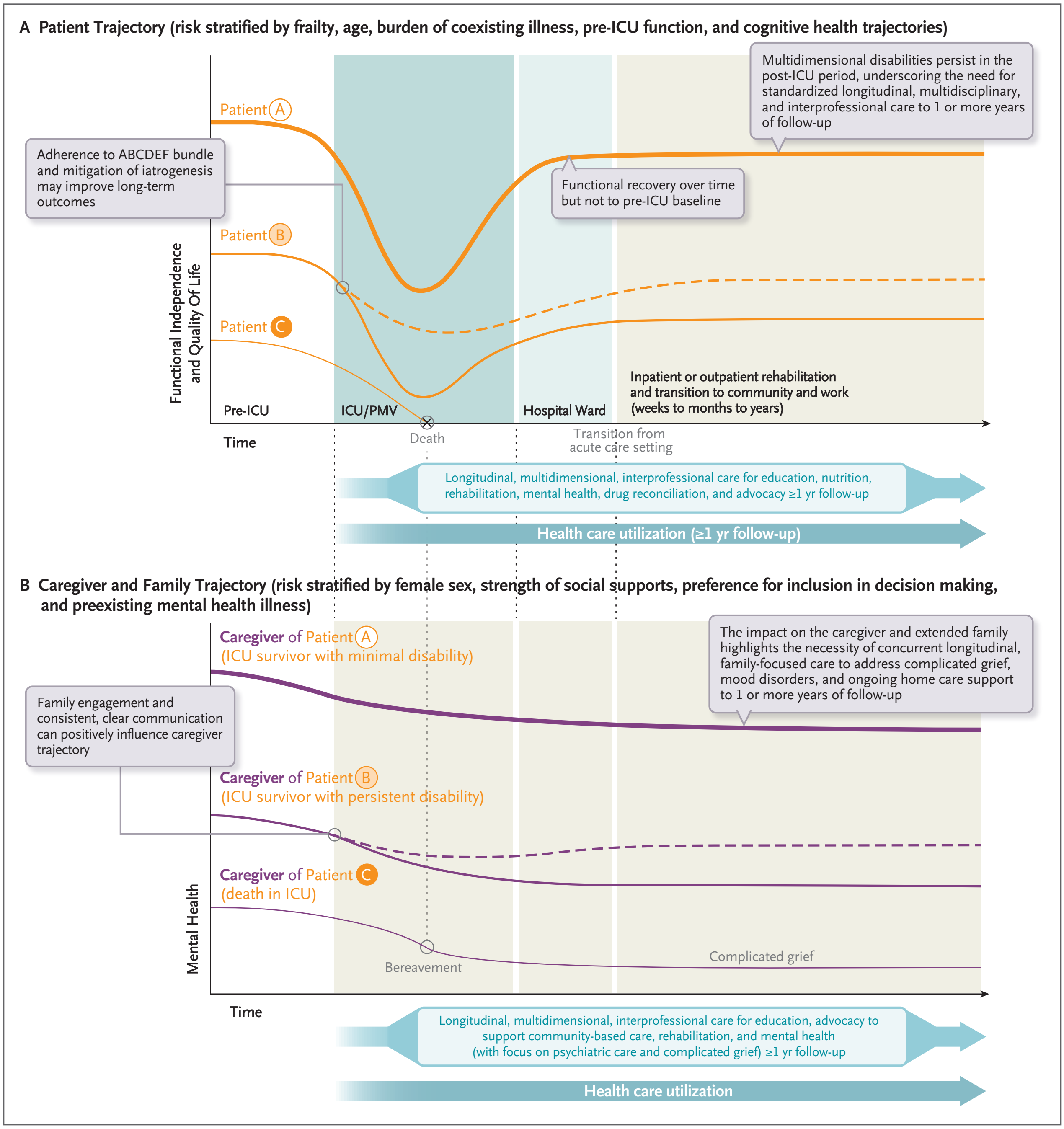
These data on the robust clinical risk factors for poor outcomes after discharge from the ICU, as well as the outcome trajectories for high-risk patients, provide a rationale for trials of limited treatment in the ICU and weekly discussion of the goals of care with patients and family caregivers after an ICU stay of 2 weeks or more. The discussions should candidly frame outcome expectations, including increased risks of disability and death, as part of the process of obtaining informed consent to ongoing ICU treatment and in an effort to mitigate suffering on the part of patients and family members. The high risks of increased disability and death with a protracted ICU stay should negate any practice of committing critically ill patients to indefinite trials of mechanical ventilation or ECMO support.

