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**ABOUT COVER**

Editorial Board Member of *World Journal of Critical Care Medicine*, Nathan J Smischney, MD, MSc, Assistant Professor, Anesthesiology, Mayo Clinic, Rochester, MN 55905, United States. [smischney.nathan@mayo.edu](mailto:smischney.nathan@mayo.edu)

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## Advances in post intensive care unit care: A narrative review

Nishant Kumar

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**Nishant Kumar**, Department of Anaesthesiology and Critical Care, Lady Hardinge Medical College and Associated Hospitals, New Delhi 110001, India

**Corresponding author:** Nishant Kumar, DA, DNB, MBBS, MNAMS, Professor, Department of Anaesthesiology and Critical Care, Lady Hardinge Medical College and Associated Hospitals, Shaheed Bhagat Singh Marg, New Delhi 110001, India. [kumarnishant@yahoo.co.uk](mailto:kumarnishant@yahoo.co.uk)

### Abstract

As the treatment options, modalities and technology have grown, mortality in intensive care unit (ICU) has been on the decline. More and more patients are being discharged to wards and in the care of their loved ones after prolonged treatment at times and sometimes in isolation. These survivors have a lower life expectancy and a poorer quality of life. They can have substantial familial financial implications and an economic impact on the healthcare system in terms of increased and continued utilisation of services, the so-called post intensive care syndrome (PICS). But it is not only the patient who is the sufferer. The mental health of the loved ones and family members may also be affected, which is termed as PICS-family. In this review, we shall be reviewing the definition, epidemiology, clinical features, diagnosis and evaluation, treatment and follow up of PICS. We shall also focus on measures to prevent, rehabilitate and understand the ICU stay from patients' perspective on how to redesign the ICU, post ICU care needs for a better patient outcome.

**Key Words:** Post intensive care syndrome; Post intensive care syndrome-family; Guidelines; Post intensive care syndrome clinics; Impediments

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**Core Tip:** Core priorities of critical illness survivors should be a part of the stakeholder-driven clinical guidelines and quality measures for post-intensive care unit (ICU) care. Future research should extend these findings among other stakeholders (e.g., family members and healthcare providers) and determine barriers and facilitators to patient-centered post-ICU care. It is not too far-fetched to think of a multi-professional patient centric critical care team that provides the right care to the right patient at the right time throughout and after the acute illness is over. What we need to change to bring in the future is how we use data, devices, and new technologies to continue to strive toward that goal.



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## INTRODUCTION

As the treatment options, modalities and technology have grown, mortality in intensive care unit (ICU) has been on the decline[1]. More and more patients are being discharged to wards and in the care of their loved ones after prolonged treatment and sometimes in isolation. These survivors have a lower life expectancy and a poorer quality of life. They can have substantial familial financial implications and an economic impact on the healthcare system in terms of increased and continued utilisation of services[2].

Though the intensivists may have cured the underlying disease, the process and time spent in the ICU far from family and loved ones predispose them to a new set of diseases which warrant special attention in terms of prevention, recognition, diagnosis, treatment and support of the so-called post intensive care syndrome (PICS)[1,2]. But it is not only the patient who is the sufferer. The mental health of the loved ones and family members may also be affected, which is termed as PICS-family (PICS-F)[1,2].

In this review, we shall be reviewing the definition, epidemiology, clinical features, diagnosis and evaluation, treatment and follow up of PICS. We shall also focus on measures to prevent, rehabilitate and understand the ICU stay from patients' perspective on how to redesign the ICU, post ICU care needs for a better patient outcome.

### Definitions

PICS may simply be defined as a new or worsening function in one or more following domains: Cognitive, psychiatric and/or physical. This includes all adult patients who after being discharged from the ICU reside in acute rehabilitation units, nursing facilities or at home. Patients with traumatic brain injury and stroke are excluded, and since this is a relatively new concept, the timeline for the occurrence after discharge is not defined[1].

PICS-F encompasses the acute and chronic psychological effects among a patient's family members that occur during the critical care or following death or discharge of the patient from the ICU[1,2]. An expansion of PICS has been proposed with a focus on the contributing factors, addition of potential new components which include: Osteopenia, metabolic disorders, endocrine dysfunction, vulnerability, fatigue, sleep disorders and chronic pain, and consequences thereof (Figures 1-3)[2].

