

# POST-INTENSIVE CARE SYNDROME (PICS) – COMPLICATIONS AFTER ICU STAY: SELECTED ISSUES

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A. Study design/planning • B. Data collection/entry • C. Data analysis/statistics • D. Data interpretation • E. Preparation of manuscript • F. Literature analysis/search • G. Funds collection

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SUBMITTED: 20.12.2023

ACCEPTED: 28.01.2024

DOI: <https://doi.org/10.5114/ppiel.2023.136172>

## ABSTRACT

Patient hospitalisation in an intensive care unit (ICU) as a result of critical illness may cause deficits and illness in physical, mental, and cognitive dimensions. Side effects referred to as post-intensive care syndrome (PICS) most often include fatigue, weakness, pain sensation, depressive symptoms, anxiety disorders, PTSD, delirium, attention, and memory deficits. PICS contributes to the patient's inability to return to work, reduced quality of life, and functional disability. The aim of this paper was to introduce selected issues concerning nature of the PICS phenomenon, based on an analysis of the available literature. Studies confirm the occurrence of PICS with varying degrees of severity and duration of symptoms, conditioned by sociodemographic variables and the patient's health status. Given the long-term consequences of PICS, there is a need for further study in this area to understand the challenges facing the patient and to sensitise the treatment team on the need to evaluate the patient's condition.