CAREGIVER OUTCOMES

High frequencies of symptoms of anxiety, depression, PTSD, and prolonged grief disorder have been reported among family members of ICU patients.[32] When a patient dies in the ICU, subsequent distress in the family is more common, more severe, and more lasting than in family members of patients who survive.[33,34] Other patient outcomes, such as persistent disability, also influence the family (Fig. 2).

Symptoms related to distress in family members impair the ability to understand information given about the patient[35] and induce excessive sleepiness, reducing the ability not only to carry on with work and other necessary activities but also to translate knowledge about the patient's wishes[36] into decisions about care.[37-39]

Observational studies have focused on five domains of relationships between family members and ICU staff: family satisfaction and the clinician's ability to address the family's needs; the quality of the information provided to family members and identification of targets for improving communication skills; shared decision making and family empowerment; symptoms of anxiety, depression, PTSD, and prolonged grief; and family-centered end-of-life care. Other studies have assessed the experiences of family members regarding brain death and organ donation or participation in research. Quantitative, qualitative, and mixed methods have been used to investigate these experiences.



A Patient Trajectory (risk stratified by frailty, age, burden of coexisting illness, pre-ICU function, and cognitive health trajectories)

Adherence to ABCDEF bundle and mitigation of iatrogenesis may improve long-term outcomes

Multidimensional disabilities persist in the post-ICU period, underscoring the need for standardized longitudinal, multidisciplinary, and interprofessional care to 1 or more years of follow-up

Functional recovery over time but not to pre-ICU baseline

Longitudinal, multidimensional, interprofessional care for education, nutrition, rehabilitation, mental health, drug reconciliation, and advocacy ≥1 yr follow-up

Health care utilization (≥1 yr follow-up)

B Caregiver and Family Trajectory (risk stratified by female sex, strength of social supports, preference for inclusion in decision making, and preexisting mental health illness)

Family engagement and consistent, clear communication can positively influence caregiver trajectory

The impact on the caregiver and extended family highlights the necessity of concurrent longitudinal, family-focused care to address complicated grief, mood disorders, and ongoing home care support to 1 or more years of follow-up

Longitudinal, multidimensional, interprofessional care for education, advocacy to support community-based care, rehabilitation, and mental health (with focus on psychiatric care and complicated grief) ≥1 yr follow-up

Health care utilization

Family satisfaction, assessed with the use of the Critical Care Family Needs Inventory, was associated with information being provided by the same clinicians every day, completeness of information received, and amount of health care received.[40-42] Using the Family Satisfaction in the ICU (FS-ICU) questionnaire to measure satisfaction with care and decision making, a study performed in Seattle underscored the need to improve the ICU atmosphere.[43]

On the basis of the Hospital Anxiety and Depression Scale, one study identified symptoms of anxiety in 70% of family members of ICU patients and symptoms of depression in 35%.[32] Symptoms of anxiety were less prevalent among families of patients with chronic conditions, family members other than spouses, and families receiving well-organized, family-centered care. Symptoms of depression were less prevalent among family members of older patients and

Figure 2 (facing page). Overview of Differential Trajectories of Patient and Family Outcomes and Their Interrelatedness across the Care Continuum after Critical Illness.