### Epidemiology

Approximately 50% of ICU survivors while out of those requiring life support, 64% at three months and 56% at 12 mo, suffer from either one or more of the three components of PICS[3-8]. Impairment of the cognitive domain has been reported with an incidence of 25%-78%[4]. The BRAIN-ICU study has reported that while 6% had cognitive impairment at baseline, 40% had impairment similar to traumatic brain injury and 26% similar to mild dementia at three months. These deficits persisted for most patients at 12 mo post discharge[6].

Depression, anxiety and post-traumatic stress disorder (PTSD) are the most common psychiatric disorders reported among survivors of critical illness. The absolute risk varies from 1%-62% in literature, with higher rates in acute respiratory distress syndrome (ARDS) survivors[9]. The reported incidence of depression is 28% and that of PTSD is 22% respectively in systematic reviews[10-12].

Twenty five percent or more ICU survivors are left with ICU acquired weakness as the most common form of physical impairment. Mobility at six months was problematic in 64%[3], while 73% complained of moderate or severe pain. As much as 26% of patients could not perform normal daily activities fully and this persisted in most patients at the end of one year[5,6]. The presence of neuropsychological and functional disability that occurs after survival leads to substantial public health burden and a negative impact on the family income[3].

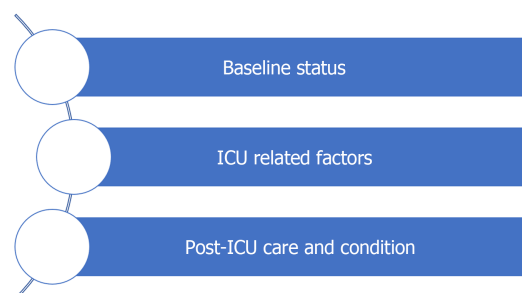
### Risk factors

These can be broadly classified into either pre-existing or ICU specific factors. Any of the factors responsible may be preexisting or acquired during or after the ICU stay[8]. It is not clear however, whether ICU related factors introduce morbidity or merely enhance the pre-existing neuropsychological and functional decline and to what extent[13].

Risk factors for the cognitive domain are: delirium[5], prior cognitive deficit[14], sepsis[15], ARDS[16] and others such as alcoholism, hypoxemia, hypotension, glucose dysregulation, respiratory failure, blood transfusions, benzodiazepines, transfusions and renal replacement therapy[5,15-20]. The possible mechanisms include ischemia, neuroinflammation and disruption of white matter integrity in areas involved in memory[16,21-23].

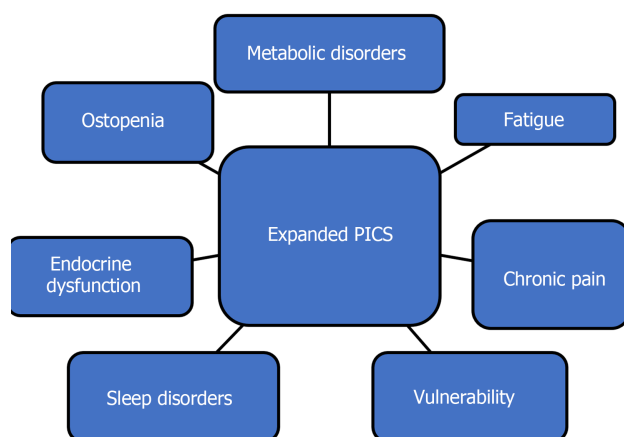
The psychiatric factors are similar to cognitive dysfunction pre-existing anxiety, depression and PTSD. Female sex, tall stature in males, age < 50 years and low level of education increase the risk. Glucocorticoid administration during critical illness may reduce the levels of cortisol, hence offering protection against development of PTSD[16,24-30].

The physical factors include pre-existing functional disability, frailty, cognitive impairment, prolonged mechanical ventilation (> 7 d), sepsis, multi-organ failure, prolonged bed rest[31-33], and others like ARDS, hyperoxia, use of vasoactive agents and steroids[15,30,34]. The role of neuromuscular blockers in developing physical component of PICS is under suspicion and more studies are required to prove it conclusively[31,35,36].



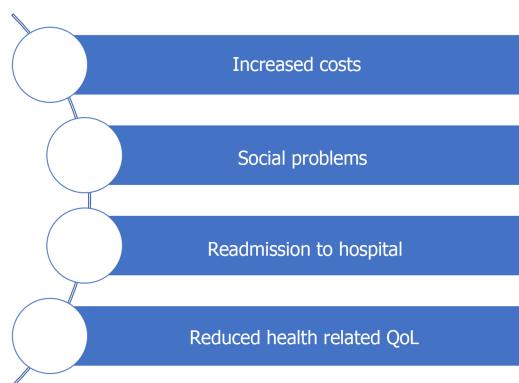
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**Figure 1 Contributing factors for post intensive care syndrome.** ICU: Intensive care unit.