**Key words:** complications, critical care, intensive care unit (ICU), post-intensive care syndrome (PICS).

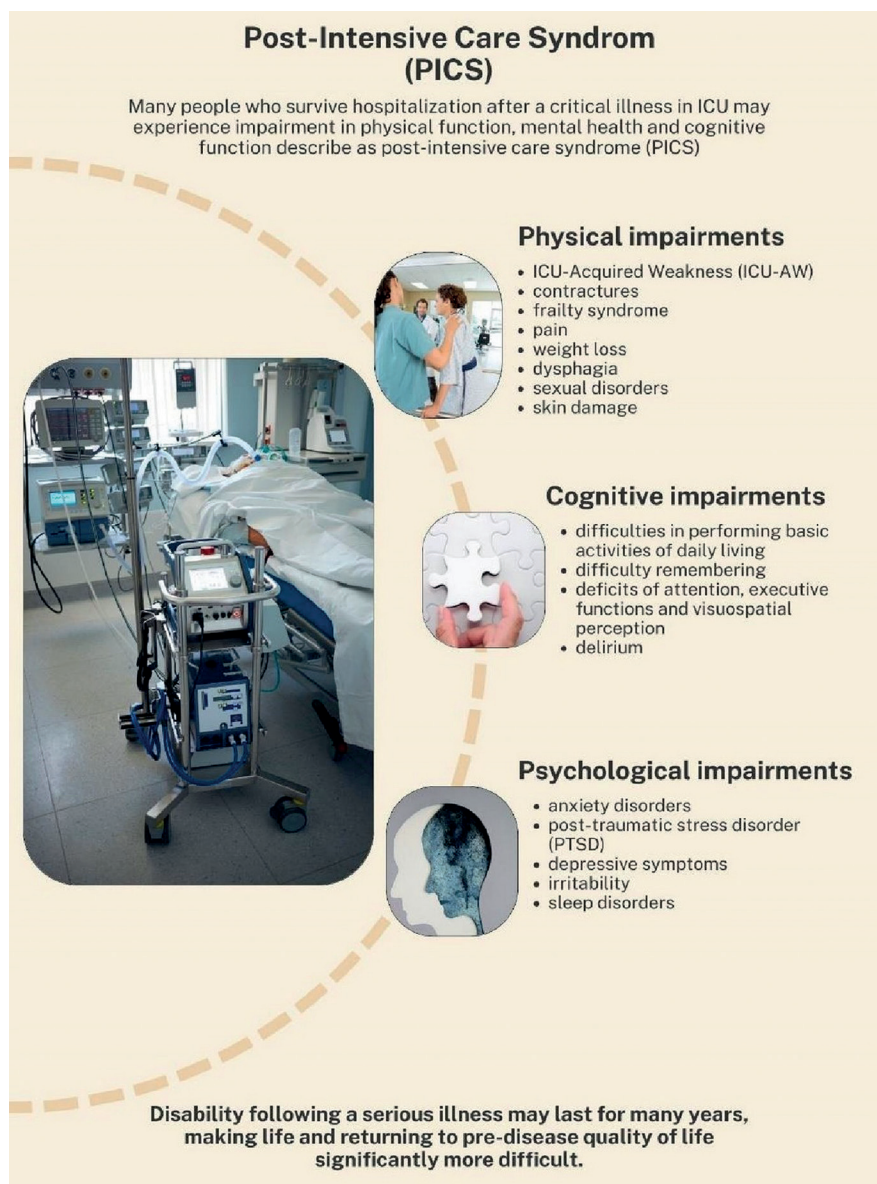
## INTRODUCTION

Critical illness is a stressful experience, and for many patients, treatment in the intensive care unit (ICU) is traumatic [1]. Causes of stress in the ICU include treatment procedures, physical factors and limitations associated with the disease, environmental factors, psychological stress, and communication problems, among others [2]. Perceived stress is related to poorer patient functioning after ICU discharge and meets criteria for post-intensive care syndrome (PICS) [2]. PICS is described by the Society of Critical Care Medicine as a new or worsening physical (neuromuscular weakness and reduced autonomy for activities of daily living), mental (anxiety, depression, post-traumatic stress disorder [PTSD]), and neurocognitive disorders that negatively affect daily functioning and quality of life in survivors of critical illness [3, 4]. PICS refers to long-term sequelae after a period of hospitalisation in the ICU [5] (Fig. 1).

Intensive care unit survivors have a higher risk of death in the years following discharge and a poorer health-related quality of life (HRQOL) compared to matched controls [6]. Half of patients experience at least one PICS symptom after hospitalisation in the ICU [7]. The increasing survival rate of patients

in the ICU means that an increasing number of them experience significant disability and limitations in terms of physical, mental, and cognitive functions over the years [8-12]. It is indicated that significant risk factors for PICS are older age, female gender, previous psychiatric problems, severity of disease, unemployment prior to hospital admission, previous negative hospitalisation experience, and delirium [10, 13]. PICS has been announced as a "hidden public health disaster" [14]. Neuropsychological and physical impairment as a result of PICS is associated with noncompliance with medical recommendations [15], inability to return to work [16], reduced quality of life [17-19], and functional disability [20].

The therapeutic management of a patient in the ICU is aimed at saving the patient's life [21], but it should also have reference to the future and orient the patient and his/her family to possible bio-psycho-social problems after hospitalisation. The patient's experience of limitations of a temporary or permanent nature due to emotional, physical, cognitive, and social disorders may require specialised assistance. This awareness should accompany all members of the treatment team and translate into providing emotional, instrumental, and informational support.



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**Figure 1.** Long-term impairments after ICU discharge (PICS)

Unfortunately, the prevalence of PICS is not obvious to most healthcare professionals [3, 8, 12, 22]. Nurses and other ward staff should intervene to prevent or reduce PICS [23]. It is worth noting that patients after hospitalisation in the ICU often use cost-generating health care services [3, 8, 12, 22].

A literature analysis of chronic disease issues in long-term ICU patients indicates the need for attention toward optimising long-term outcomes after critical illness [24] and the need for qualitative research among those experiencing critical illness to understand the challenges and factors associated with their recovery [4].

The aim of this paper was to present selected issues regarding patients after treatment in the ICU in

terms of physical, mental, and cognitive functioning. The paper was based on an analysis of available research results in the Medline, PubMed, and SAGE databases, among others.

### Physical complications after ICU discharge

Complications within the patient's physical functioning in relation to the need for ICU stay may be related to chronic fatigue and weakness, including osteoarticular dysfunction and pain. Other distant effects of ICU hospitalisation can be related to the presence of endotracheal and tracheostomy tubes, increased incidence of new cardiovascular disease, venous and arterial cannulation and treatment, as well as disorder-

ders of the genitourinary and gastrointestinal systems and skin [10, 13, 25-44] (Table 1).

Each of these complications can cause deterioration of the quality of life, lack of independence, and consequently the need for assistance. It is extremely important to emphasise that the nature of some complications is long-term, progressive, and in the form of irreversible changes.