The care continuum for patients (Panel A) extends from pre-ICU health status through the ICU stay, including prolonged mechanical ventilation (PMV) and chronic critical illness, to the hospital ward and inpatient or outpatient rehabilitation to community reintegration and return to prior social roles including paid and unpaid work. Patient outcomes may be risk-modified by baseline frailty, age, burden of coexisting illness, and pre-ICU functional status and modified by adherence to the ABCDEF bundle and minimization of iatrogenesis in the ICU. Care transitions and readmissions are complex and commonly occur from hospital ward to ICU and inpatient rehabilitation to hospital ward or ICU. This figure illustrates three different patterns of post-ICU patient outcomes according to risk strata: Patient A, a young, nonfrail, highly functional patient pre-ICU with a shorter ICU stay and full recovery and minimal coexisting illness; Patient B, an older, frail patient with moderate burden of chronic illness and functional dependency pre-ICU, a longer ICU stay, and more residual multidimensional disability; and Patient C, an older, frail patient with severe burden of chronic illness and functional dependency pre-ICU who dies in the ICU. The care continuum for family (Panel B) is related to patient outcome (survival vs. death) and to the degree of durable multidimensional disability sustained by the patient over time. Caregiver outcomes may be risk-modified by female sex, strength of social supports, preference for inclusion in decision making, and preexisting mental health illness and mitigated by the quality and consistency of communication during the ICU stay and the quality of death and dying. This figure illustrates three different patterns of post-ICU family outcomes according to the patient outcome (survived vs. died) and to ICU-acquired disability in patients who survived: a caregiver of Patient A (an ICU survivor with minimal disability), a caregiver of Patient B (an ICU survivor with moderate disability resulting in significant caregiver burden), and a caregiver of Patient C (who died in the ICU) who experiences bereavement and complicated grief. These curves are composites of published data from the ICU outcomes literature.

family members other than the spouse but were more prevalent among families with a language barrier and those who reported having received contradictory information. PTSD is a debilitating mental condition that can significantly affect quality of life and is associated with depression, substance use disorders, and a significantly increased risk of suicide.[44,45] Symptoms of PTSD have been found in one third of the relatives of ICU patients.[33] Prolonged grief is an incapacitating syndrome characterized by a persistent focus on the loss, rumination about death, an inability to adjust to life without the loved one, and loss of any prospect of joy, satisfaction, or pleasure. Prolonged grief occurs in about 10% of bereaved people overall and in more than 50% of relatives of patients who die in the ICU.[33]

Overall, general anxiety, PTSD, and depression carry a heavy personal and societal economic burden. These disorders are associated with increased use of health care services and medications, absenteeism from work and loss of productivity, substance misuse or dependency, and suicidality. Studies have shown that both patients and relatives experience stress from financial concerns.[46] However, further studies are needed to establish a causal relationship between financial stress and symptoms of anxiety, depression, and PTSD.

POST-ICU SYNDROMES

There are several overlapping constructs for the post-ICU condition, which highlight anticipated disorders resulting from severe lung injury, sepsis, and prolonged mechanical ventilation. The emerging post-Covid critical illness outcomes literature reflects these multidimensional sequelae to 1 year of follow-up.[47] In 2010, after reports on the outcomes of ARDS, Iwashyna et al. reported important decrements in cognition and function among survivors of severe sepsis, which persisted through 8 years of follow-up.[48] The post-sepsis syndrome has been widely reported, with documentation of the spectrum of sepsis-related, long-term disorders, as well as possible mitigation strategies.[49-51]

