Received: 6 May 2024 | Revised: 14 August 2024 | Accepted: 1 October 2024

DOI: 10.1111/nicc.13190

SYSTEMATIC REVIEW

BACCN Nursing in Critical Care WILEY

Non-pharmacological interventions to support the cognitive rehabilitation of patients admitted to the intensive care unit: An umbrella review

Anna Holm[1,2] | Linette Thorn[1] | Anette Bjerregaard Alrø[1,2] | Helene Korvenius Nedergaard[3,4] | Hanne Irene Jensen[3,4,5] | Pia Dreyer[1,2]

[1]Department of Intensive Care, Aarhus University Hospital, Aarhus, Denmark

[2]Department of Public Health, Section of Nursing and Health Care, Aarhus University, Aarhus, Denmark

[3]Department of Anaesthesiology and Intensive Care, Kolding Hospital, University Hospital of Southern Denmark, Kolding, Denmark

[4]Department of Regional Health Research, University of Southern Denmark, Odense, Denmark

[5]Department of Anaesthesiology and Intensive Care, Vejle Hospital, University Hospital of Southern Denmark, Vejle, Denmark

Correspondence
Anna Holm, Department of Intensive Care, Aarhus University Hospital, Aarhus, Denmark.
Email: annasoe6@rm.dk

Funding information
The Novo Nordisk Foundation

[Correction added on 14 November 2024, after first online publication: Several in-text citation numbers have been corrected in this version.]

Abstract

Background: Critically ill patients experience cognitive impairment throughout their intensive care unit trajectory, in the acute phase and the long-term alike. Cognitive impairment may negatively impact patients' quality of life and rehabilitation outcomes.

Aim: To provide an overall examination of literature concerning non-pharmacological interventions that can enhance cognitive functioning in critically ill patients or facilitate their rehabilitation pathway during and after their intensive care unit stay.

Study Design: This study was conducted as an umbrella review. A systematic search was conducted in CINAHL, Embase, PubMed and PsychINFO, including all types of peer-reviewed research syntheses published between 2008 and 2023. Eligible studies had to describe interventions capable of improving adult patients' cognitive functioning or supporting their cognitive rehabilitation process throughout the intensive care unit trajectory. All eligible research syntheses were screened systematically; those included were critically appraised.

Result: Based on 13 research syntheses, this review summarizes rehabilitative interventions that may be delivered during different phases of critical illness and recovery, in relation to content, delivery and timing. Interventions were: (1) cognitive activities and training, (2) mobilization and physical exercises, (3) emotional, psychological and social support and (4) information.

Conclusion: Due to limited evidence, no definitive conclusion can be drawn about which type of intervention is most supportive or effective. Additionally, no recommendations can be made about the optimal timing for intervention delivery.

Relevance to Clinical Practice: Clinicians involved in developing and implementing cognitive rehabilitation measures should consider designing individualized, multicomponent interventions with a focus on content, delivery and timing.

KEYWORDS

cognitive impairment, complex intervention, intensive care unit, rehabilitation, review

1 | INTRODUCTION

This review compares and contrasts existing research syntheses to provide a summary of current knowledge about interventions that may support patients' cognitive rehabilitation during an intensive care unit (ICU) admission and the subsequent recovery process.

What is known about the topic

- Cognitive impairment is a frequent and under-recognized complication in critically ill patients.
- Cognitive impairments can significantly impact the quality of life for patients and pose a considerable burden for those who survive an intensive care unit (ICU) admission.
- The ideal approach to designing and implementing cognitive rehabilitation throughout the ICU pathway, spanning from the acute phase to a long-term perspective, remains uncertain.

What this paper adds

- A comprehensive overview of non-pharmacological interventions aimed at supporting cognitive rehabilitation and enhancing cognitive functioning in ICU patients and survivors is provided.
- Researchers and clinicians engaged in developing and implementing cognitive rehabilitation measures should acknowledge the significance of them being personalized and multi-component.
- Owing to limited evidence, definitive conclusions regarding the effectiveness and supportive nature of the interventions cannot be drawn. Therefore, additional research is needed.

2 | BACKGROUND

Cognitive impairment is a common phenomenon observed in patients admitted to the ICU, which may persist from the acute phase throughout the recovery phase of critical illness. In the acute phase, cognitive impairments are typically identified as delirium[1,2]; in the long-term perspective, the post-intensive care syndrome (PICS) is often used to describe the cognitive impairments in conjunction with new or worsening impairments in physical or mental health status.[1,3] Cognitive impairment following ICU admission is frequent and under-recognized. It has considerable short- and long-term consequences for ICU survivors.[4] Prominent cognitive sequelae in this group of patients are impaired executive function, including working memory, flexible thinking and self-control. Additionally, mental processing speed, memory, attention and concentration may be reduced.[5] The prevalence of cognitive impairment varies according to which assessment tool is used and the timing of screening; one review suggested that 17%–78% of patients discharged from an ICU suffer from sustained long-term cognitive impairments.[6] The cause of cognitive impairment is multifactorial and not fully understood.[1,7] Factors that increase the risk of cognitive impairment before admission to the ICU may include age, lower educational level, alcohol abuse and pre-existing cognitive impairment, and ICU-related risk factors were described as being related to pathophysiology and environmental factors.[1] Delirium, which is known as 'critical illness brain injury', is also closely associated with cognitive impairment.[8,9]

Cognitive impairments may affect patients' quality of life and constitute a substantial burden to ICU survivors.[10] Patients experience a challenging everyday life due to their cognitive impairments and require strategies to support their recovery and rehabilitation.[11,12] For example, managing daily tasks may be challenging due to loss of short- and long-term memory.[12,13] A systematic review showed that 67% of ICU survivors had not returned to work at 3 months after a critical illness episode, and 44% had not returned at 12 months.[14] Although the risk factors are not yet fully understood, cognitive impairments such as memory issues or executive dysfunction might limit ICU survivors' ability to return to work. Furthermore, families, friends and colleagues are affected by patients' suffering from cognitive impairments. Families often feel insufficiently informed and lack the skills required to manage the patient's rehabilitation needs.[15]

The World Health Organization defines rehabilitation as '*a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment*'.[16] Rehabilitation of patients with cognitive impairments during and after critical illness is complex and challenging. Nurses hold a key

position in rehabilitating ICU-related cognitive impairments but may be unsure of the optimal approaches.[2] Two areas are of particular interest in relation to rehabilitation in the ICU setting and the subsequent patient pathway: (1) identification of patients' cognitive impairment and (2) interventions that support patients' cognitive function. In this regard, researchers emphasize the need for routine screening of all critically ill patients to detect their risk of developing short- and long-term cognitive impairments as an important first step.[17–19] A recent guideline on multimodal rehabilitation for patients with PICS suggests computer-based learning and/or therapies aiming to improve cognition in conjunction with delirium prophylaxis and stress reduction for rehabilitation of cognitive health in ICU survivors.[20] Despite the recommendations made by Renner et al.[20] for interventions to enhance cognitive functioning in critically ill patients, a more detailed overview of available interventions is needed, focusing on contents, delivery and timing. Furthermore, it remains unclear which interventions are most supportive from patients' perspectives throughout their ICU rehabilitation pathway.

2.1 | Aim

The aim of this review was to provide an overall examination of literature describing non-pharmacological interventions that may improve cognitive functioning in critically ill patients or ease their rehabilitation pathway during and after an ICU admission. The focus was to build an overview of the interventions focusing on contents, delivery (who and how) and timing (frequency and duration). The review questions were:

1. Which non-pharmacological interventions improve critically ill patients' cognitive functioning?
2. Which non-pharmacological interventions do patients find supportive throughout their rehabilitation pathway from ICU to home?