One of the most common symptoms experienced by patients in relation to their ICU stay is fatigue [11, 13, 45], which contributes to difficulties in performing activities of daily living and movement, among others [3]. The results of the ALTOS study confirm fatigue at 6 months after hospitalisation in 70% of patients after acute respiratory distress syndrome (ARDS), and at 12 months in 66%, and an additional 28% of participants confirmed an increase in symptoms. Fatigue symptoms coexisted with poorer physical functioning and mental disorders but had no relationship with hospitalisation time and patient status [13].

ICU-acquired weakness (ICU-AW) is common, and emerging neuromuscular dysfunction affects most critically ill patients. ICU-AW is associated with prolonged mechanical ventilation and hospitalisation, potentially resulting in functional impairment after discharge [10, 46, 47]. ICU-AW often is symptomatic in 3 ways: critical illness polyneuropathy (CIP), critical illness myopathy (CIM), and/or muscle atrophy [48]. Critical illness polyneuropathy is characterised by a symmetric, distal sensory-motor axonal polyneuropathy affecting limb and respiratory muscles, as well as sensory and autonomic nerves [49, 50]. Critical illness myopathy is characterized by limb and respiratory muscle weakness with preserved sensory function [50]. Although ICU-AW is increasingly recognised as a clinical entity, there are no criteria for the identification of patients at high risk for its development and for understanding its role in long-term complications following ICU hospitalisation [10]. ICU-AW may not only be an ICU-acquired disorder resulting from the immediate effects of a critical disease or the seque-

**Table 1.** Physical complications after ICU discharge

Systems	Complications	
Respiratory system	Presence of an endotracheal tube and prolonged intubation	– paralysis, paresis, vocal cord atrophy, laryngeal oedema, dysphagia, arytenoid cartilage injuries, upper airway obstruction [25, 26]
	Presence of a tracheostomy tube	– paralysis, paresis, vocal cord atrophy, laryngeal oedema, dysphagia, arytenoid cartilage injuries, upper airway obstruction [25, 26], tracheal stenosis [25] – stoma opening infection, wound breakdown and granulation, uncoordinated glottal closure and mechanical airflow, vocal cord tremor, dysphonia [26] – glottic and laryngeal stenosis, tracheomalacia, recurrent infections [25]
	Other	– exertional dyspnoea, impaired respiratory function [25]
Cardio-vascular system	Arterial line	– limb ischaemia due to embolism, less commonly pseudoaneurysms – scarring, numbness, neuropathic pain, and local tenderness of the limb [34]
	Venous catheter (CVC)	– vasoconstriction and/or thrombosis, limb swelling, difficulty in further cannulation [30]
	Related to vasoactive treatment	– arrhythmias, myocardial ischemia, metabolic disorders (e.g. hyperglycaemia), ischemia of distal body parts (most often fingers and toes), leading to necrosis and the need for amputation of parts or entire fingers/limbs [35, 36]
	Post-critical illness cardiovascular disease (PICD)	– hyperlipidaemia, hypertension, diabetes, coronary artery disease, cerebrovascular disease, heart failure, chronic kidney disease [27, 28, 38, 39]
	Other	– tissue remodeling in the parenchymal vascular bed, heart, kidney, vascular dysfunction, heart, atherosclerosis [27]
Gastrointestinal system	– difficulty in food intake and weight loss [39] – intestinal obstruction and malabsorption syndrome, change in taste, nausea, food aversion, anorexia [25]	
Genitourinary system	– acute renal failure and risk of developing chronic renal failure and death [31, 40] – tissue remodeling in the parenchymal vascular beds of kidney [29] – sexual dysfunctions [41]	
Musculoskeletal system	– contractures, most commonly in elbows, ankles, knees, and hips; limitations in movement and activity [25] – risk of higher mortality, cause of irreversible disability [42]	
Skin	– reduced skin perfusion [32, 43] – limited hydration and maceration cause of susceptibility to damage [32, 44] – drug reactions, dermatoses [34, 44] – infectious dermatological lesions [32] – further skin damage due to skin disruption [25] – slow wound healing [25] and infections [25, 44] – hair loss, intractable dry skin [25]	

lae of short-term interventions, but also a result of a patient's overall functional status prior to hospital admission or pre-hospital muscle function [10].

