



Canadian Geriatrics Society

COGNITIVE IMPAIRMENT FOLLOWING CRITICAL ILLNESS IN OLDER ADULTS

Abstract

Post Intensive Care Syndrome (PICS) encompasses new or worsening cognitive, mental, or physical health impairments following an admission to an intensive care unit (ICU). Older adults who survive ICU are at increased risk for PICS. The number of older adults admitted to ICUs is increasing, with over 50% of Canadian ICU patients being over the age of 65 in 2014, and similar statistics observed during the COVID-19 pandemic. The anticipated corresponding increase in PICS prevalence has important implications for ICU survivors, their families, and our healthcare system. Currently, family physicians manage the majority of post-hospital care for ICU survivors in Canada. This article provides family physicians with a pragmatic approach to the diagnosis and management of cognitive impairment in older adults following an admission to ICU.

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5 Key Statements

- Post Intensive Care Syndrome (PICS) is defined as new or worsened impairment in cognition, mental health, or physical function following an ICU admission.
- PICS-cognitive impairment is common, ranging from 35-81% depending on the population studied and method of diagnosis.
- Diagnosis includes taking a cognitive and functional history, obtaining objective cognitive testing, and ruling out other contributors to cognitive changes.
- Treatment is primarily non-pharmacological, and may include cognitive rehabilitation and optimization of sleep, diet, and exercise.
- Prognosis is variable, with deficits persisting years after ICU discharge in some patients. More research is needed to understand factors contributing to its natural history.

Cognitive impairment following an ICU admission

Post Intensive Care Syndrome (PICS) is defined as new or worsening impairments in cognitive, mental, or physical health following an ICU admission¹. The cognitive impairment component (referred to as PICS-cognitive impairment) is a broad category and does not stipulate the underlying etiology of impairment, but rather signifies the presence or absence of cognitive changes.

PICS-cognitive impairment is common, with prevalence ranging from 35% to 81% at 3 months following discharge depending on the population studied and method of diagnosis². Understanding of PICS in post-COVID-19 survivors is evolving^{3,3} and there is growing concern that the long-term complications of the pandemic will include an “aftershock” of survivors with physical, mental, and cognitive health impairment³⁻⁶.

Risk factors for PICS-cognitive impairment include pre-existing cognitive impairment, ICU-associated delirium (odds ratio [OR] 2.85, 95% confidence interval [CI] 1.10 to 7.38)⁷, longer duration of delirium⁸, use of benzodiazepines, and presence of sepsis, hypoxia, ARDS, or shock⁹.

The degree of cognitive impairment in PICS-cognitive impairment ranges from mild to severe, and may interfere with the patient’s ability to complete day-to-day tasks, although a change in function is not necessary for diagnosis as it is for major neurocognitive disorder (dementia)^{1,10}. In ICU survivors, PICS-cognitive impairment may present as difficulties remembering to take medications or attend follow up appointments, preparing meals following new dietary restrictions, or learning how to manage new chronic conditions such as stoma care. PICS-cognitive impairment may directly impact ICU recovery and may persist for years after the incident critical illness². It is important for family physicians to recognize cognitive impairment in ICU survivors as early recognition, management, and counselling may improve function and understanding of disease trajectory for patients and their families^{11,12}.

Importantly, cognitive, mental health, and physical impairments may be present concurrently in ICU survivors¹³. Successful management of each component requires identification and management of the others. Therefore, we have included advice on screening for all components of PICS in this article, while focusing on diagnosis and management of PICS-cognitive impairment.

How should I screen for PICS among ICU survivors?

