

The Analysis Study of Prevalence, Risk Factor and Management of Persistent Pain in Intensive Care Survivors: A Comprehensive Systematic Review

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ABSTRACT

Background: Post-intensive care syndrome (PICS), encompass physical, cognitive, and mental health deficits that arise and persist following hospitalization for critical illness. This systematic review aims to evaluate the prevalence, risk factor and management of persistent pain in intensive care survivors by analyzing available studies on literatures of the last 10 years. **Methods:** The study adhered to PRISMA 2020 standards, examining English literature from 2014 to 2024. It excluded editorials, reviews from the same journal, and submissions without a DOI. PubMed, SagePub, SpringerLink, and Google Scholar were utilized as literature sources. **Result:** Initially retrieving 360 articles from online databases (PubMed, SagePub, SpringerLink and Google Scholar) eight relevant papers were selected after three rounds of screening for full-text analysis. **Conclusion:** A large proportion of ICU survivors suffer from physical, mental, and cognitive impairments. Holistic approach to post-ICU care, which includes pain management and psychological support, is essential for improving the overall quality of life of ICU survivors.

Keyword: post-intensive care syndrome, intensive care unit, survivor

INTRODUCTION

The recent decline in intensive care unit (ICU) mortality rates has led to a growing population of ICU survivors. However, survival often comes at the cost of long-term impairments that significantly diminish quality of life. These impairments, collectively known as post-intensive care syndrome (PICS), encompass physical, cognitive, and mental health deficits that arise and persist following hospitalization for critical illness. While PICS is a well-recognized issue globally, the scope and impact of these impairments remain insufficiently understood.^{1,2}

Numerous observational studies have sought to explore various aspects of PICS among ICU survivors. However, these studies often focus narrowly on individual components of PICS, such as cognitive function or physical and mental health, rather than examining the syndrome's co-occurrence in individual patients. This compartmentalized approach limits our understanding of the full spectrum

of challenges faced by ICU survivors and underscores the need for more comprehensive research that considers the interplay between different aspects of PICS.^{3,4}

Additionally, the majority of existing research on PICS has been conducted in Western populations, with limited data available from Asian populations, where cultural and racial differences may influence the presentation and management of PICS.⁵ This gap in the literature is particularly important given the increasing awareness and implementation of PICS prophylaxis strategies, such as clinical practice guidelines for managing pain, agitation, sedation, delirium, immobility, and sleep disruption in ICU patients. Despite these efforts, there remains a paucity of evidence on the effectiveness of these strategies in diverse cultural contexts.^{6,7}

Moreover, ICU patients often enter critical care with a lower baseline health-related quality of life (HRQOL) than the general population, yet many studies compare

their post-ICU HRQOL with that of age-matched controls, rather than their pre-ICU baseline. This approach overlooks the true impact of ICU care on patient outcomes.⁸ The use of the 36-item Short Form (SF-36) health survey questionnaire version 2, a widely adopted HRQOL measure among ICU survivors, further complicates this issue, as most studies lack baseline data for comparison. As a result, the clinically significant changes in HRQOL post-ICU remain unclear.^{9,10}

This systematic review aims to address these gaps by providing a comprehensive analysis of the prevalence, risk factors, and management strategies for PICS among ICU survivors. By integrating data from diverse populations and considering the co-occurrence of PICS symptoms, this review seeks to enhance our understanding of PICS and inform more effective interventions to improve long-term outcomes for ICU survivors. This systematic review aims to evaluate the prevalence, risk factor and management of persistent pain in intensive care survivors by analyzing

available studies on literatures of the last 10 years.

METHODS

Protocol

The author carefully followed the rules laid out in the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020. This was done to make sure the study met all its standards. The selection of this methodological approach was specifically aimed at ensuring the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic to evaluate the prevalence, risk factor and management of persistent pain in intensive care survivors based on literatures of the last 10 years. This study meticulously analyzed data on literatures to provide insights and enhance patient treatment strategies. The primary objective of this paper is to highlight the collective significance of the identified key points.

Inclusion criteria for this study entail: 1) Papers must be in English, and 2) Papers must have been published between 2014 and 2024. Exclusion criteria comprise: 1) Editorials; 2) Submissions without a DOI; 3) Previously published review articles; and 4) Duplicate entries in journals.