3 | DESIGN AND METHODS

The umbrella review method was adopted to summarize extant evidence and address the review questions. We were inspired by the approach described by the Joanna Briggs Institute (JBI).[21] This included the formulation of review questions, search strategy, quality assessment of included research syntheses, the qualitative synthesis of data and reporting of results. The umbrella review method is ideal for highlighting whether the evidence base for a specific topic is consistent or contradictory.[21] According to Aromataris et al.,[21] umbrella reviews may help answer 'how' and 'why' interventions do or do not work and how patients experience them, rather than focusing on effectiveness exclusively. Thus, we found the method useful for establishing an overview of interventions for cognitive ICU rehabilitation described in the literature. Our interest was not limited to studies that could provide objective evidence of an improved cognitive functioning owing to a certain intervention. We also aimed to establish whether patients found certain interventions useful in supporting their cognitive rehabilitation process. Additionally, we aimed to provide an overview of interventions used throughout patients' rehabilitation pathways in and after ICU admission. This also concerned the contents or component(s) of the intervention (single or multicomponent), the individuals delivering the intervention, the approach adopted and the timing of intervention delivery. These aspects are important for complex intervention development and design.[22] The preferred reporting items for overviews of reviews (PRIOR) statement was used as a checklist for this study.[23]

3.1 | Search strategy

A systematic search was conducted between February and April 2022 in CINAHL, Embase, PubMed and PsychINFO (Figure 1). A secondary and updated search was performed in January 2024. The PCC model (population/concept/context) was combined with reviews as publication type, producing four search blocks. The overall blocks were 'patients with cognitive impairments' AND 'interventions to improve cognitive functioning' AND 'intensive care unit' AND 'research syntheses'. Thesaurus and key search terms were combined with OR within each block (see full search strategy in Data S1). Two researchers conducted the searches together, and the process was validated by a librarian. Covidence was used for screening of the title and abstract. Any disagreement about eligibility was resolved by discussion among the research team. We did not search for grey literature.

3.2 | Inclusion and exclusion criteria

To compare and contrast the existing body of literature, peer-reviewed research syntheses published between 2008 and 2023 were included. Given the scarcity of knowledge within this area, all types of research syntheses were included. Eligible studies had to describe interventions capable of improving cognitive functioning or supporting the patients' cognitive rehabilitation process throughout the trajectory from ICU to home. The population comprised adult patients from the general ICU setting. Thus, the neuro-ICU setting and patients with brain injury or head trauma were excluded. Studies published in English or any of the Scandinavian languages were included. Studies focusing on pathophysiological causes of cognitive impairments, pharmacological interventions or delirium were excluded.

The critical appraisal tool recommended by JBI was applied (see Data S2). We included studies that answered questions 1–3 on the checklist. These questions were: (1) Is the review question clearly and explicitly stated? (2) Were the inclusion criteria appropriate for the review question? (3) Was the search strategy appropriate? Otherwise, studies were excluded due to low quality. Quality appraisal was conducted by two researchers independently and subsequently discussed among the research team to reach a consensus.

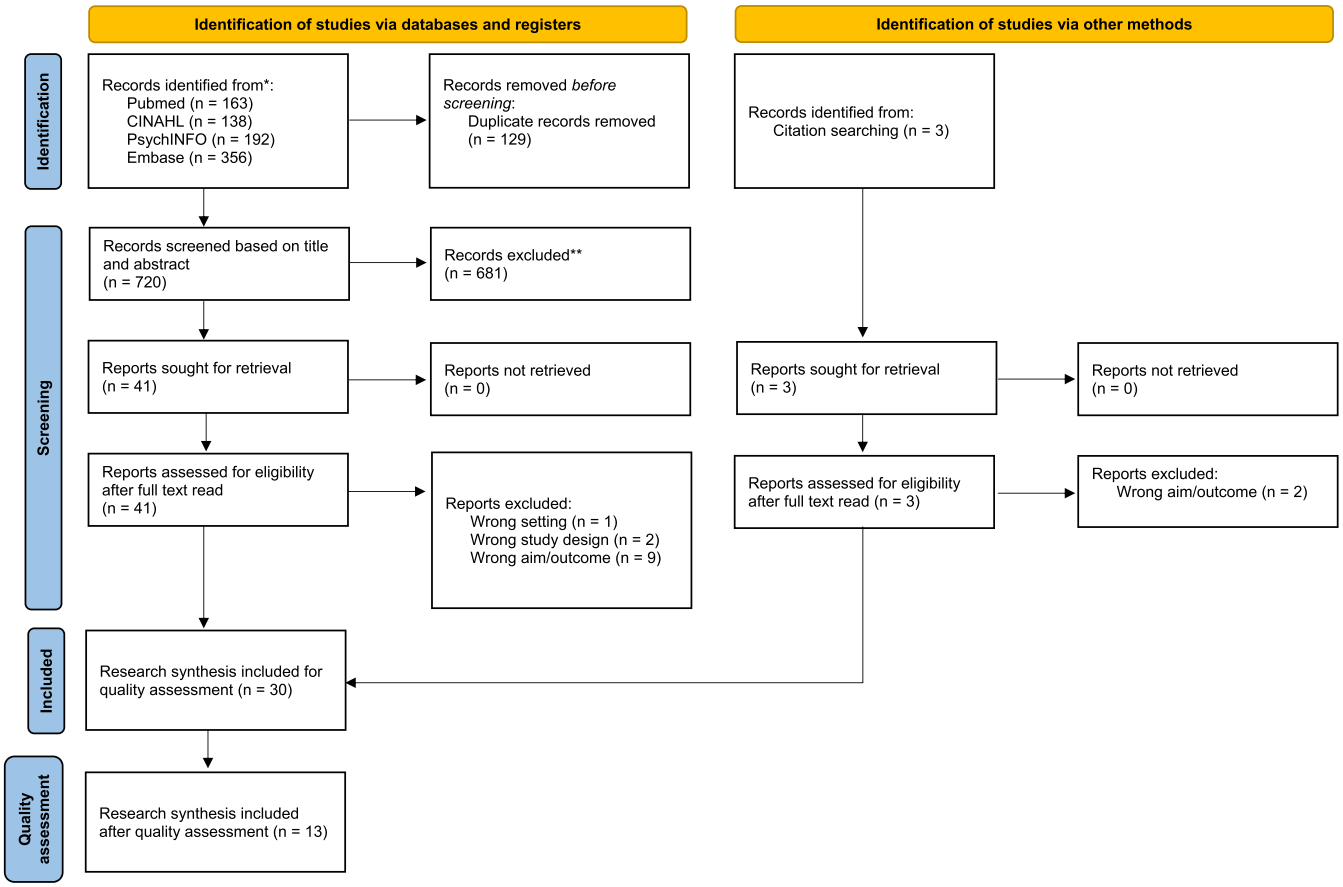

FIGURE 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of the search and screening strategy.

3.3 | Data analysis

The focus of an umbrella review is to provide a summary of existing research syntheses on a given topic or question, not to re-synthesize existing results.[21] Therefore, the analysis provided a summary of findings that were compared and contrasted to answer research questions 1 and 2. First, data were extracted and placed in a table designed for the purpose. This was done individually and then validated by another researcher; any disagreements were discussed within the research team. Second, the data were analysed in NVivo (QRS). Here, both qualitative and quantitative data were coded line-by-line and grouped into categories. The categories were developed to emphasize the type, content delivery and timing of the interventions, along with their effectiveness and supportiveness. Due to insufficient data, we did not perform any specific quantitative analysis (e.g., heterogeneity or sensitivity). Instead, our analysis was qualitative and descriptive. The first author analysed the data whereafter the results were discussed among the research team.