The Society of Critical Care Medicine recommends screening all ICU survivors for PICS 2-4 weeks following hospital discharge, with serial assessments thereafter⁹. Although no specific timeline is given for serial assessments, 3 and then 6 months following hospital discharge is likely appropriate, with changes in frequency based on clinical need. Evaluation based on domains of impairment are as follows:

1. Cognitive impairment: Cognitive and functional history combined with a screening cognitive test such as the Montreal Cognitive Assessment (MoCA)⁹ or other freely available tool that assesses executive function in addition to memory impairment (<https://agsjournals.onlinelibrary.wiley.com/doi/full/10.1111/jgs.16713>)
2. Mental health impairment: The Hospital Anxiety and Depression Scale (HADS) may be used (<https://www.svri.org/sites/default/files/attachments/2016-01-13/HADS.pdf>) to assess anxiety and depression, with a score of 8 or greater identifying clinically significant disease⁹. For Post-Traumatic Stress Disorder (PTSD), the 6-item Impact of Event Scale-6 (IES-6) may be used, with a score of 1.75 or greater suggestive of PTSD^{9,14,15}.
3. Physical impairment: The 6-minute walk test and EuroQol-5D-FL are recommended by SCCM guidelines⁹. Shorter alternatives often used in geriatric medicine clinics to assess frail older adults who are phenotypically similar to patients with PICS-physical impairment include a 4-metre walk test (https://41e5fc1d-e404-4830-8c07-64690e79acce.filesusr.com/ugd/2a1cfa_26c3bb2a5bd6480b864aa95c6bb00d90.pdf) or the timed-up-and-go test (https://www.cdc.gov/steady/pdf/TUG_test-print.pdf). Additionally, asking about difficulties with basic activities of daily living due to physical limitations and physical examination for decreased quadriceps and grip strength as global markers of weakness have been used in post-ICU multidisciplinary clinics³

Step-by-step approach to PICS-cognitive impairment

The following is a step-by-step approach to the diagnosis and management of PICS-cognitive impairment, based on the best available evidence and expert opinion from our team of geriatricians and intensivists.

Step 1: History

Take a cognitive history following a similar approach as when assessing cognitive changes in patients who have not been admitted to ICU (Table 1). Specific deficits seen in PICS-cognitive impairment include difficulties with executive function (planning and sequencing tasks), short-term memory (forgetting appointments, repeating questions or stories in conversations, misplacing household items), attention and concentration (easy distractibility), and reduced mental processing speed (requiring a longer time to complete tasks correctly)⁸. Clarify the onset of cognitive changes, as cognitive impairment that pre-dates ICU admission is often under-recognized¹⁶.

Ask about risk factors for PICS-cognitive impairment experienced during hospitalization such as benzodiazepine exposure and episode(s) of delirium. The underlying etiology of cognitive changes, such as resolving delirium, may have implications on prognosis (see *Step 5: Prognosis*).

Take a functional history using the Lawton-Brody instrumental activities of daily living (IADL) scale¹⁷ (<https://www.alz.org/careplanning/downloads/lawton-iadl.pdf>) and Katz Index of basic activities of daily living (BADL)¹⁸ (<https://www.alz.org/careplanning/downloads/katz-adl.pdf>) to determine the impact of cognitive changes on the patient's day-to-day life. This may be difficult to elucidate in ICU survivors as they may also have PICS-physical impairment and are therefore no longer completing some BADLs or IADLs independently due to physical limitations. As a surrogate of cognitive effect on function, consider asking, "Are there things you (or the person you are caring for) are no longer able to do because of the way you (they) think? For example, playing cards, completing crossword puzzles, or another hobby?" In our experience with patients with dementia, caregivers are often more easily able to identify changes in hobbies that require intact cognitive function, especially earlier in the course of disease.

Table 1. PICS-cognitive impairment history

Cognitive domains associated with PICS-cognitive impairment	Questions to ask on history
Executive Function	Do they have difficulty multitasking? Do they have difficulty with tasks that require multiple steps such as cooking a complex meal?
Short Term Memory	Are they more forgetful? Do they repeat themselves in conversations? Do they misplace items around the house? Do they forget events?
Attention and Concentration	Do they get distracted during tasks such as forgetting what they came into a room for or not recalling what they just read?
Reduced mental processing speed	Are they able to complete tasks correctly, but more slowly than others? Do they seem slower to respond to questions?
Cognitive domains not currently known to be associated with PICS-cognitive impairment	
Social cognition / frontal features	Have there been any personality changes? Have there been instances of socially inappropriate behaviour?
Language	Do they have difficulty finding their words? Have there been changes in reading or writing abilities?
Apraxia	Do they have difficulty using items such as remote controls, utensils, or combs
Visuospatial	Have they gotten lost in a familiar environment? Have they had difficulties recognizing faces or places they should know?