Long-term immobilisation of a patient in the ICU can lead to osteoarticular and muscular changes in the form of contractures. Studies confirm that hospitalisation for more than 14 days was significant in the formation of contractures [25] and was associated with higher patient mortality and greater difficulty with mobility and return to activity, becoming a cause of irreversible disability [42].

Older age predisposes to sarcopaenia, which is related to loss of muscle mass and forms part of frailty syndrome [51]. It has been documented that there is a threefold increase in mortality and an increased risk of death from this condition in older patients [52]. It has also been shown that the vast majority of elderly patients meet frailty criteria [53], and about 22% have reduced HRQOL and are less likely to function independently [53, 54]. Frailty is a significant factor in complications after critical illness in the ICU [53, 54].

The perception of pain has consequences in the patients' subsequent psychological functioning and contributes to anxiety, depression, sleep disorders, cognitive impairment, and chronic pain [55]. Regarding painful procedures, patients most often indicated those related to the presence of vascular catheters, ongoing physiotherapy [56], change of bed position, intratracheal suctioning, change the wound dressing, and chest tube removal (CTR), which were considered to be the most painful procedures [55]. Indeed, clinical pain during the first year after leaving the ICU was reported by half of the individuals [33].

### Cognitive and mental health disorders in relation to ICU hospitalisation

Patients treated in the ICU also experience cognitive dysfunction [7]. This is a common dysfunction [57], and its prevalence among patients ranges from 4% to 64%. Such a wide range of data may be due to the methodological criterion and differences in the qualification of patients for the study [58], and cognitive impairment is diagnosed in almost all elderly patients [59]. The quality of health prior to an ICU stay is closely related to long-term health problems occurring after hospitalisation [45]. Cognitive impairment leads to difficulties in performing basic activities of daily life such as handling a car, preparation of medications, and managing finances, and it directly hinders or prevents a return to work [60]. Among cognitive impairments, those related to memory are also noted. Many patients confirm difficulties recalling memories of their ICU stay. Others relate to the expression of emotions, and reduced vocabulary and performance of daily tasks [59].

Negative experiences in the ICU and the occurrence of delirium episodes have a strong impact on the development of cognitive impairment [61]. Cognitive disorders most often manifest in the form of delirium symptoms and deficits in attention, memory, and visuospatial orientation, even during the ICU stay [62]. Delirium is often the first symptom of the onset of cognitive dysfunction along with mood swings [60]. It is the most common acute central nervous system dysfunction in ICU patients, conditioning long-term cognitive dysfunction [63].

Several potentially modifiable risk factors have been investigated, and delirium during ICU stay has been shown to have a strong and consistent relationship with the subsequent onset of cognitive impairment [58], and the duration of delirium during hospitalisation influences cognitive deterioration, regardless of the sedative drugs used, analgesic treatment, age, comorbidities, and number of organs failing during ICU stay [64]. Patients who have an episode of delirium show a higher mortality rate in the ICU [65].

Risk factors for the development of cognitive impairment after ICU hospitalisation have been divided into modifiable and non-modifiable. Non-modifiable risk factors have been repeatedly subjected to research, but it still seems that not all of them are known. Knowledge of modifiable factors significantly affects the ability to implement strategies aimed at preventing the onset of permanent cognitive impairment. Many factors such as metabolic abnormalities, inflammatory response to a pathogen, or exposure to toxic substances (e.g. sedative or opioid drugs) influence the development of cognitive impairment in critically ill patients. Cognitive dysfunction in the course of severe disease may result from newly developed processes or be an exacerbation of an earlier, sub-clinical neurodegenerative process [58]. Septic shock is independently associated with up to a threefold higher incidence of moderate and severe cognitive impairment. Other risk factors for the development of cognitive impairment include older age, pre-existing cognitive impairment prior to ICU stay, and burden of comorbid diseases [64]. Several other potentially modifiable risk factors for the development of cognitive impairment have been studied but have shown weak or inconsistent relationships. Risk factors that have been studied include a period of mechanical ventilation, hypoxaemia, blood pressure, blood transfusions, and glycaemic abnormalities [58].