3.4 | Ethical and institutional approvals

No ethical approval was required for this review.

4 | RESULTS

4.1 | Sample

As illustrated in Figure 1, a total of 720 research syntheses were identified in the systematic search. After removing duplicates and screening the studies based on title and abstract, 44 papers were assessed for eligibility by full-text reading. Research syntheses were excluded due to wrong setting ($n = 1$), wrong study design ($n = 2$) or wrong aim/outcome ($n = 11$). The remaining 30 research syntheses were included for quality assessment (see Data S2); 13 syntheses were subsequently included in the final analysis.

Various research syntheses were represented in the final sample: two scoping reviews,[24,25] one mapping review,[26] one narrative review,[27] one integrative review,[28] one topical systematic review,[29] three systematic reviews,[30–32] two systematic review and meta-analyses[33,34] and two reviews without further definition.[35,36] Table 1 provides an overview of the included research syntheses. Upon exploring the results related to the research questions, we found that the research syntheses cited 29 different original studies. These studies were published between 1975 and 2021 and adopted various study designs, most of which were interventional. Among the 13 included research syntheses, nine cited the RETURN pilot study by

TABLE 1 Overview of included studies.

First author (Year)	Type of research syntheses	Study aim	Cognitive interventions received by intervention group (type and delivery)	Main results (effectiveness and supportiveness)
Alrø et al. (2022)	Scoping review	To review literature on patients' experiences of cognitive impairment following critical illness treated in an intensive care unit.	Information from health care professionals about patients' illness, admission and discharge.	Information may be supportive during recovery from cognitive impairment as lack of information leads to unmet needs and feelings of being unsupported and vulnerable.
			Personal active or passive coping strategies. Internal resources such as self-efficacy, optimism and resilience.	Assisted and supported patients in their cognitive recovery.
			Social support from families, friends, neighbours, church members and/or social welfare services. Medical support by health care professionals. Spiritual support (e.g., prayers).	Limited patient vulnerability and supported them during their recovery from cognitive impairments.
			Self-support strategies (taking naps, talking to someone, watching TV, reading, seeking information about their illness, taking notes, calendar reminders, games like sudoku, etc.).	Helped patients overcome recovery barriers.
			Referral to, for example, follow-up clinics or specialized health care professionals.	Aided in targeting patients' specific cognitive impairments.
Geense et al. (2019)	Systematic review and meta-analysis	To assess the effectiveness of nonpharmacologic interventions to prevent or mitigate adverse long-term outcomes among ICU survivors.	Exercise and physical rehabilitation (during and after ICU admission).	Four randomized controlled trials reported cognitive outcomes. Data could not be pooled due to use of medians and heterogeneity in interventions and measurement times.
			Follow-up services (after ICU admission).	Cognitive outcomes were reported in only 10% of the included studies and non-pharmacological interventions lacked effect.
Holod et al. (2023)	Systematic review	To aggregate and summarize the findings of studies focused on post-ICU rehabilitation following critical illness, delivered in the home setting.	A structured 12-week in-home rehabilitation programme of ICU survivors with cognitive and/or physical impairment.	Statistically significant changes in cognitive function at 3 months.
Jensen et al. (2015)	Systematic review and meta-analysis	To evaluate the impact of routine follow-up consultations versus standard care for ICU survivors.	Follow-up consultations.	Existing evidence indicated that follow-up consultations did not improve cognitive function.
Karnatovskaia et al. (2015)	Review	To review the cognitive and psychiatric dysfunction experienced by critically ill patients during and after hospitalization.	A 6-week multifaceted intervention with in-home cognitive, physical and functional rehabilitation.	The intervention improved executive function compared with controls.
			Diaries used during ICU admission.	ICU diaries enabled ICU patients to fill in the memory gaps and make sense of their experiences.
			Combined early cognitive and physical therapy (in the ICU).	Combined cognitive and physical therapy failed to demonstrate a difference compared with usual care or only physical training.
			Physical exercise in general (during and after ICU stay).	Physical exercise in general has demonstrated neuroprotective effects including improved cognitive function.

(Continues)

TABLE 1 (Continued)

First author (Year)	Type of research syntheses	Study aim	Cognitive interventions received by intervention group (type and delivery)	Main results (effectiveness and supportiveness)
Lasiter et al. (2021)	Mapping review	To examine effects of physical or cognitive training and simultaneous (dual-task) physical and cognitive training on cognition in adult ICU survivors.	Physical exercise in general (during and after ICU stay).	Physical exercise in general increases neuroplasticity, angiogenesis and neurogenesis. Therefore, physical exercise is crucial for the recovery of long-term cognitive function in ICU survivors.
			Combined physical and cognitive training (during and after an ICU stay).	Two studies evaluated combined physical and cognitive training. One was not sufficiently powered to detect efficacy; the other found no statistically significant difference.
Mehlhorn et al. (2014)	Systematic review	To assess the effectiveness of rehabilitation interventions in adult post-ICU patients.	Rehabilitation programmes/complex after care programmes (after ICU stay).	No significant effect on cognition found.
Muradov et al. (2021)	Scoping review	To identify all available cognitive interventions and measurable outcomes for the cognitive rehabilitation of adult ICU survivors.	Twelve weeks in-home cognitive, physical and functional rehabilitation intervention (GMT). Six in-person visits and six televisits by a social worker or a psychology technician.	Significant improvement in cognitive executive function in the intervention group versus control group after a 3-month intervention.
			Cognitive rehabilitation intervention (modified GMT) 12 weeks after discharge. Delivered either at the patient's home or during a return visit. Intervention provided by a psychologist or a counsellor.	No statistically significant difference between groups in usual versus combined care.
			A cognitive training series lasting 3 months (4 days a week with two sessions per day). Delivered in the hospital after ICU discharge by a psychiatrist. The intervention had four components: (1) learning to play keyboard, (2) learning simple Spanish, (3) memorizing a picture of a clock, (4) focusing on psychological health.	The long-term cognitive impairment rate was 82% in the control group versus 59% in the intervention group, indicating that cognitive training suppressed the slow deterioration of cognitive functions observed after ICU discharge in all five categories measured (executive function, language, orientation, memory, and visuospatial ability) with significant effect on the protection of memory.
			A collaborative, interdisciplinary care model to enhance cognitive, physical and psychological recovery. Individualized treatment plan. Treatment may include cognitive training, problem-solving therapy and psychotropics.	Significant improvements were seen in all domains, including cognitive scores.
			Computerized cognitive rehabilitation programme with adaptive exercises focusing on optimizing speed and memory accuracy and auditory verbal processing. Seven cognitive exercises daily for 12 weeks, 5 days per week (each game lasting approximately 6 min). Eighteen computerized training exercises with visual and auditory processing accuracy, speed and sequencing targets mimicking attention, memory and executive control capabilities. Continuous escalation of difficulty based on individual performance.	Statistically significant improvement between baseline and intervention scores in four cognitive domains (attention, processing speed, memory and executive function). A positive correlation was found between number of training hours and amount of improvement, suggesting transfer of general untrained cognitive abilities.