In 1985, Girard and Raffin introduced the concept of chronic critical illness to highlight patients who received prolonged mechanical ventilation.[52] In 2010, Nelson et al. documented the role of prolonged mechanical ventilation (for 1 to 3 weeks) in the syndrome of chronic critical illness and extended the definition of the syndrome to include ICU-acquired weakness, brain dysfunction, endocrinopathy, malnutrition, recurrent infections, pressure injuries, and symptom-related distress.[53] Mortality in this diverse patient group was reported as 48 to 68%. Hough et al. reported that patient age, platelet count, requirement for vasopressors, dialysis, and nontrauma admission determined 1-year mortality in survivors of 2 weeks of mechanical ventilation.[54] Unroe and colleagues detailed 1-year outcomes after 3 weeks of mechanical ventilation, reporting that only 9% of patients have a good outcome with functional independence, and 65% have a poor outcome (complete functional dependency or death), with byzantine post-ICU care transitions.[55] Only 20% of patients surviving chronic critical illness will return home, and the majority will be discharged to skilled nursing facilities with incurred costs in the billions.[56] In 2012, Needham et al.[57] and Davidson et al.[58] introduced the post–intensive care syndrome and the counterpart of that syndrome in family members, respectively, as additional constructs to elevate public awareness of the post-ICU condition and to group common features of post-ICU disorders, including physical and cognitive disabilities and mood disorders, in both patients and their families. The extended post–intensive care syndrome has recently been added to further expand the broad spectrum of disorders that develops after critical illness.[59] The persistent syndrome of inflammation, immunosuppression, and catabolism has also been hypothesized to promote poor recovery and rehabilitation and extends beyond multiple organ dysfunction in patients with chronic critical illness.[60]

The continuum of critical illness lends itself to the complementary construct of a continuum of tailored care, nutrition, follow-up, and rehabilitation (Fig. 2, and Table S1 in the Supplementary Appendix, available with the full text of this article at NEJM.org). Patients come to the ICU with variations in health status, baseline nutrition status, and organ resilience. Optimal outcomes require tailored multimodal management at each transition in care. There is an expansive literature on interventions before, during, and after an episode of critical illness that is beyond the scope of this review. A succinct overview of evidence-based ICU practice for optimal outcomes has been effectively articulated in the ABCDEF bundle: assess, prevent, and manage pain; both spontaneous awakening trials and spontaneous breathing trials; choice of analgesia and sedation; delirium: assess, prevent, and manage; early mobility and exercise; and family engagement and empowerment.[61] The suspension of these practices during the Covid-19 pandemic exacerbated many of the disorders described above, underscoring the fundamental importance of such practices with respect to outcomes. Policies of isolation have altered the processes of ICU care for which family centeredness is paramount, deeply affecting patients, caregivers, children, and health care providers.

POST-ICU FOLLOW-UP AND REHABILITATION

A summary of studies of post-ICU follow-up and rehabilitation is provided in Table S1. The first reports of post-ICU follow-up originated from groups in the United Kingdom, and the early work was led by Jones, Skirrow, and Griffiths.[62] To date, there is contradictory literature on the efficacy of ICU-based follow-up and rehabilitation programs.[63-65] Patient heterogeneity and differences in pre-ICU health profiles and post-ICU recovery trajectories pose a major challenge to the development and testing of these programs. Results may have more to do with the study sample and the patients' baseline health and nutrition[66] status before their critical illness than to the nature of the follow-up and rehabilitation interventions. Important guidelines have been established for follow-up and rehabilitation after discharge from the ICU, but the evidence base for guiding practice in this area is still sparse.[67] Limitations include the timing and choice of multidimensional core outcomes and the duration of follow-up after an intervention, as well as the absence of robust knowledge of the mechanistic determinants of multisystem organ injury and repair and how they interact with tailored nutrition management and the timing and intensity of exercise and mental health programs.