Search Strategy

The keywords used for this research are post-intensive care syndrome, intensive care unit, survivor. The Boolean MeSH keywords inputted on databases for this research are: (*"postintensive care syndrome"[Supplementary Concept] OR "postintensive care syndrome"[All Fields] OR "post intensive care syndrome"[All Fields]) AND ("intensive care units"[MeSH Terms] OR ("intensive"[All Fields] AND "care"[All Fields] AND "units"[All Fields]) OR "intensive care units"[All Fields] OR ("intensive"[All Fields] AND "care"[All Fields] AND "unit"[All Fields]) OR "intensive care unit"[All Fields]) AND ("survivor s"[All Fields] OR "survivors"[MeSH*

Terms] OR "survivors"[All Fields] OR "survivor"[All Fields]).

Data retrieval

The authors assessed the studies by reviewing their abstracts and titles to determine their eligibility, selecting relevant ones based on their adherence to the inclusion criteria, which aligned with the article's objectives. A consistent trend observed across multiple studies led to a conclusive result. The chosen submissions had to meet the eligibility criteria of being in English and a full-text.

This systematic review exclusively incorporated literature that met all predefined inclusion criteria and directly pertained to the investigated topic. Studies failing to meet these criteria were systematically excluded, and their findings were not considered. Subsequent analysis examined various details uncovered during the research process, including titles, authors, publication dates, locations, study methodologies, and parameters.

Quality Assessment and Data Synthesis

Each author independently evaluated the research presented in the title and abstract of the publication to determine which ones merited further exploration. The subsequent

stage involved assessing all articles that met the predefined criteria for inclusion in the review. Decisions on including articles in the review were based on the findings uncovered during this evaluation process.

Table 1. Article Search Strategy

Database	Strategi Pencarian	Hits
Pubmed	<i>("postintensive care syndrome"[Supplementary Concept] OR "postintensive care syndrome"[All Fields] OR "post intensive care syndrome"[All Fields]) AND ("intensive care units"[MeSH Terms] OR ("intensive"[All Fields] AND "care"[All Fields] AND "units"[All Fields]) OR "intensive care units"[All Fields] OR ("intensive"[All Fields] AND "care"[All Fields] AND "unit"[All Fields]) OR "intensive care unit"[All Fields]) AND ("survivor s"[All Fields] OR "survivors"[MeSH Terms] OR "survivors"[All Fields] OR "survivor"[All Fields])</i>	100
Science Direct	<i>((post-intensive care syndrome) AND (intensive care unit)) AND (survivor)</i>	150
Sagepub	<i>((post-intensive care syndrome) AND (intensive care unit)) AND (survivor)</i>	50
Google Scholar	<i>((post-intensive care syndrome) AND (intensive care unit)) AND (survivor)</i>	160

Table 2. JBI *Critical appraisal of Study*

Parameters	Zeeshan (2018)	Sprague (2017)	Moon (2014)	Aristokli (2022)	Sumkin (2019)	Lehman (2015)	Lee (2016)	Badu- Peprah (2018)
1. Bias related to temporal precedence								
Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation								
Was there a control group?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Bias related to confounding factors								
Were participants included in any comparisons similar?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Bias related to administration of intervention/exposure								
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	No.	No.	No.	No.	No.	No.	No.	No.
5. Bias related to assessment, detection, and measurement of the outcome								
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the outcomes of participants included in any comparisons measured in the same way?	No.	No.	No.	No.	No.	No.	No.	No.
Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Bias related to participant retention								
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7. Statistical conclusion validity								
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