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**Figure 2 Potential new components of post intensive care syndrome.** PICS: Post intensive care syndrome.



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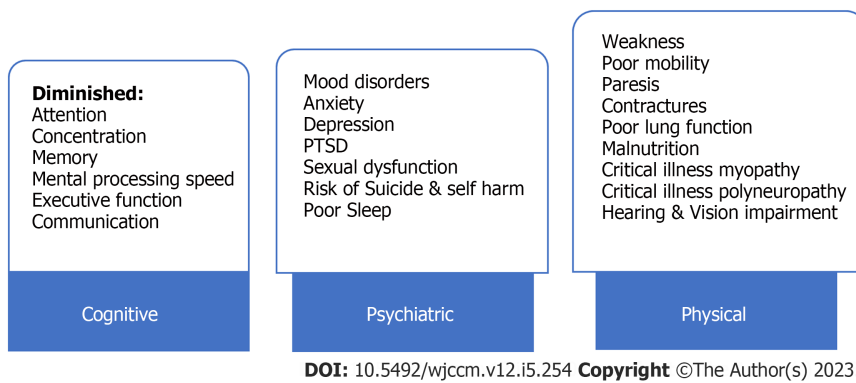
**Figure 3 Consequences of post intensive care syndrome.** QoL: Quality of life.

### Clinical presentation

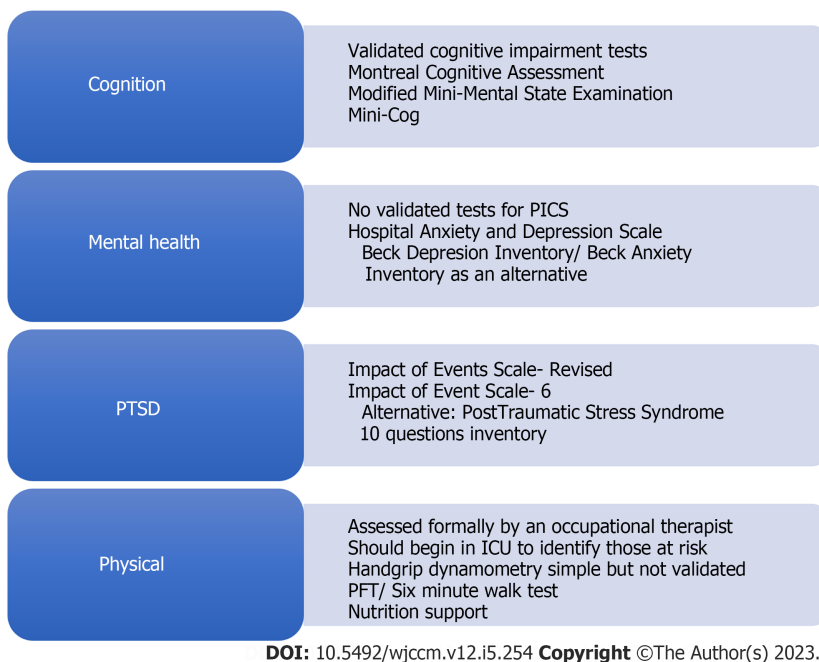
The common symptoms include weakness, poor mobility, poor concentration, fatigue, anxiety, and depressed mood. These symptoms are either new or represent worsening after the critical illness. The clinical features are depicted in Figure 4[1,7,16,31,32,37].

### Diagnosis

A high index of suspicion is required for its identification. There are no formal screening or definitive tests available for its diagnosis[38,39]. The society of critical care medicine advocates an early and serial assessment which begins at admission to ICU, as a part of ICU to ward over and involves predischARGE functional assessment, followed by 2-4 wk post discharge and throughout recovery. Those at high risk due to pre-existing or ICU related risk factors should be prioritised for evaluation[40]. All three domains are evaluated using a systematic screening approach beginning two to four weeks after hospital discharge (Figure 5)[33,40-44].



**Figure 4 Clinical features of post intensive care syndrome.** PTSD: Post-traumatic stress disorder.



**Figure 5 Evaluation tools for diagnosis of post intensive care syndrome.** PTSD: Post-traumatic stress disorder; PICS: Post intensive care syndrome; ICU: Intensive care unit; PFT: Pulmonary Function Test.