TABLE 1 (Continued)

First author (Year)	Type of research syntheses	Study aim	Cognitive interventions received by intervention group (type and delivery)	Main results (effectiveness and supportiveness)
Nedergaard et al. (2017)	Topical systematic review	To summarize current evidence on clinical interventions during ICU admission to reduce cognitive impairment in survivors of critical illness.	Night-time sleep-promoting environment and daytime normal circadian rhythm-interventions. Usual care versus early once-daily physical therapy and twice-daily cognitive therapy.	None of the interventions had significant positive effects on cognitive impairments following critical illness.
Schofield-Robinson et al. (2018)	Systematic review	To assess the effectiveness of follow-up services for ICU survivors that aim to identify and address unmet health needs related to the ICU period. A variety of outcome measures were assessed including cognitive function.	A manual-based, self-directed, physical rehabilitation programme developed by a physiotherapist and introduced by a nurse. Participants were assessed face-to-face at a clinic (at 1, 3 and 9 months), including a structured case review, discussion of ICU experiences, assessment of specialist medical referral and screening for psychological morbidity. Meeting with participant and family before hospital discharge. Nurse completed a discharge summary plan, which was sent to all relevant out-of-hospital health care providers. Participants received a visit within 48 h and again within the first week and then at least weekly for the next 3 weeks, and at least every other week for 4 weeks (min. eight visits). Visits took place at the participant's home or care facility. Participants received an information pamphlet 'Life after ICU'. First, consultation at a clinic with participant and a close relative at 1–3 months after discharge from the ICU. The intention was to construct an illness narrative; dialogue was aided by using photographs of the participant taken by ICU nurses. Second and third consultations were conducted at 5 and 10 months after ICU discharge, by telephone. Structured nurse-led intervention post-discharge intervention aimed at identifying and dealing with critical illness sequelae. Nurses were trained to identify and monitor symptoms using a validated screening tool. The intervention was primary care-based and involved training of participants and primary care providers. Initial training was provided 8 days after ICU discharge, then monthly telephone follow-up for 6 months and then every month for the subsequent 6 months.	It remains uncertain whether using a follow-up service improves cognitive function at 12 months. Certainty of evidence is very low.
Stollings et al. (2016)	Review	To review data related to cognitive rehabilitation, formation of post-intensive care clinics, and potential neuropharmacological therapy.	Usual care versus early once-daily physical therapy versus early once-daily physical therapy and twice-daily 20-min. cognitive therapy	No significant difference was found at 3-month follow-up between groups in measures of executive

(Continues)

TABLE 1 (Continued)

First author (Year)	Type of research syntheses	Study aim	Cognitive interventions received by intervention group (type and delivery)	Main results (effectiveness and supportiveness)
			(orientation, memory and attention exercises).	function, global cognition, functional mobility or activities of daily living.
			In-home combination therapy (cognitive, physical and functional therapy).	At 3 months, cognitive, executive functioning was improved in the intervention group versus the usual care group.
Svenningsen et al. (2017)	Integrative review	To determine the symptoms seen in patients after ICU discharge and the follow-up programmes offered to help patients deal with problems that arise.	Multicomponent rehabilitation programmes.	Appears to improve cognitive performance and functional outcomes.
			Use of diaries (during ICU stay).	Can fill in memory gaps.
Tingey et al. (2022)	Narrative review	To provide an overview of cognitive outcomes associated with critical illness by integrating recent literature focused on aetiology, assessment and interventions in the context of ICU-related cognitive impairments.	Screening for cognitive impairments to obtain information about patients' cognitive status and change over time.	The Mini Mental Status Exam (MMSE) or the Montreal Cognitive Assessment (MoCA) tool were suggested as these are validated screening tools. The MoCA has demonstrated greater sensitivity.
			Environmental modifications like matching lighting to time of day, prioritizing patients' sleep, placing a clock and calendar in a visible location, removing restraints, maintaining a distraction-free environment and providing trauma-informed care.	Embedding such interventions in the ICU may reduce the risk of long-term cognitive impairments among ICU survivors.
			Enteral nutrition, fluid status, sedation, weaning, mobilization, cognitive activities and sleep quality improvement.	No intervention demonstrated significant positive effects on long-term cognitive impairments.
			Outpatient interventions.	Few studies have examined the effects in ICU survivors, and the literature is limited by heterogenous study designs, small sample sizes, varying methods of measurements/ neuropsychological testing and differences in patient cohorts.
			In-home GMT.	No significant effects on cognitive outcomes of ICU survivors.
			A 3-month cognitive intervention protocol.	ICU survivors exhibited significantly higher global scores and less deterioration of cognitive functioning over time.
			A multicomponent in-home cognitive, physical and functional rehabilitation programme was assessed over a 3-month period in ICU survivors. Cognitive interventions were facilitated by a technician based on a goal management training model.	Significant improvements observed on measures of executive functioning. In contrast, another study failed to find any significant improvements or differences when using a similar goal management training protocol (more comprehensive tests of executive function was used). Incongruity may have been caused by a lack of power and a small sample size.
			A computerized programme with adaptive exercises focusing on	Significant improvements in cognitive areas directly addressed in the

TABLE 1 (Continued)

First author (Year)	Type of research syntheses	Study aim	Cognitive interventions received by intervention group (type and delivery)	Main results (effectiveness and supportiveness)
			improving processing speed, memory and verbal processing. Participants completed daily cognitive exercises 5 days a week for 12 weeks and a comprehensive neuropsychological battery before and after the exercises.	computerized testing along with several separate neuropsychological measures of attention and executive functioning. A positive association between number of training hours and overall scores on the untrained neuropsychological measures, suggesting a dose-response effect and potential transfer of rehabilitated cognitive abilities.

Jackson et al.,[37] making it the most cited original study. The ACT-ICU trial by Brummel and colleagues[38] was cited seven times. Furthermore, the research syntheses cited two reviews, which were also included in the present umbrella review[29,34] and three narrative review papers, which were excluded after quality appraisal.[39–41] Data S3 lists all original studies that are represented in each research synthesis.

4.2 | Intervention type

Although assessment of cognitive function does not fall within the scope of this review, the data synthesis showed that assessing cognitive function may be considered an initial step before delivering the intervention(s) to support patients' cognitive rehabilitation. The screening instruments ranged from brief tests to comprehensive neuropsychiatric test batteries.[25,27,29] Tingey et al.[27] described that screening provides valuable 'snapshot' information about a patient's cognitive status and possible change over time and that assessing which cognitive domain is affected may guide the choice of intervention.

In designing and implementing interventions targeting cognitive impairment in patients admitted to the ICU and throughout their rehabilitation pathway, several research syntheses have described the efficacy of multicomponent interventions.[25–28,30,31,33,35,36] These interventions often combine cognitive activities and physical exercises or psychological support, among others. This approach has been deemed feasible in various contexts.[33,36] One research synthesis suggested that combined interventions yielded greater improvements in executive function and functional ability than usual care.[26] However, none of the research syntheses reported studies comparing single interventions with multicomponent interventions. This means that it remains unclear whether the intervention had an impact because it was multicomponent or if the observed impact was owed to patients receiving an intervention rather than usual care. Lasiter et al.[26] also concluded that: '*Further research is needed to better understand the additive benefits of combined therapy*' (p. 328). One research synthesis described interventions that were individualized as an approach.[25] Interventions that build upon existing skills were mentioned as a way of individualizing them, for example, cognitive exercises that gradually become more challenging.[27] Furthermore, based on '*the link between physical, mental and cognitive outcomes, and combination of problems patients experience*' (p. 1615), Geense et al.[33] argued that interventions should be multicomponent and coordinated across various domains rather than simply targeting one PICS component.