Step 2: Objective testing

We suggest screening for cognitive impairment using a test that evaluates commonly affected domains of PICS-cognitive impairment, including executive function, short term memory, attention, and concentration. The SCCM recommends the MoCA; use of the MoCA, however, requires a 1-hour training module and certification with an associated fee, which may pose a barrier to its use. As such, other cognitive testing options can be considered; a discussion of which may be found here: (<https://agsjournals.onlinelibrary.wiley.com/doi/full/10.1111/jgs.16713>).

Importantly, these tests are not diagnostic on their own, but serve as part of a comprehensive assessment which includes the patient and caregiver’s subjective report of cognitive changes. This is important to avoid over- or under-diagnosis of cognitive impairment based on cut-off scores that cannot be universally extrapolated^{19,20}.

Step 3: Rule out confounding causes

Rule out confounders of cognitive impairment, including medication effects, mood, metabolic abnormalities, sleep apnea, and structural brain diseases.

Medication review: Look for new medications started during hospitalization that can be associated with cognitive side effects. These include benzodiazepines, antipsychotics, opioids, or drugs with anticholinergic effects. If there is no longer an indication for these medications, discontinue and monitor for improvement in cogni-

tive symptoms. Consider use of formal tools for assessing potentially inappropriate medications, such as the Beers criteria²¹ or START/STOPP criteria²².

Underlying mental health disorder: In older adults, mood disorders may present with cognitive changes, including changes to memory, attention, motivation, processing speed, and organization²³. If the patient scores abnormally on mental health screening (see *Screening tests*), treat these underlying conditions first, followed by repeat cognitive testing in 3-6 months.

Screening blood tests: Obtain blood tests for disorders that can impact cognition, if not done recently, on discharge from hospital. This includes screening for anemia, electrolyte abnormalities (particularly sodium and calcium), diabetes, B12 deficiency, and thyroid or liver dysfunction.

Obstructive sleep apnea (OSA): OSA is underrecognized as a cause of cognitive dysfunction, and may lead particularly to executive dysfunction, which overlaps with PICS-cognitive impairment. If the patient is at high risk for OSA using the STOP-BANG Score (<http://www.stopbang.ca/translation/pdf/caeng.pdf>), they should be referred for a sleep study.

Structural imaging: If brain imaging has not been done since discharge from the ICU it is reasonable to obtain a non-contrast computed tomography (CT) or magnetic resonance imaging (MRI), if MRI is readily available. Neuroimaging helps assess for intracranial causes of cognitive changes, such as ischemia or mass lesions, and may demonstrate patterns of atrophy suggestive of underlying primary neurocognitive disorders, such as frontotemporal dementia or Alzheimer's disease.

STEP 4: Diagnosis

There are no diagnostic guidelines or accepted diagnostic criteria currently for PICS-cognitive impairment. Based on our literature review and opinion, we believe a practical set of criteria for PICS-cognitive impairment should include all the following:

1. New (not present prior to ICU admission) or worsening subjective cognitive changes reported on history by the patient or a reliable informant following an ICU admission
2. Objective deficits on cognitive testing
3. With or without functional impact
4. No identified reversible etiology for cognitive impairment (Step 2).

Patients admitted to the ICU with primary diagnoses of traumatic brain injury or stroke are typically excluded in the literature from a concurrent diagnosis of PICS-cognitive impairment after discharge. Pre-existing dementia, however, is not currently an exclusion criterion, and due to the broad definition of new or worsening cognitive impairment, patients with pre-existing dementia who experience a decline in cognition after an ICU admission should be considered to also have PICS-cognitive impairment. Consideration of this additional diagnosis is important with respect to counseling for patients and caregivers and further prompts clinicians to address potentially reversible contributors to cognitive decline (step 2).