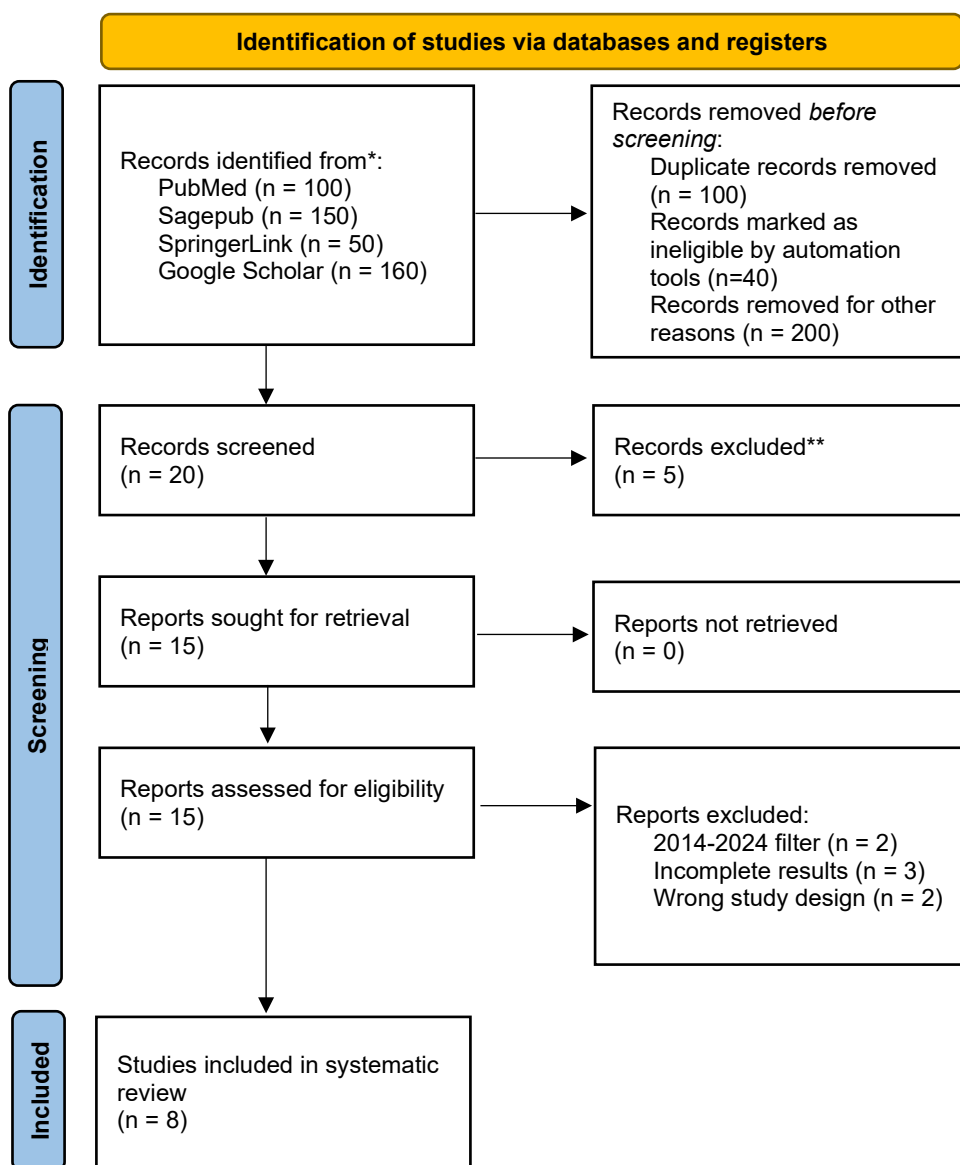


Figure 1. Article search flowchart

RESULT

The initial number of articles retrieved from online databases (PubMed, SagePub, SpringerLink, and Google Scholar) is 360 articles. After conducting three levels of screening, eight articles that directly relate to the current systematic review have been chosen for further assessment through full-text reading and analysis. Table 3 presents the selected literature included in this analysis.

Baumbach, et al.¹¹ (2016) showed that a significant proportion of ICU survivors develop chronic pain, with the presence of sepsis having a minimal impact on this outcome.

Langerud, et al.¹² (2018) concluded that pain interference had a significant impact, leading to the greatest reduction in physical HRQOL at both time points.

Fernández-de-las-Peñas, et al.¹³ (2022) showed that female sex, history of musculoskeletal pain, presence of myalgia and headache as COVID-19 symptoms at the acute phase, and days at hospital were risk factors associated with musculoskeletal post-COVID pain.

Kawakami, et al.¹⁴ (2021) highlights that 64% of survivors had PICS, with 20% experiencing multiple impairments, and suggests the need for further research on the MCID of SF-36 scores and standardizing the definition of PICS.

Peng, et al.¹⁵ (2014) underscore the need for early prevention and aggressive treatment to improve quality of life for patients with CPSP following thoracic surgery.

Huang, et al.¹⁶ (2016) highlights the need to assess ARDS survivors for a full range of psychiatric sequelae, focusing on sociodemographic factors and opioid use to identify those at highest risk.

Szakmany, et al.¹⁷ (2019) highlights the high mortality rate and resource use among ICU survivors and suggests that understanding and addressing modifiable factors could improve long-term outcomes and optimize service delivery for critically ill patients.

Martillo, et al.¹⁸ (2021) underscores the high risk of PICS in COVID-19 ICU survivors and the need for comprehensive post-ICU care to address these issues.