The overall types of interventions described in the research syntheses are illustrated in Table 2, including delivery time. In the acute phase, early rehabilitation was mentioned without being defined.[33,35] Tingey et al.[27] described factors that focused on optimizing the ICU environment, such as limiting physical restraints, minimizing distractions and other environmental modifications like matching lightning to the time of the day. Other interventions described in the ICU were diaries,[28,33,35] orientation in time and space,[27] sleep improvements,[27,29,35] focus on normal circadian rhythm[27,29] and trauma-informed care.[27] In a long-term perspective, follow-up offers were described as comprising follow-up consultations,[34] outpatient therapies,[27] follow-up services,[32] ICU follow-up clinics[24,33,35] and ICU survivor clinics.[36] Goal management training (GMT) was also mentioned as an in-home cognitive rehabilitation programme.[25–27] Interventions that may be applicable and supportive throughout the patient pathways included non-digital cognitive activities and training focusing on orientation, memory, concentration and attention exercises or problem-solving.[24–27,29,33,35,36] Computer-based cognitive training was also suggested.[25–27] Mobilization and physical exercises were described as interventions impacting cognitive function.[26,27,33,35] Lasiter et al.[26] elaborated that physical exercise enhances, for example, learning and memory and is crucial to long-term cognitive function. Emotional, psychological, social and spiritual support may also be provided throughout patient care pathways, underpinning cognitive rehabilitation.[24,35] Actual psychological therapy or counselling was also suggested.[27,35] Karnatovskaia et al.[35] argued that psychological symptoms (e.g., difficulties in sleeping, intrusive memories, depression and anxiety) may have an impact on cognitive difficulties and that psychological interventions may serve to improve cognitive function. Personal coping strategies (e.g., self-efficacy, optimism and resilience) and self-support strategies were described by Alrø et al.[24] These self-support strategies were established by the patients themselves and included activities to stimulate

TABLE 2 Overview of interventions and overall intervention delivery time.

Type of interventions and overall delivery time	References
Overall considerations of intervention design	
Multicomponent interventions	24–27,29,30,32,34,35
Individualized interventions	24,26
Early (during the ICU stay)	
Early rehabilitation (physical and cognitive)	32,34
Environmental modifications (e.g., limit physical restraints, minimize distractions, match lightning to the time of the day)	26
Diaries	27,32,34
Orientation in time and space	26
Sleep improvements and focus on normal circadian rhythm	26,28,34
Trauma-informed care[a]	26
Throughout patient pathways (in and after the ICU stay)	
Cognitive activities and training (non-digital or computer-based)	23–26,28,32,34,35
Mobilization and physical exercises	25,26,32,34
Emotional, psychological and social support and self-support strategies	23,26,34
Personal coping strategies and self-support strategies	23
Information about patients' illness, cognitive impairments and life after ICU	23
Long-term (after the ICU stay)	
Follow-up offers (follow-up consultations, outpatient therapies, follow-up services, ICU follow-up clinics and ICU survivor clinics)	23,26,31–35
Goal management training (GMT)[b]	24–26

Abbreviation: ICU, intensive care unit.
[a]Trauma-informed care is an approach where care is delivered in a way that promotes healing and strives to avoid experiences of trauma or re-traumatization. It may build on various principles depending on the theoretical rooting.
[b]GMT is a cognitive rehabilitation programme based on neuroscientific principles supporting patients with impairments in executive functioning to improve their planning and ability to achieve goals.

cognitive function (reading, watching TV and playing games like sudoku), balancing between rest and activity (taking naps and pacing activity levels) and trying to maintain an overview of their life and situation (seeking information about their illness, keeping a calendar, receiving calendar reminders, taking notes and talking to someone about their experiences).[24]

4.3 | Intervention delivery (who, how, when)

The re synthesis provided insight into several aspects of intervention delivery, that is, where the intervention was delivered, how it was delivered, by whom it was delivered and when it was delivered. The latter being how often the intervention was delivered (frequency), how long the intervention lasted (duration) and the time period during which the intervention was delivered.

Intervention delivery extends from the acute setting to long-term perspectives, with many interventions applicable across hospital and home settings (see Table 2). Karnatovskaia et al.[35] argued that even though the evidence remains incomplete, '*there are undeniable signals that early interventions conducted during the ICU stay may have the most impact on subsequent cognitive and psychological morbidity*' (p. 135). They further elaborated by emphasizing patients' return to consciousness as a possible timing for initiation of cognitive rehabilitation: '*Once consciousness is active, we need to approach it from the same perspective as we do physical therapy of the body and engage the patients in tasks that help stimulate their thinking*' (p. 135). Two of the included research syntheses directly described initiation of cognitive interventions in the ICU[27,29]; none argued against or described the risk of adverse events when intervening in the acute phase. Interventions were delivered either in person,[24–27,31,32] by telephone[26,31,32] or as a combination of both.[26,31] Computer-based delivery was also described.[25–27] However, this may be regarded both as the type of intervention and as a method of delivery. Various health care professionals were reported to deliver the interventions, including nurses, social workers, speech-language pathologists, psychologists, neuropsychologists, psychiatrists, neurologists, physiotherapists and occupational therapists.[24,25,27,32] Two research syntheses described that the interventions were delivered by interdisciplinary or multidisciplinary teams.[25,32]

Most interventions were described as lasting approximately 3 months.[25–27,31] One research synthesis described a 6-week intervention.[35] The frequency of the interventions was not described in much detail, but one was delivered 5 days per week,[25,27] another was delivered 4 days per week with two daily sessions and one was delivered every other week.[25] The intervention duration was described as 30 min, 42 min or 60–75 min.[25] Tingey et al.[27] emphasized the significance of intensity when developing and implementing these types of interventions: '*Cognitive interventions appear to be more effective with increased intensity. This suggests that cognitive exercises be administered and practised at the highest frequency (e.g., multiple times per week) as can be tolerated by the individual over a period of 2–3 months*' (p. 266). For research syntheses describing follow-up services, consultations were described as varying regarding time to follow-up after discharge (2–12 months), number of consultations (2-8) and frequency of consultations (weekly, monthly or 6-monthly).[32,34] Consultation duration was not described.

4.4 | The effectiveness of the interventions

Several of the included research syntheses included descriptions of the effectiveness of the various intervention types. Overall, the effectiveness was very uncertain. Holod et al.[30] argued that this is due to '*the heterogeneity of study design, measurement, timing, duration, or*

intervention targets' (p. 144). Most research syntheses reporting significantly improved cognitive function referred to the RETURN study by Jackson et al.,[37] which was a multicomponent and GMT-based intervention.[25,27,28,30,35,36] Muradov et al.[25] further reported three interventions that proved effective: (1) computerized, adaptive cognitive training, (2) a series of cognitive training exercises and (3) a specific multicomponent and individualized intervention. However, measurement tools varied, hampering comparison. Two research syntheses found only a limited effect of follow-up in regard to improving cognitive function.[32,34] Schofield-Robinson et al.[32] reported that it is uncertain whether using a follow-up service may improve cognitive function at 12 months, whereas Jensen et al.[34] concluded that existing evidence indicates that follow-up consultations do not improve cognitive function. In contrast, Stollings et al.[36] described that ICU survivor clinics may impact cognitive function through early identification and cognitive rehabilitation. Although the included research syntheses reported only limited evidence, a tendency was observed to acknowledge the potential of interventions supporting ICU survivors' cognitive rehabilitation, with an overall conclusion being that more research in the field is needed.[25–36]