Additionally, given the lack of practical biomarkers for either dementia or PICS-cognitive impairment, it is difficult to differentiate PICS-cognitive impairment from stable, unrecognized pre-existing dementia. Thus, there is potential overlap with both mild neurocognitive disorders (mild cognitive impairment) and major neurocognitive disorders (dementia), but the exact relationships between these entities have not been defined.

STEP 5: Prognosis

The natural history of PICS-cognitive impairment is variable, with patients experiencing improvement, stability, or worsening over time, with more than 40% of ICU survivors continuing to have cognitive impairment more than 24 months after ICU discharge². It is hypothesized that this variability is related to the underlying critical illness, such as septic shock, ARDS, trauma, etc². Extrapolating from geriatric studies, we would speculate the underlying cause of PICS-cognitive impairment (such as delirium, acquired brain injury, or unmasking of dementia) may better explain the individual prognosis in older adults. As research into PICS-cognitive impairment advances to distinguish between underlying causes of the syndrome, this relationship may become clearer. Pragmatically, prognosis could be divided into the following:

- A. **Improvement if PICS-cognitive impairment is primarily due to resolving delirium.** Symptoms of delirium can persist 6 months or longer after hospital discharge in older non-critically ill adults, but the majority of patients improve over this timeframe²⁴. Given the prevalence of ICU-delirium may be as high as 80%²⁵, patients presenting with PICS-cognitive impairment may have similar potential to improve in the initial months following ICU discharge.
- B. **Stability if PICS-cognitive impairment is primarily due to an acquired brain injury (ABI).** If the patient's PICS-cognitive impairment is primarily attributable to an acquired brain injury (ABI) from hypoxia, hypotension, glucose dysregulation, or inflammatory and cytokine response incurred during critical illness²⁶, deficits may be more persistent, but not worsen, if no new insult is experienced. With optimal rehabilitation such patients may also improve, in keeping with other ABI populations^{12,27,28}.
- C. **Progression if PICS-cognitive impairment is primarily due to a pre-existing or unmasked neurodegenerative disorder (dementia).** Cognitively intact older adults can have Alzheimer's neuropathologic changes on autopsy without having had clinical symptoms of dementia²⁹. Clinical features of dementia present when additional stressors on the brain, such as delirium, anoxic brain injury, or ischemic events, overcome an individual's "cognitive reserve"²⁹. In these circumstances, cognitive decline may progress over time in keeping with dementia syndromes.

Serial assessments at 3, 6 and 12 months after hospital discharge may be helpful in elucidating a patient's cognitive trajectory, which may help in counselling families on prognosis. If there is ongoing diagnostic uncertainty, referral to geriatric medicine could be considered. Additionally, if there are concurrent mental health concerns, referral to geriatric psychiatry may also be beneficial, although the benefits of referral pathways have not been directly studied.

STEP 6: MANAGEMENT

Currently, there are no pharmacologic options for the management of PICS-cognitive impairment, and non-pharmacologic management is the mainstay of treatment (Table 4).

It is important to elicit patient perspectives on management when creating a treatment plan. The interventions that mean the most to the individual and are feasible within their biopsychosocial situation may vary. Individualized treatment plans should be created through shared decision making between the clinician, patient, and substitute decision makers.