It is also important to rule out other causes which may cause disability and loss of function after ICU discharge. Most important of these include pre-existing illness which may persist and remain unchanged, thus excluding a diagnosis of PICS. The worsening or appearance of new illness may be difficult if the pre-existing illness is not known. Help may be sought from family members to obtain an extended history and pre admission status may help confirm the diagnosis. Apart from above, certain conditions may mimic PICS, including but not limited to stroke, hypo/hyper-thyroidism, vitamin B12 deficiency, anaemia, malignancy and obstructive sleep apnoea. These can usually be detected by routine laboratory testing or imaging, but should be directed based on history and examination findings. Rhabdomyolysis, cachetic myopathy and Guillain Barre syndrome may be mistaken for ICU acquired weakness, but usually obvious on admission[40].

A transient hospital- associated disability (post-hospital syndrome) may be confused with PICS. However, this is transient, seen in elderly and associated with a number of functional disabilities. PICS, on the other hand, may afflict all ages and runs a protracted course[45].

### Prevention

All patients being admitted into the ICU facility should undergo a psychological evaluation that includes pre-admission history, ability to adapt to stress in past, medication history, current mental and clinical status and environmental and family factors[46].

An ABCDEF bundle approach is warranted to prevent PICS especially in patients receiving mechanical ventilation. This approach includes: (1) Awakening (minimal, light sedation, daily interruption, minimising use of benzodiazepines); (2) Breathing (disease appropriate ventilation, ventilator liberation practices including spontaneous breathing trials); (3) Coordination of care and communication among various disciplines; (4) Delirium monitoring and management; (5) Early

ambulation/exercise; and (6) Family empowerment and engagement[47-49].

Additional interventions to prevent PICS include avoiding hypoglycaemia and hypoxemia, maintenance of ICU diary prospectively by the family members, health care providers, or both during the patient's ICU stay, has shown to decrease symptoms of PTSD, and can be used as a holistic tool to provide support and care to the patient and family[50]. Creating post-ICU clinics to provide follow-up counselling and support to the patients and family[51]. Maintaining good nutritional status and adequate sleep of the patient. Progressive feeding in the early phase for both proteins and calories is essential to prevent overfeeding and high caloric intake. After 4-7 d, high-protein intake and sufficient calories, essential to prevent further loss of muscle mass and function should be initiated. High-protein targets either by prolonged tube feeding or by enhanced high-protein oral nutrition (supplement) intake should be ensured post discharge[52].

The different phases of critical illness and recovery can be classified as acute illness, hospital recovery, and early and late post discharge recovery. Table 1 summarizes the various phases of critical illness and its consequences, which may be amenable to interventions that attempt to prevent, ameliorate, or treat the underlying impairments of PICS. Identification of the issues associated with each phase encourages development of targeted strategies to mitigate the impediments to complete recovery[53].

### Treatment

The clinician should endeavour to treat each component and seek appropriate post ICU discharge services such as cognitive, mental health, physical therapy, occupational rehabilitation and social/family support. Early physical rehabilitation and nutrition along with psychological and familial support right from the early recovery phase within the ICU itself may improve outcomes (Figure 6)[54-57]. Of late, the primary involvement of rehabilitation therapists and psychosocial support have emerged to be the mainstay of the treatment. While the intensivist may ameliorate and prevent the development of PICS, therapy beyond the walls of ICU lies outside the domain of the intensivist[40].

### Follow up

The exact period for follow up is not known, but may extend up to years every 2-3 mo post discharge. There is no set protocol and it should be individualised to the disease and needs of each patient. The multidisciplinary team should include specialist providers, social services, occupational and physical therapists[40].

Communication between the care givers and patients should be optimised. PICS clinics are specialised clinics which recognise the need for the care of patients and families with medical, mental health, social support and counselling requirements. Post pandemic, e surveys and tele-medicine have been incorporated for far to reach areas or where expert consultation is required in the absence of available specialists[40]. Peer support groups much like alcoholic anonymous, is being attempted to mitigate PICS and may go a long way in providing help and therapy to these patients[58,59].

### PICS-F

Family provides an unyielding and strong support to the individual. Just as the family has an effect on individual, the family itself cannot remain unaffected by the suffering of the individual. Over half of the family can be affected psychologically by the critical illness in of a member, which may persist for months to years. This is termed as PICS -F.

The risk factors may be lower educational level, being the decision maker, child or spouse of the patient, long term stay, less social and financial support, death of the patient and poor communication between the staff[60,61]. Usually family members present with anxiety, depression, PTSD, sleep deprivation, complicated grief, and financial stress[60]. Diagnosis is based on presence of any psychological sequelae that is directly attributable to the critical illness of a loved one. This can however be prevented while the patient is still in ICU by liberalised family presence, structured communication approaches and increasing access to information[62-64]. Additional measures which may reduce the incidence are use of a trained nurse though that may induce additional financial burden, participation in bedside care and keeping a diary to reduce PTSD[65]. The treatment modalities remain the same as for the patients suffering from PICS.