In 2009, Schweickert and colleagues evaluated a combined intervention of daily interruption of sedation with exercise and mobilization within 72 hours after the initiation of mechanical ventilation in patients with baseline functional independence.[64] As compared with usual care, this intervention was associated with improved functional independence at hospital discharge, suggesting the potential for resilience in patients who were functionally independent before they became critically ill. The improved function resulting from early goal-directed mobilization in a surgical ICU population[65] may further reinforce the important effect of premorbid status on the effectiveness of rehabilitation. The positive effect of a post-ICU 6-week self-care and rehabilitation manual[62] underscores the overarching principle of tailored care and nutrition[68] after critical illness, and the effect of a diary intervention on PTSD highlights the ability to target and mitigate mood disorders. Interdisciplinary and interprofessional programs for post-ICU follow-up and rehabilitation, ranging from nurse-led clinic follow-up to exercise programs to programmatic approaches to nutrition and rehabilitation, have achieved modest improvements in functioning or quality of life, but some have noted improved patient-reported satisfaction.[15,30,69-71] Historical models of such approaches can be found in the literature on cardiac and pulmonary rehabilitation.[72,73] Programs of post-ICU education, advocacy, and ongoing clinical care for patients and families are largely built on these same tenets of care (e.g., programs from the Intensive Care National Audit and Research Centre [https://www.icnarc.org/About/Patients-Relatives/For-Patients-Relatives]; the Critical Illness, Brain Disorder, and Survivorship Center [www.icudelirium.org]; the Sepsis Alliance [www.sepsis.org]; the Thrive Initiative [www.sccm.org/MyICUCare/THRIVE]; ICU Steps [www.icusteps.org]; the European Society of Intensive Care Medicinse [www.esicm.org/patient-and-family]; the American Thoracic Society [www.thoracic.org/patients/patient-resources]; and ARDS Global Organization [www.ardsglobal.org]), as are those focused currently on care after Covid-19 critical illness.[74]

FOLLOW-UP FOR FAMILY CAREGIVERS

Several randomized, controlled trials have assessed the effectiveness of various interventions to improve the experience of family members of ICU patients (Table S2). Of the 19 trials listed in Table S2, 8 evaluated communication strategies, 4 studied end-of-life care, 4 outlined programs teaching communication skills, and 3 determined whether facilitators improved family outcomes. Seven trials showed outcome gains for family members, 3 showed outcome losses, and 9 failed to show any effect.

An informational leaflet provided to family members improved their comprehension of information about the ICU.[75] For family members of patients dying in the ICU, a proactive communication strategy that included longer conferences with the family members and more time for them to talk was associated with a decreased prevalence of symptoms of anxiety, depression, and PTSD.[76] In the case of patients with cardiac arrest, PTSD-related symptoms were less common in family members who were given the opportunity to observe cardiopulmonary resuscitation efforts.[77]

A trial assessing the benefits of a communication facilitator showed that symptoms of depression were less common in family members when a facilitator was involved.[78] For family members of patients who received mechanical ventilation for more than 2 days, a telephone-based training program focused on coping skills and access to a study website or a critical illness education program were associated with improved mental health outcomes at 6 months.[79] In a trial involving surrogate decision makers for patients receiving prolonged mechanical ventilation, a Web-based decision aid that provided individualized prognostic estimates, explained treatment options, and clarified patient values was associated with a substantial reduction in decision-making conflicts.[80] A large trial showed that flexible visitation policies for family members were associated with a decreased prevalence of anxiety and depression.[81] Nielsen et al. reported that a family-authored diary was associated with a reduction in symptoms of post-traumatic stress.[82]

In an early trial showing that a family intervention was associated with adverse outcomes, the intervention consisted of a condolence letter sent to bereaved family members 3 weeks after the patient's death.[33] Symptoms of PTSD and depression 6 months after the death were increased among family members who had received the letter. Another trial assessed a palliative care intervention aimed at surrogate decision makers for patients with chronic critical illness.[83] The intervention, which consisted of at least two structured family meetings, led by palliative care specialists, and an informational brochure, had no effect on symptoms of anxiety and depression at 3 months, but PTSD-related symptoms were significantly more frequent in the intervention group. Several trials either are recruiting participants or have recently ended recruitment and should provide new, high-level evidence about family-centered care.