Table 3. The litelature include in this study

No.	Author	Origin	Method	Sample	Result
1.	Baumbach, et al. ¹¹ (2016)	Germany	Case control study	253 patients	The study used the German pain questionnaire to assess patients' pain six months after ICU discharge, comparing septic and nonseptic patients to healthy controls. No significant differences in pain prevalence, severity, or interference were found between septic and nonseptic patients, though both patient groups reported worse outcomes compared to controls. About one-third of patients experienced chronic pain linked to their ICU stay, with half having preexisting pain conditions and the other half developing new, disabling pain after ICU discharge.
2.	Langerud, et al. ¹² (2018)	Norway	Retrospective cohort study	207 patients	ICU survivors experienced reduced physical and mental health-related quality of life (HRQOL) compared to the general population, with the decline in physical HRQOL being more noticeable at 3 months. Mental HRQOL showed only a minor and clinically insignificant reduction. Social support was positively linked to mental HRQOL at 3 months, while a higher number of comorbidities was associated with reduced physical HRQOL at both 3 months and 1 year, and mental HRQOL at 1 year
3.	Fernández-de-las-Peñas, et al. ¹³ (2022)	Multicenter	Retrospective cohort study	1969 patients	In a study of 1,969 COVID-19 survivors assessed on average 8.4 months post-discharge, 45.1% reported musculoskeletal pain related to their COVID-19 experience. Among those with post-COVID pain, 74.9% developed new-onset pain, while 25.1% experienced exacerbation of pre-existing symptoms. Risk factors for musculoskeletal post-COVID pain included female sex (odds ratio [OR] 1.349), a history of musculoskeletal pain (OR 1.553), presence of myalgia (OR 1.546), headache (OR 1.866) during the acute phase of COVID-19, and the number of days spent in the hospital (OR 1.013).

4.	Kawakami, et al. ¹⁴ (2021)	Japan	Retrospective cohort study	192 patients	In a study of 192 patients who survived ICU treatment, 48 (25%) had died by 6 months. Of the 96 survivors who completed the questionnaire, 63.5% had at least one Post-Intensive Care Syndrome (PICS) impairment, and 17.8% had two or more impairments. Physical, mental, and cognitive impairments were reported by 32.3%, 14.6%, and 37.5% of patients, respectively. Having only mandatory education was associated with an increased risk of PICS (odds ratio 4.0). The Minimal Clinically Important Difference (MCID) for Physical Component Summary (PCS) and Mental Component Summary (MCS) scores was 6.5 and 8.0, respectively.
5.	Peng, et al. ¹⁵ (2014)	China	Retrospective cohort study	1284 patients	The study found that 24.9% of patients who underwent thoracic surgery developed Chronic Post-Surgical Pain (CPSP), with 32.5% of those having a neuropathic component. CPSP did not significantly improve over time. Predictive factors for CPSP included being under 60 years old, female gender, prolonged post-operative chest tube drainage (≥ 4 days), certain post-operative pain management strategies, and pre-existing hypertension. Patients with CPSP experienced significantly reduced physical function and lower quality of life, particularly those with neuropathic pain.
6.	Huang, et al. ¹⁶ (2016)	USA	Retrospective cohort study	698 patients	In a study evaluating psychiatric symptoms in acute respiratory distress syndrome (ARDS) survivors, 66% of 629 patients exhibited substantial symptoms in at least one psychiatric domain (depression, anxiety, or posttraumatic stress disorder) at 6 and 12 months. The prevalence of these symptoms was consistently high, with the most common pattern being the presence of symptoms in all three domains simultaneously. Factors such as younger age, female sex, unemployment, alcohol misuse, and higher opioid use in the ICU were significantly associated with psychiatric symptoms, while the severity of illness and ICU length of stay were not.

7.	Szakmany, et al. ¹⁷ (2019)	UK	Retrospective cohort study	40631 patients	In a study of ICU survivors, 19.4% of patients died within one year. Key factors predicting long-term mortality included advanced age and comorbidities, while expedited discharge due to ICU bed shortages was linked to a higher risk of death. Hospitalization rates increased significantly post-ICU, with survivors experiencing 88 days of hospitalization per 1,000 days and those who died having 412 days per 1,000 days.
8.	Martillo, et al. ¹⁸ (2021)	USA	Retrospective cohort study	45 patients	In a study of 45 COVID-19 ICU survivors, 91% were diagnosed with Postintensive Care Syndrome (PICS), indicating significant impairment in at least one domain. Physical impairments were present in 86.7% of patients, psychiatric impairments in 48%, and cognitive impairments in 8%. Mobility issues affected 58% of survivors, with 38% experiencing at least mild depression, 18% moderate to severe depression, and 18% showing signs of posttraumatic stress disorder.