Table 2: Management of Post-Intensive Care Syndrome – Cognitive Impairment

Target	Action	Explanation
Improve cognition	Treat underlying confounding factors that could be contributing to cognitive changes	See <i>Step 3</i> for details. This includes medication review; management of underlying anxiety, depression, or PTSD; screening blood work; neuroimaging; and referral for sleep study if obstructive sleep apnea is suspected.
	Cognitive rehabilitation program	Cognitive rehabilitation for younger ICU survivors without pre-existing cognitive impairment results in significant improvement in executive function ¹² , memory, attention, and language ³⁰ . Referral to cognitive rehabilitation for older ICU survivors should be considered if available, but this has not been directly studied. In the absence of a formal cognitive rehabilitation program, referral to an occupational therapist may be considered to focus on improving self-efficacy and goal management training.
	Physical rehabilitation program and/or daily exercise	In addition to other benefits to physical and mental health, there are cognitive benefits to staying physically active ³¹ , and exercise should be encouraged. In the ICU population, early physical therapy has demonstrated benefit for improved physical function ³² and mortality ¹¹ . Referral to an older adult exercise program may help increase adherence while also providing socialization.
Stabilize cognition	Reduce or eliminate alcohol intake	Limiting alcohol intake (preferably abstinence) is suggested.
	Maintain adequate sleep	Impaired sleep following ICU admission is common ³³ . Non-pharmacologic strategies such as sleep hygiene and CBT-insomnia should be used. Patient resources are available at https://mysleepwell.ca/ . To learn more, see https://canadiangeriatrics.ca/wp-content/uploads/2020/01/Chun-Insomnia-in-the-Elderly-Formatted.pdf and http://canadiangeriatrics.ca/wp-content/uploads/2016/11/INSOMNIA-IN-THE-ELDERLY-UPDATE-ON-ASSESSMENT-AND-MANAGEMENT.pdf Should medication be sought, we suggest melatonin 3mg by mouth in the evening.
	Environmental modification	Request an occupational therapy home safety assessment. Home adjustments may include large clocks, calendars, and planners that are visible and accessible; and bright lighting over work areas such as the kitchen and bathroom. Other recommendations to reduce falls risk are available here: https://www.cdc.gov/steady/pdf/STEADI-Brochure-CheckForSafety-508.pdf
	Peer support counselling	Support groups for ICU survivors are a good source of counselling, community, and practical advice and education ^{34,35} . Patient and family resources are also available through the Society of Critical Care Medicine’s THRIVE resources: https://www.sccm.org/MyICUCare/THRIVE/Patient-and-Family-Resources
Prevent worsening	Discuss goals of care	During reassessments, patient perspectives on their ICU experience, post-ICU course, and preferences regarding future ICU care should be addressed. Specifically, if patients have experienced cognitive impairment following an ICU admission and have not improved to their pre-ICU baseline despite appropriate time and management, they and their caregivers should be prepared that future admissions to ICU may result in further cognitive decline.

Target	Action	Explanation
	Manage modifiable risk factors for dementia	<p>Managing modifiable risk factors for dementia can help protect against further decline in cognition from a secondary neurodegenerative etiology³⁶. As always, management should consider the time-to-benefit of proposed treatment in the context of the individual’s life expectancy and goals of care. This includes:</p> <ul style="list-style-type: none"> Management of hypertension, diabetes, obesity, and smoking cessation Address social isolation – refer to local community resources Address hearing impairment – refer for audiology if concerns from patient or caregivers²³.
	Screen for safety concerns	<p>Cognitive changes can result in safety concerns for the patient and others. These include:</p> <ul style="list-style-type: none"> Driving – assess driving safety and formal reporting of driving concerns as per jurisdiction requirements. On-road driving tests are the gold standard but are typically private pay and expensive. Resources to guide clinicians include the CMA guidelines, CFP advice (Approach to assessing fitness to drive in patients with cardiac and cognitive conditions The College of Family Physicians of Canada (cfp.ca)) and RGPEO resources (Driving-and-Dementia-Toolkit-3rd-Ed-pdf-July-2009.pdf (rgpeo.com)). Wandering and physical aggression – consider referral to geriatric medicine or geriatric psychiatry if behavioural and psychological symptoms of dementia are present. Home safety – burning pots, fires, or floods in the home may indicate a higher level of supervision is required for the patient, either in their own home or in an alternative environment (assisted living, retirement home, long-term care). Financial safety – ensure a power of attorney for finances and personal care is in place. Suicidality – screen for suicidal ideation. Survivors of critical illness may have increased risk of suicide and self-harm (HR 1.22, 95% CI 1.11-1.33)³⁷.
Other	Family support	<p>Family members of ICU survivors may experience physical and mental impairments following ICU, termed Post Intensive Care Syndrome-Family. Symptoms may include interrupted sleep, anxiety, depression, grief, and PTSD¹. Given the impact our social circles have on our health and wellbeing, it is important to consider if the needs of your patient’s caregivers are also addressed. Family resources are also available through the Society of Critical Care Medicine’s THRIVE resources: https://www.sccm.org/MyICUCare/THRIVE/Patient-and-Family-Resources</p>

Dissemination

A sample clinic template for PICS-cognitive impairment (Appendix 1) may help readers synthesize the information in this article for clinical practice.