4.5 | The supportiveness of the interventions

Two of the included research syntheses reported measurements of patients' health-related quality of life; however, the interventions had no significant effect on this parameter.[29,36] One research synthesis explored patients' daily living activities, which were not found to be improved by cognitive interventions.[36] Another research synthesis assessed patients' self-perceived daily functioning, which was improved after a cognitive intervention.[25] Evidence was sparse on the impact of the intervention on quantitative measures of the ability to function in everyday life after an ICU admission. The scoping review by Alrø et al.[24] provided various insights into aspects of the cognitive interventions that may be experienced as supportive by former ICU patients. Information was one key point described: '*Information from health care professionals about patients' illness, admission and discharge appeared to be very important and supportive during recovery from cognitive impairment*' (p. 4385). However, because of their cognitive problems, patients struggled to understand, recall or process the information given. All patients required assistance in managing their specific cognitive impairments to overcome their experienced vulnerabilities after critical illness and reintegrate into everyday life.[24]

5 | DISCUSSION

This umbrella review provides an overview of non-pharmacological interventions that may support ICU patients' and ICU survivors' cognitive rehabilitation and improve their cognitive functioning. To the best of our knowledge, this is the first research synthesis to summarize rehabilitative interventions throughout ICU patients' pathways and provide suggestions for feasible interventions in the various phases of critical illness and recovery. We identified interventions that may be used both during and after ICU stays, with the predominant categories being: (1) cognitive activities and training, (2) mobilization and physical exercises, (3) emotional, psychological and social support and (4) information about ICU-related problems. However, evidence was limited, and it was not possible to determine the effectiveness of the interventions. Moreover, findings that facilitated our understanding of what patients found supportive were sparse.

Concerning contents and type of interventions, the results underpin the challenges and complexity of this research area. Two specific aspects made data extraction and analysis difficult: (1) many interventions were designed as multicomponent interventions, and (2) cognitive impairment is embedded within the concept of PICS and is intertwined with the physical and psychological aspects.

Results suggest that merging various components in a multicomponent intervention is recommendable. However, this approach adds to the complexity of interventions.[42,43] The exact mechanisms of combining different interventions are not fully understood in ICU populations, but any additive effect may be achieved because multicomponent interventions target several cognitive domains.[44] A recent RCT study conducted by Dong et al.[45] exemplifies a multicomponent cognitive rehabilitation training programme tested within the ICU. The intervention consisted of a digital training system, music therapy, aerobics training and a mental health intervention. Results showed significantly higher cognitive scores in the intervention group than in the control group.[45] However, based on the results, it is impossible to establish whether the combination of intervention components produced the impact or if one specific component accounted for the entire difference achieved in cognitive scores. A randomized study design with multiple arms testing one intervention component against another may potentially unravel the effect of each individual intervention. Within non-pharmacological delirium prevention, multicomponent interventions are also suggested as the most promising methods.[46] Cognitive impairment and delirium are, like PICS, highly intertwined.[1] Therefore, delirium preventive interventions should be considered when developing and testing interventions to support ICU patients' cognitive rehabilitation. However, these interventions were excluded from the literature search. A recent umbrella review identifying non-pharmacological interventions for prevention of delirium found several interventions similar to those of the present umbrella review.[46] These interventions fell within the following categories (1) early mobilization, (2) family participation and (3) environmental interventions. Notably the multicomponent interventions were highlighted (e.g., a combination of physical activity, family participation, cognitive stimulation, reorientation, sensory stimulation and environmental control). Lange et al.[46] conclud that these delirium-preventive strategies are promising in the ICU. However, the effect in the longer term remains unknown.

Because cognitive impairment forms part of PICS and is affected by physical and psychological aspects, it can be difficult to conduct research that rigorously separates the three components. For example, Karnatovskaia and colleagues[47] used the term psycho-cognitive in their research, mixing the psychological and cognitive parts,[35,47]

and both the ACT-ICU and RETURN studies combined physical and cognitive aspects.[37,38] Also, an umbrella review focusing on psychological outcomes found some of the same interventions described in the present umbrella review.[48] The interventions were early rehabilitation, post-ICU follow-up and diaries illustrating how some rehabilitative interventions may target several outcome measures in PICS. Separating the individual PICS components may be beneficial from a research perspective, as a unitary term fails to capture the unique manifestations of each component.[49] However, this may be difficult or even inappropriate from a clinical perspective, where the patients' problems should be viewed holistically. This leaves researchers within this area facing a dilemma as they need to balance their intervention design between a robust set of outcome measures addressing only one aspect of PICS to ensure unambiguous research results with broad measurements that cover several or all aspects of PICS and have a better fit with clinical practice. To complicate the area even further, one could discuss whether it would be more appropriate to design interventions targeting the specific cognitive impairment domains. Heterogeneity and vulnerability of the ICU population also add to the complexity as these aspects may introduce a need for individualized interventions and information that take patients' cognitive impairment into account. Overall, researchers who venture into the design and testing of interventions aiming to improve ICU patients' cognitive functioning or support their cognitive rehabilitation need to consider several methodological and clinical issues.

6 | LIMITATIONS

This umbrella review carries a number of limitations. Firstly, the details of the intervention descriptions may be shallow as this is a review of reviews. In recent years, the MRC guidance has brought attention to the importance of detailed intervention descriptions, for example, by using the Template of Intervention Description and Replication.[50] In future, researchers will hopefully gain the opportunity to understand interventions in sufficient detail to replicate them. Secondly, JBI recommends including only systematic reviews and meta-analysis; our inclusion of other types of research syntheses may impact the level of evidence. Thirdly, many research syntheses were excluded as it was impossible to exactly delineate the effect of cognitive interventions as outcome measures were mixed with other PICS aspects. Fourthly, studies based on COVID-19 cognitive rehabilitation were excluded from the search. However, even though COVID-19 patients may have cognitive impairments that are particular to this patient category, these studies may provide some insights into possible interventions. This is also the case for studies focusing on delirium prevention. Thus, research syntheses may exist that can provide useful evidence but were, nevertheless, excluded from our search. Fifthly, because the ACT-ICU and RETURN were the most cited original studies, their results have had a great impact on this umbrella review, whereas other studies received less attention. Finally, due to the umbrella review design adopted herein, a risk exists that missing data or mistakes made by previous research have been brought forward in our analysis.

6.1 | Recommendations, implications for practice and future research

In clinical practice and future research, implementation strategies should be carefully considered when developing interventions to support ICU patients' cognitive function. A recent review described the implementation strategies of different care bundles in the ICU and found that these strategies typically lacked structure and relied on simple strategies such as conducting educational meetings.[51] Specific implementation strategies or frameworks may be used, for example, the Expert Recommendations for Implementing Change (ERIC)[52] or the context and implementation of complex interventions (CICI).[53]

In clinical practice, a need exists to direct attention towards rehabilitation of patients' cognition. Thus, activities to stimulate and maintain cognitive function should be initiated as soon as possible, and the time point at which the patient regains consciousness is pivotal in this context. Such activities may be related to delirium prevention, that is, the ABCDEF bundle[54,55] or early rehabilitation in general.[56,57]

7 | CONCLUSION

Even though several interventions to support patients' cognitive rehabilitation during their critical care pathway were identified in this umbrella review, it remains impossible to draw final conclusions as to which type of intervention is most supportive or effective. Furthermore, no recommendations can be made on the optimal timing for intervention delivery considering the entire complex and multifaceted patient trajectory from ICU admission to home. Researchers and clinicians developing and implementing cognitive rehabilitation measures should consider designing individualized, multicomponent interventions.

FUNDING INFORMATION

Funding for this study was given by the Novo Nordisk Foundation (grant number NNF200C0061394).

CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Anna Holm https://orcid.org/0000-0002-2582-4984
Linette Thorn https://orcid.org/0000-0001-8743-2962
Anette Bjerregaard Alrø https://orcid.org/0000-0001-9600-5006
Helene Korvenius Nedergaard https://orcid.org/0000-0002-5988-4563
Hanne Irene Jensen https://orcid.org/0000-0001-9323-4284
Pia Dreyer https://orcid.org/0000-0002-3581-7438

REFERENCES

1. Bødker Hanifa AL, Svenningsen H, Møller AN, Dreyer P, Holm A. Cognitive impairment in critically ill patients and former critically ill patients: a concept analysis. *Aust Crit Care*. 2024;37(1):166-175. doi:10.1016/j.aucc.2023.10.002
2. Hanifa ALB, Alrø AB, Holm A, Dreyer P. Nurses' experiences of managing cognitive problems in intensive care unit patients: a qualitative study. *Intensive Crit Care Nurs*. 2023;79:103508. doi:10.1016/j.iccn.2023.103508
3. Needham DM, Davidson J, Cohen H, et al. Improving long-term outcomes after discharge from intensive care unit: report from a stakeholders' conference. *Crit Care Med*. 2012;40(2):502-509. doi:10.1097/CCM.0b013e318232da75
4. Wergin R, Modrykamien A. Cognitive impairment in ICU survivors: assessment and therapy. *Cleve Clin J Med*. 2012;79(10):705-712. doi:10.3949/ccjm.79a.12038
5. Peach BC, Cooney S, Richards S. Prominent cognitive impairment sequelae in adult survivors of acute respiratory distress syndrome. *Rehabil Nurs*. 2022;47(2):72-81. doi:10.1097/RNJ.0000000000000351
6. Kohler J, Borchers F, Endres M, Weiss B, Spies C, Emmrich JV. Cognitive deficits following intensive care. *Dtsch Arztebl Int*. 2019;116(38):627-634. doi:10.3238/arztebl.2019.0627
7. Honarmand K, Lalli RS, Priestap F, et al. Natural history of cognitive impairment in critical illness survivors. A systematic review. *Am J Respir Crit Care Med*. 2020;202(2):193-201. doi:10.1164/rccm.201904-0816CI
8. Pandharipande P, Girard TD, Jackson JC, et al. Long-term cognitive impairment after critical illness. *N Engl J Med*. 2013;369(14):1306-1316. doi:10.1056/NEJMoa1301372
9. Girard TD. Sedation, delirium, and cognitive function after critical illness. *Crit Care Clin*. 2018;34(4):585-598. doi:10.1016/j.ccc.2018.06.009
10. Granja C, Amaro A, Dias C, Costa-Pereira A. Outcome of ICU survivors: a comprehensive review. The role of patient-reported outcome studies. *Acta Anaesthesiol Scand*. 2012;56(9):1092-1103. doi:10.1111/j.1399-6576.2012.02686.x
11. Mortensen CB, Collet MO, Samuelson K. Struggling to return to everyday life—the experiences of quality of life 1 year after delirium in the intensive care unit. *Nurs Crit Care*. 2023;28(5):670-678. doi:10.1111/nicc.12939
12. Bjerregaard Alrø A, Svenningsen H, Korvenius Nedergaard H, Irene Jensen H, Dreyer P. Cognitive impairment in intensive care unit patients: a qualitative exploration through observations and interviews. *Intensive Crit Care Nurs*. 2023;81:103611. doi:10.1016/j.iccn.2023.103611
13. Calkins K, Kako P, Guttormson J. Patients' experiences of recovery: beyond the intensive care unit and into the community. *J Adv Nurs*. 2021;77(4):1867-1877. doi:10.1111/jan.14729
14. McPeake J, Mikkelsen ME, Quasim T, et al. Return to employment after critical illness and its association with psychosocial outcomes: a systematic review and meta-analysis. *Ann Am Thorac Soc*. 2019;16(10):1304-1311. doi:10.1513/AnnalsATS.201903-248OC
15. Choi J, Lingler JH, Donahoe MP, Happ MB, Hoffman LA, Tate JA. Home discharge following critical illness: a qualitative analysis of family caregiver experience. *Heart Lung*. 2018;47(4):401-407. doi:10.1016/j.hrtlng.2018.04.003
16. World Health Organization. Rehabilitation. Accessed October 10, 2023. 2023 https://www.who.int/news-room/fact-sheets/detail/rehabilitation
17. Agarwal S, Pavol M. Cognitive assessments in critical care patient populations: methodological considerations. *Neurocrit Care*. 2021;34(2):379-381. doi:10.1007/s12028-020-01187-9
18. Mulkey MA, Olson DM, Hardin SR. Patient safety: cognitive assessment at intensive care unit discharge. *Crit Care Nurse*. 2023;43(2):64-67. doi:10.4037/ccn2023718
19. Eman G, Marsh A, Gong MN, Hope AA. Utility of screening for cognitive impairment at hospital discharge in adult survivors of critical illness. *Am J Crit Care*. 2022;31(4):306-314. doi:10.4037/ajcc2022447
20. Renner C, Jeitziner MM, Albert M, et al. Guideline on multimodal rehabilitation for patients with post-intensive care syndrome. *Crit Care*. 2023;27(1):301. doi:10.1186/s13054-023-04569-5
21. Aromataris E, Fernandez R, Godfrey CM, Holly C, Khalil H, Tungpunkom P. Summarizing systematic reviews: methodological development, conduct and reporting of an umbrella review approach. *Int J Evid Based Healthc*. 2015;13(3):132-140. doi:10.1097/XEB.0000000000000055
22. Skivington K, Matthews L, Simpson SA, et al. A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance. *BMJ*. 2021;374:n2061. doi:10.1136/bmj.n2061
23. Gates M, Gates A, Pieper D, et al. Reporting guideline for overviews of reviews of healthcare interventions: development of the PRIOR statement. *BMJ*. 2022;378:e070849. doi:10.1136/bmj-2022-070849
24. Alrø AB, Nedergaard HK, Svenningsen H, Jensen HI, Dreyer P. Patients' experiences of cognitive impairment following critical illness treated in an intensive care unit: a scoping review. *J Clin Nurs*. 2023;32(15–16):4374-4390. doi:10.1111/jocn.16490
25. Muradov O, Petrovskaya O, Papathanassoglou E. Effectiveness of cognitive interventions on cognitive outcomes of adult intensive care unit survivors: a scoping review. *Aust Crit Care*. 2021;34(5):473-485. doi:10.1016/j.aucc.2020.11.001
26. Lasiter S, Chrisman M, Snodgrass B, Thompson M, Harmon K. Physical and cognitive training to enhance intensive care unit Survivors' cognition: a mapping review. *Rehabil Nursing*. 2021;46(6):323-332. doi:10.1097/RNJ.0000000000000325
27. Tingey JL, Dasher NA, Bunnell AE, Starosta AJ. Intensive care-related cognitive impairment: a biopsychosocial overview. *PM R*. 2022;14(2):259-272. doi:10.1002/pmrj.12773
28. Svenningsen H, Langhorn L, Ågård AS, Dreyer P. Post-ICU symptoms, consequences, and follow-up: an integrative review. *Nurs Crit Care*. 2017;22(4):212-220. doi:10.1111/nicc.12165
29. Nedergaard HK, Jensen HI, Toft P. Interventions to reduce cognitive impairments following critical illness: a topical systematic review. *Acta Anaesthesiol Scand*. 2017;61:135-148. doi:10.1111/aas.12832
30. Holod AF, Choi J, Tate J. Optimizing recovery following critical illness: a systematic review of home-based interventions. *Home Health Care Manag Pract*. 2023;35(2):140-149. doi:10.1177/10848223221127440
31. Mehlhorn J, Freytag A, Schmidt K, et al. Rehabilitation interventions for Postintensive care syndrome: a systematic review*. *Crit Care Med*. 2014;42(5):1263-1271. doi:10.1097/CCM.0000000000000148
32. Schofield-Robinson OJ, Lewis SR, Smith AF, McPeake J, Alderson P. Follow-up services for improving long-term outcomes in intensive care unit (ICU) survivors. *Cochrane Database Syst Rev*. 2018;11(11):CD012701. doi:10.1002/14651858.CD012701.pub2
33. Geense WW, van den Boogaard M, van der Hoeven JG, Vermeulen H, Hannink G, Zegers M. Nonpharmacologic interventions to prevent or mitigate adverse long-term outcomes among ICU survivors: a systematic review and meta-analysis. *Crit Care Med*. 2019;47(11):1607-1618. doi:10.1097/CCM.0000000000003974
34. Jensen JF, Thomsen T, Overgaard D, Bestle MH, Christensen D, Egerod I. Impact of follow-up consultations for ICU survivors on post-ICU syndrome: a systematic review and meta-analysis. *Intens Care Med*. 2015;41(5):763-775. doi:10.1007/s00134-015-3689-1
35. Karnatovskaia LV, Johnson MM, Benzo RP, Gajic O. The spectrum of psychocognitive morbidity in the critically ill: a review of the literature