DISCUSSION

The persistent pain experienced by ICU survivors is a growing area of concern, with studies indicating that a significant portion of this population suffers from long-term pain-related complications. The prevalence of chronic pain following ICU discharge is alarmingly high, with studies such as Baumbach et al. (2016) demonstrating that about one-third of ICU survivors develop chronic pain, regardless of the presence of sepsis during their ICU stay. This suggests that critical illness, in general, plays a significant role in the development of long-term pain, highlighting the need for early identification and management strategies to prevent or mitigate chronic pain in ICU survivors.¹¹

Quality of life (QoL) post-ICU is another critical issue, with physical health-related quality of life (HRQOL) often being significantly reduced. As Langerud et al. (2018) demonstrated, pain is a key factor contributing to this decline, particularly within the first three months after ICU discharge. The

study further underscores the importance of addressing both physical and psychological aspects of recovery, as social support was shown to positively influence mental HRQOL. These findings suggest that a holistic approach to post-ICU care, which includes pain management and psychological support, is essential for improving the overall QoL of ICU survivors.¹²

The COVID-19 pandemic has introduced new challenges, particularly concerning post-ICU musculoskeletal pain, as observed in Fernández-de-las-Peñas et al. (2022). Nearly half of the COVID-19 survivors in their study reported musculoskeletal pain, with many experiencing new-onset pain post-discharge. The identification of risk factors such as female sex, preexisting musculoskeletal pain, and specific COVID-19 symptoms like myalgia and headache highlights the need for targeted pain management strategies in this subgroup. These findings also suggest that COVID-19 survivors may require specialized post-ICU care to address their unique pain-related challenges.¹³

Post-Intensive Care Syndrome (PICS) has emerged as a significant concern, with studies like Kawakami et al. (2021) showing that a large proportion of ICU survivors suffer from physical, mental, and cognitive impairments. The co-occurrence of these impairments complicates recovery, and certain demographic factors, such as limited education, have been linked to a higher risk of PICS. These findings indicate the need for standardized definitions and assessment tools for PICS, as well as comprehensive rehabilitation programs that address the multifaceted nature of this syndrome.¹⁴

Chronic post-surgical pain (CPSP) is another area of concern for ICU survivors, particularly those who have undergone major surgeries like thoracic procedures. As highlighted by Peng et al. (2014), nearly one-quarter of patients who underwent thoracic surgery developed CPSP, with a significant portion experiencing neuropathic pain. The identification of predictive factors, including younger age, female gender, and prolonged post-operative

interventions, underscores the importance of early prevention and treatment to improve long-term outcomes and quality of life for these patients.¹⁵

Psychiatric symptoms, including depression, anxiety, and posttraumatic stress disorder (PTSD), are prevalent among ICU survivors, as demonstrated by Huang et al. (2016). The high co-occurrence of these symptoms suggests that ICU survivors are at significant risk of long-term mental health issues, which may be exacerbated by sociodemographic factors and in-ICU treatments such as opioid use. These findings highlight the need for comprehensive mental health assessments and interventions in ICU survivors, with a particular focus on identifying and addressing modifiable risk factors to improve psychological outcomes.¹⁶

Long-term mortality among ICU survivors remains a critical issue, with studies like Szakmany et al. (2019) showing that nearly one in five survivors dies within a year of discharge. Factors such as advanced age, comorbidities, and system-

related issues like expedited discharge due to ICU bed shortages contribute to this high mortality rate. These findings underscore the importance of optimizing post-ICU care processes, including early discharge planning and follow-up care, to reduce mortality and improve the long-term survival of ICU survivors.¹⁷

Finally, the high prevalence of Post-Intensive Care Syndrome (PICS) in COVID-19 ICU survivors, as reported by Martillo et al. (2021), highlights the ongoing challenges faced by this population. With significant physical, psychiatric, and cognitive impairments reported, the need for comprehensive, multidisciplinary post-ICU care has never been more apparent. These findings reinforce the importance of early intervention, thorough assessment, and personalized rehabilitation plans to support the recovery and long-term well-being of ICU survivors, particularly in the context of the COVID-19 pandemic.¹⁸

CONCLUSION

A large proportion of ICU survivors suffer from physical, mental, and cognitive impairments. Holistic approach to post-ICU care, which includes pain management and psychological support, is essential for improving the overall quality of life of ICU survivors.

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