Conclusion

Cognitive impairment following ICU admission, known as PICS-cognitive impairment, is common and often persistent. The family physician's approach to diagnosis includes taking a cognitive and functional history and ruling out confounding conditions such as medication side effects, mood disorders, metabolic abnormalities, sleep apnea, or structural brain lesions. Management is primarily nonpharmacologic and includes cognitive and/or physical rehabilitation and optimization of sleep, exercise, and diet. If the diagnosis is uncertain, such as when there is concern also for a primary neurodegenerative disorder such as Alzheimer's dementia, consider a referral to geriatric medicine.

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Appendix 1 - PICS - Cognitive Impairment Template

Step 1: History

Onset: same as prior to ICU | new after ICU | worse after ICU

Memory

Repeating conversations
Misplacing items
Forgetting events

Executive function

Planning events
Multitasking

Attention

Difficulty concentrating
Easily distracted

Other (less suggestive of PICS)

Change in personality
Word finding difficulty
Getting lost

Impact on Function

IADL		BADL	
Finance	I A D	Dress	I A D
Meds	I A D	Eat	I A D
Drive	I A D	Ambu- late	I A D
Cook	I A D	Transfer	I A D
Clean	I A D	Toilet	I A D
Laundry	I A D	Hygiene	I A D
Groceries	I A D		
Tele- phone	I A D		

*I = independent; A = assist; D = dependent

why: cognition | physical

Step 2: Objective Testing

Time since ICU	Cognitive Score
1 month	
3 months	
6 months	
12 months	

Baseline score prior to ICU (if available): _____

Step 3: Rule out confounding causes

- Deprescribe medications that may worsen cognition (benzodiazepines, antipsychotics, and medications with anticholinergic effects) if it is safe to do so
- Assess and manage concurrent mood disorders (depression, anxiety, PTSD)
- Check and manage abnormalities on CBC, electrolytes, calcium, albumin, HbA1C, TSH, B12, LFTs
- Order sleep study if symptoms of sleep apnea
- Order CT or MRI brain if not done recently during admission

Step 4: Diagnosis (all of the following)

- new or worsening subjective cognitive changes reported on history by patient or reliable informant following an ICU admission
- objective deficits on cognitive testing
- with or without functional impact
- no identified reversible/confounding etiology

Step 5: Management

Guide the patient and family in choosing options that align with their goals of care:

General Safety Considerations

- Screen for driving safety
- Ensure safe adherence to medications (suggest blister packs or other adherence packaging if there are concerns)
- Ask about suicidal ideation

Initial Post-ICU Visit

- Deprescribe cognitive dulling medications if no longer indicated (benzodiazepines, antipsychotics, opioids, anticholinergic drugs)
- Treat underlying depression, anxiety, and/or PTSD and follow up as per mental health guidelines
- Refer for audiology if there are hearing impairment concerns
- Refer to local cognitive/physical rehabilitation programs or occupational and physical therapists
- Provide patient education to optimize sleep, diet, and exercise
- Encourage ICU survivor support groups

3 month follow up

- If family reports a change (improvement or worsening), repeat cognitive testing
- Optimize risk factors associated with development of certain kinds of dementia if within goals of care and life-expectancy (hypertension, diabetes, obesity, smoking cessation as per guidelines)
- Consider referral to geriatric medicine or geriatric psychiatry if diagnostic uncertainty

6 month follow up

- Repeat cognitive testing
- Consider referral to geriatric medicine or geriatric psychiatry if diagnostic uncertainty
- Future planning: Ensure there is a financial power of attorney and elicit patient perspectives on goals of care

12 month follow up

- Repeat cognitive testing and revisit trajectory with patient and family
- Continued focus on patient described goals of care and maintaining self-efficacy