Current non-modifiable factors include education level, age, gender, the existence of comorbidities, and the severity of underlying disease. The highest risk of developing permanent cognitive impairment is found in people who are older, have a low level of education, and suffer from comorbidities [58]. Men with higher education present fewer health problems after an ICU stay [45].

Patients suffering from cognitive disorders before their ICU stay (e.g. dementia) may experience a worsening of their condition after ICU discharge. If cognitive impairment causes difficulty in thinking, remembering, or concentrating, an evaluation by a neurocognitive specialist may be helpful [66].

Patient hospitalisation in the ICU is associated with a variety of emotions, among which fear, anxiety, apprehension, low mood, depression, or sometimes accompanying the experience of pain, shortness of breath, disturbances, of consciousness, consequently limiting functioning, independence, and self-reliance, are intertwined with the hope of receiving help and eliminating the causes and unpleasant, acute symptoms associated with the disease [67]. The need to trust the treatment team as they undertake medical procedures poses an additional challenge, especially if this involves handling complex medical equipment [68].

The perception of anxiety is not only a reaction presented to the disease, but also a challenge in the face of which the patient activates coping resources, and the treatment team should be particularly sensitive to this circumstance. Anxiety can relate to both outcomes and treatment modalities and perceptions of the current health situation. Persistent anxiety is related to memories of health and life threats as well as interventions taken [69]. A depressive disorder with a predominant sense of sadness, a sense of hopelessness, helplessness, passivity, and turning attention inward can prolong the healing process [69]. Depressive disorders can be a cause of engaging in self-destructive behaviour and can delay the healing process and treatment effectiveness, reduce motivation for further treatment, and limit the acceptance of social support [69].

The experience of strong emotions due to the feeling of threat to health and life is reflected in the mental health dimension and often requires many years of specialised treatment. This is because it cannot be assumed that only compensating for the physical condition and pushing back the risk of life-threatening situations allows for full functioning and a good evaluation of the quality of life. According to some authors, it is emphasised that some of the patients remain alone with their problems [70], and therefore it can be assumed also those of a psychological nature. According to some researchers, there is a lack of a broader perspective on the PICS phenomenon in reference to long-term follow-up [71].

Recognition of patients' mental health needs takes on particular importance in the ICU, which may have a direct bearing on minimising PICS symptoms [72]. The area of mental disorders among patients is dominated by depression, anxiety, post-traumatic stress disorder [73], irritability, and sleep disorders [58], and the risk of worsening symptoms is higher in patients with a psychiatric past [66]. Researchers

addressing PICS issues have proven that after leaving the ICU, individuals struggle with mental health problems [74], experience social isolation, and, unfortunately, undertake suicide attempts [75], and the risk of psychopathological problems with a long-term dimension is increased [76].

Studies prove the consequences of hospitalisation in the ICU in the form of depressive disorders of varying degrees. Such disorders have a relationship with experiencing pain of a chronic nature, reduced quality of life, or post-traumatic stress [5]. The relationship between pain and depression as well as anxiety has also been confirmed in other studies [76], and therefore attention is being paid to its treatment as an elimination of a risk factor for the above conditions. The findings of one study showed that more than half of the participants in the study had symptoms indicative of anxiety, depression, or PTSD, and the diagnosis of one mental disorder was a risk factor for co-occurring symptoms of the other disorders. Depression was also shown to have a relationship with an increased risk of death during the first 2 years after hospitalisation [77]. The results of other studies have proven the prevalence of mental health problems in patients of all ages, but depression and other problems in this regard are more common in elderly patients. Depression with varying degrees of symptoms was diagnosed several times more often than post-traumatic stress disorder, and its onset was related to the patient's somatic condition [78].