and call for improvement. *J Crit Care*. 2015;30(1):130-137. doi:10.1016/j.jcrc.2014.09.024
36. Stollings JL, Wilson JE, Jackson JC, Ely EW. Executive dysfunction following critical illness: exploring risk factors and management options in geriatric populations. *Curr Behav Neurosci Rep*. 2016;3(2):176-184. doi:10.1007/s40473-016-0076-3
37. Jackson JC, Ely EW, Morey MC, et al. Cognitive and physical rehabilitation of intensive care unit survivors: results of the RETURN randomized controlled pilot investigation. *Crit Care Med*. 2012;40(4):1088-1097. doi:10.1097/CCM.0b013e3182373115
38. Brummel NE, Girard TD, Ely EW, et al. Feasibility and safety of early combined cognitive and physical therapy for critically ill medical and surgical patients: the activity and cognitive therapy in ICU (ACT-ICU) trial. *Intensive Care Med*. 2013;40(3):370-379. doi:10.1007/s00134-013-3136-0
39. Wilcox ME, Brummel Nathan E, Archer Kristin W, Ely EC, Jackson James O, Hopkins RO. Cognitive dysfunction in ICU patients: risk factors, predictors, and rehabilitation interventions. *Crit Care Med*. 2013;41(9 Suppl 1):S81-S98. doi:10.1097/CCM.0b013e3182a16946
40. Hopkins R, Suchyta MR, Farrer TJ, Needham D. Improving post——intensive care unit neuropsychiatric outcomes: understanding cognitive effects of physical activity. *Am J Respir Crit Care Med*. 2012;186(12):1220-1228. doi:10.1164/rccm.201206-1022CP
41. Rengel KF, Hayhurst CJ, Pandharipande PP, Hughes CG. Long-term cognitive and functional impairments after critical illness. *Anesth Analg*. 2019;128(4):772-780. doi:10.1213/ANE.0000000000004066
42. Moore GF, Evans RE, Hawkins J, Littlecott HJ, Turley R. All interventions are complex, but some are more complex than others: using iCAT_SR to assess complexity. *Cochrane Database Syst Rev*. 2017;7(7):ED000122. doi:10.1002/14651858.ED000122
43. Trompette J, Kivits J, Minary L, Alla F. Dimensions of the complexity of health interventions: what are we talking about? A review. *Int J Environ Res Public Health*. 2020;17(9):3069. doi:10.3390/ijerph17093069
44. Salzman T, Sarquis-Adamson Y, Son S, Montero-Odasso M, Fraser S. Associations of multidomain interventions with improvements in cognition in mild cognitive impairment a systematic review and meta-analysis. *JAMA Netw Open*. 2022;5(5):e226744. doi:10.1001/jamanetworkopen.2022.6744
45. Dong Q, Yang Y, Tang Q, et al. Effects of early cognitive rehabilitation training on cognitive function and quality of life in critically ill patients with cognitive impairment: a randomised controlled trial. *Aust Crit Care*. 2023;36(5):708-715. doi:10.1016/j.aucc.2022.10.015
46. Lange S, Medrzycka-Dabrowska W, Friganovic A, Oomen B, Krupa S. Non-pharmacological nursing interventions to prevent delirium in ICU patients-an umbrella review with implications for evidence-based practice. *J Pers Med*. 2022;12(5):760. doi:10.3390/jpm12050760
47. Karnatovskaia LV, Schulte PJ, Philbrick KL, et al. Psychocognitive sequelae of critical illness and correlation with 3 months follow up. *J Crit Care*. 2019;52:166-171. doi:10.1016/j.jcrc.2019.04.028
48. Zheng Y, Zhang L, Ma S, et al. Care intervention on psychological outcomes among patients admitted to intensive care unit: an umbrella review of systematic reviews and meta-analyses. *Syst Rev*. 2023;12(1):237. doi:10.1186/s13643-023-02372-5
49. Flaws D, Patterson S, Fraser J, Tronstad O, Scott JG. Reconceptualizing post-intensive care syndrome: do we need to unpick our PICS? *Nurs Crit Care*. 2021;26(2):67-69. doi:10.1111/nicc.12545
50. Hoffmann TC, Glasziou PP, Boutron I, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ*. 2014;348:g16. doi:10.1136/bmj.g1687
51. Paul N, Ribet Buse E, Knauthe AC, Nothacker M, Weiss B, Spies CD. Effect of ICU care bundles on long-term patient-relevant outcomes: a scoping review. *BMJ Open*. 2023;13(2):e070962. doi:10.1136/bmjopen-2022-070962
52. Powell BJ, Waltz TJ, Chinman MJ, et al. A refined compilation of implementation strategies: results from the expert recommendations for implementing change (ERIC) project. *Implement Sci*. 2015;10(1):21. doi:10.1186/s13012-015-0209-1
53. Pfadenhauer LM, Gerhardus A, Mozygemba K, et al. Making sense of complexity in context and implementation: the context and implementation of complex interventions (CICI) framework. *Implement Sci*. 2017;12(1):21. doi:10.1186/s13012-017-0552-5
54. Marra A, Ely EW, Pandharipande PP, Patel MB. The ABCDEF bundle in critical care. *Crit Care Clin*. 2017;33(2):225-243. doi:10.1016/j.ccc.2016.12.005
55. Sosnowski K, Lin F, Chaboyer W, Ranse K, Heffernan A, Mitchell M. The effect of the ABCDE/ABCDEF bundle on delirium, functional outcomes, and quality of life in critically ill patients: a systematic review and meta-analysis. *Int J Nurs Stud*. 2023;138:104410. doi:10.1016/j.ijnurstu.2022.104410
56. Fuke R, Hifumi T, Kondo Y, et al. Early rehabilitation to prevent post-intensive care syndrome in patients with critical illness: a systematic review and meta-analysis. *BMJ Open*. 2018;8(5):e019998. doi:10.1136/bmjopen-2017-019998
57. Hodgson CL, Schaller SJ, Nydahl P, Timenetsky KT, Needham DM. Ten strategies to optimize early mobilization and rehabilitation in intensive care. *Crit Care*. 2021;25(1):1-324. doi:10.1186/s13054-021-03741-z

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Holm A, Thorn L, Alrø AB, Nedergaard HK, Jensen HI, Dreyer P. Non-pharmacological interventions to support the cognitive rehabilitation of patients admitted to the intensive care unit: An umbrella review. *Nurs Crit Care*. 2025;30(3):e13190. doi:10.1111/nicc.13190