CONCLUSIONS AND RECOMMENDATIONS

The field of critical care has made enormous gains in its mission to save lives. Critical illness, however, changes a life trajectory and is often a traumatic experience for the entire family. The next challenge for critical care is to look beyond the ICU, hospital discharge, and survival at 30

Table 2. Recommendations to Improve Patient- and Family-Centered Outcomes after Critical Illness.

Provide broad education on ICU outcomes and the continuum of critical care construct
Educate both the lay public and the medical community, with a focus on primary care physicians, who will assume the care of most post-ICU patients.
Develop a formal educational program for general medical and critical care trainees in prolonged mechanical ventilation units and post-ICU follow-up clinics.
Ensure accountability and reporting of multidimensional outcomes at 1 year
Establish transparent and mandated reporting of patient- and family-centered outcomes to institutions or government and third-party payers.
Ensure health policy planning and cost assessment to determine both risk profiles for patients with high-cost needs and long-term outcomes for such patients.
Include ICU outcomes as part of informed consent, perform trials of limited treatment, and engage family in weekly goals-of-care discussions
High-risk, complex medical (e.g., oncology), surgical (e.g., burns), or innovative surgery or life-sustaining treatment (e.g., high-risk surgery, high-risk donor–recipient pairings for multiorgan transplantation and ex vivo organ use, and advanced technologies, including ECMO) that may require a prolonged ICU stay warrants a discussion of ICU outcomes as part of informed consent.*
Institute time-limited trials of ICU treatment[84] on the basis of robust data on risk factors for a poor outcome, including older age, pre-ICU functional dependency, frailty, declining cognitive or health trajectory before critical illness, and a high burden of coexisting disease that predates the critical illness.
Institute weekly goals-of-care discussions for education about outcome and ongoing consent to treatment as standard practice. The risks of disability and death within 1 year increase with each additional week spent in the ICU, regardless of the medical or surgical admitting diagnosis.
Curtail time-unlimited ICU stays to mitigate patient suffering, emotional harm or moral injury for the family and professional caregivers, and intergenerational trauma for children.
Prioritize basic and translational science inquiry into multisystem tissue injury and repair, risk stratification, role of nutrition and rehabilitation, and determination of outcome trajectories
Collaborative basic and translational research on risk factors and outcomes will enhance our understanding of mitigating strategies for tissue injury and repair and how they complement evolving ICU practice standards and the continuum of tailored care, nutrition, follow-up, and rehabilitation and recovery.
Integrate longitudinal, granular data on ICU outcomes into administrative data sets as the ongoing standard for patient- and family-centered data collection
Foster local, national, and international programs focused on the ICU care continuum and advocate for permanent funding as a timely and urgent public health priority
Ensure optimal, consistent, and timely communication by the multidisciplinary team with family members
Provide respectful and compassionate care for the patient and family
Refrain from using pejorative descriptors of patients and families (e.g., “difficult,” “crazy”) and identify and advocate for mental health resources to mitigate mood disorders and substance misuse.
Encourage family involvement at bedside and always in end-of-life decisions
Increased support for surrogate decision makers and better compliance with the level of control over patient care that surrogates desire are essential.

* ECMO denotes extracorporeal membrane oxygenation.

and 90 days and to embrace the construct of ICU care as part of a continuum of care, with the goal of optimizing care transitions and long-term multidimensional functioning for surviving patients and their families. The literature on long-term ICU outcomes is robust across a broad spectrum of patient and caregiver groups, yet long-term outcomes are not a prominent part of the ICU lexicon. Our patients and their families need this to change. Table 2 outlines current recommendations to promote such changes. The international burden of post-Covid critical care illness makes this an urgent public health priority. The ICU community can — and should — make mitigation of suffering and a sense of futility in the ICU and of disability after discharge our next priorities. Stepping away from our historical compartmentalization of critical illness and establishing a longer, 1-year time horizon as the practice standard for assessing the myriad consequences of ICU care provide an opportunity for education, advocacy, continuity of care, and accountability for critically ill patients, their caregivers, their children, and our health care system.

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