The occurrence of PTSD is increasingly analysed in the context of hospitalisation and ICU admission [79] and is considered one of the dimensions of PICS. Therefore, it is important to evaluate the patient's mental state and the ability to respond to stress in the past [80]. Patients experiencing sleep disorders in the form of insomnia, sleep nightmares, as well as anxiety with agitation, intrusive memories of ICU-like hospitalisations that are real in nature, and experiences of a psychotic nature are particularly at risk for PTSD [79]. PTSD symptoms may take up to several months from the onset. Among them are persistent experiencing of the situation, avoidance of engaging in conversations about it, and the occurrence of vegetative excitability reflected by attention deficit disorder, hypervigilance, and hyperactivity to stimuli. People with PTSD may also express reduced social activities, interests, and changes in existing relationships due to lack of empathy or emotional burnout [81].

The research conducted allows PTSD symptoms to be included and considered as one of the risk factors for cognitive disorders [79]. Symptoms of depression and post-traumatic stress disorder are also analysed in the context of sedation, delirium or delusional memories, and long-term impairment of quality of life [82].

Some studies show that mechanically ventilated patients with no prior mental problems had a higher

risk of mental disorders and the need for pharmacotherapy in the first months after ICU hospitalisation [83]. The researchers also highlighted the duration of hospitalisation and the duration of mechanical ventilation. Published results have confirmed a significant relationship between severity of depression, experienced anxiety, and stress with longer duration of ICU stay and longer duration of mechanical ventilation [84]. The results of other studies also point to factors that increase the likelihood of receiving psychiatric care after an ICU stay. These include female gender, use of a psychiatrist, and number of sepsis episodes. In addition, the need for evaluation of mental health among patients with mental disorders who are addicted to nicotine is emphasised [85].

The emotions experienced and disclosed by the patient are a result of the prominence given to the disease and the determination of challenges it poses and the treatment implemented, but they are also a result of the suffering or weakness disclosed. Adoption by health care professionals of the above theses allows for an understanding of these emotions and changes in the patient's mental functioning [69].

The quality of life of people with complications from ICU treatment is also a subject of interest to researchers. Some studies confirm its reduction even several years after hospitalisation compared to the period before the ICU stay in physical, mental, and general health and social functioning. Surviving patients are estimated to have largely regained age-specific HRQOL 10 years after ICU discharge [24].

An analysis of the literature confirms the presence of complications in terms of physical, mental, and cognitive functioning among patients after ICU hospitalisation. The therapeutic team should be aware of their occurrence because many of them develop during the patient's stay in the ICU in relation to the patient's condition or as a result of undertaking invasive treatment procedures. The therapeutic team should be prepared to provide the patient and their family with information on further management to facilitate post-hospitalisation functioning.

In addition, it is critical to implement strategies in the course of PICS that are relevant to facilitating the patients' return to life after hospitalisation in the intensive care unit [60]. When confronted with a difficult situation related to the hospitalisation of a loved one, the family may develop PICS-F, especially concerning the mental state [86, 87], and therefore the interventions taken should not only concern the patient, but also the family.

According to the authors, the situation of patients after hospitalisation in the ICU due to COVID-19 requires separate analysis. These patients experience mental, cognitive, and physical symptoms consistent with PICS syndrome. However, there are doubts as to whether they are the result of critical disease

and treatment in the ICU or they are caused by COVID-19. Due to the severity and the sanitary regime, this group of patients is more likely to be separated from their loved ones for longer periods of time, have shorter visits, and, unfortunately, be stigmatised. Perhaps the aforementioned circumstances may exacerbate or worsen mood disorders, and feelings of anxiety and uncertainty. It seems that a longer period of observation of COVID-19 patients is necessary. It should also be emphasised that each group of hospitalised patients in the ICU is at risk of PICS syndrome in some way (e.g. disaster victims, patients with multiple organ injuries, patients with ARDS, patients in shock). The authors' aim was not to compare the incidence of PICS among patients with COVID-19 to patients with other diagnoses, but to draw general attention to the PICS phenomenon in domains that can develop in any patient hospitalised in the ICU.

## CONCLUSIONS

Available studies confirm the occurrence of complications in terms of physical, mental, and cognitive functioning among patients treated in the ICU, along with the factors that determine them.

Patient care in the ICU requires the interprofessional team to be sensitive regarding the possibility of complications and to prepare the patient and their environment for care outside the hospital ward.

In view of the nature of symptoms and the course of PICS, it is necessary to take measures aimed at preventing or reducing its occurrence.

### Disclosure

The authors declare no conflict of interest.

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