## FUTURE TRENDS

Seamless care integration appears to be a key factor in ensuring optimal continuum of care for survivors of critical illness. With growing ICU survivorship and increasing burden of PICS, it is imperative to integrate post-acute care services targeting residual impairments into the discharge process. It may aid post-discharge recovery, but also optimize resource use utilising bundled episode-based care[66].

Patients' ICU and post-ICU experiences are challenging, with little or no preparation or support. There are no evidence-based, patient-centered guidelines for the interdisciplinary care teams to develop and execute care plans meeting patients' medical, social, and rehabilitation needs. Before these guidelines can be developed, it is necessary to understand patients' priorities during recovery. The patients want to feel safe, be comfortable, engage in mobility, participate in self-care, resume normal roles and routines, connect with people, assert personhood, ensure family well-being, go home, restore physical and psychological health and seek new experiences[66].

These core priorities of critical illness survivors should be a part of the stakeholder-driven clinical guidelines and quality measures for post-ICU care. Future research should extend these findings among other stakeholders (e.g., family members and healthcare providers) and determine barriers and facilitators to patient-centered post-ICU care[66].

Some of the barriers that are needed to be crossed before a critical care team of the future can be created are: Enhancing collaboration and communication, evolving technologies, enhanced security of health data, evolving research techniques, provider responsibilities to improve patient care and innovative educational models[67]. To achieve this, the role of



**Table 1 Various phases of critical illness, its consequences amenable to interventions[53]**

Phase of critical illness	Acute illness	Recovery	Early post-discharge recovery	Late post-discharge recovery
Desired outcome	Survival	Discharge home	Stay home and improving	Return to baseline
Location	ICU	Hospital ward	Home	Home
Impediments	(1) Late antibiotics or source control for sepsis; (2) Hospital-onset infection (e.g., VAP, CABSII, CAUTI); (3) Lack of venous thromboembolism prophylaxis; and (4) High-tidal volume ventilation for ARDS	(1) Immobility; (2) Delirium; (3) Lack of rehabilitation; (4) Polypharmacy; (5) Prolonged catheterization; and (6) Disruption of circadian rhythm	(1) Post-intensive care syndrome; (2) Caregiver misinformation; (3) Fragmented care or inadequate follow-up; (4) Vague or incomplete discharge instructions; (5) Non-compliance to medication; (6) Absence of ME; (7) Inadequate rehabilitation; (8) Lack of subspecialist follow-up; and (9) Polypharmacy	(1) Post-intensive care syndrome; (2) Inadequate vocational rehabilitation; (3) Disrupted employment; (4) Patient and family financial burden; (5) Socioeconomic barriers to care (insurance, transport); (6) Fragmented or inadequate family support; and (7) Polypharmacy

The table was adapted from Brown SM *et al*[53]. VAP: Ventilator associated pneumonia; CABSII: Catheter associated blood stream infection; CAUTI: Catheter associated urinary tract infection; ARDS: Acute respiratory distress syndrome; ICU: Intensive care unit; ME: Medical equipment.

Cognitive deficits	Non pharmacological Pharmacological
Anxiety	Pharmacotherapy Psychotherapy Non pharmacological therapy
Depression	Pharmacotherapy Non pharmacological therapy
PTSD	Pharmacotherapy Non pharmacological therapy
Physical dysfunction	Exercise endurance Symptom management Mobility aids
Sexual dysfunction	Treating underlying illness/mental health conditions Pharmacological therapy
Malnutrition	Calories by mouth Tube feeding/intravenous nutrition

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**Figure 6 Treatment modalities for post intensive care syndrome.** PTSD: Post-traumatic stress disorder.

professional societies would be equally important to improve outcomes for a diverse population of critically ill and injured patients, expand and support a global network of critical care professionals and advocate for patients, families, and critical care professionals[67].

## CONCLUSION

It is not too far-fetched to think of a multi-professional patient centric critical care team that provides the right care to the right patient at the right time throughout and after the acute illness is over. What we need to change to bring in the future is how we use data, devices, and new technologies to continue to strive toward that goal.

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**Country/Territory of origin:** India

**ORCID number:** Nishant Kumar [0000-0002-6064-3580](https://orcid.org/0000-0002-6064-3580).

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