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Effectiveness of Nurse-Led Early Mobility Protocols on the Outcomes of Critical Care Patients: A Systematic Review and Meta-Analysis

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ABSTRACT

Aim: This review evaluates the effectiveness of nurse-led early mobility protocols on key patient outcomes, including length of ICU and hospital stay, body function, mobility, muscle strength and mortality.

Design: Systematic review and meta-analysis.

Methods: This review was conducted, following PRISMA 2020 guidelines. Outcomes assessed included ICU stay, hospital stay, body function, mobility, muscle strength, and mortality. Meta-analysis using a random-effects model calculated pooled estimates such as weighted mean differences (WMD) and standardised mean differences (SMD) for continuous outcomes, and risk ratios (RR) for mortality.

Results: The pooled WMD indicated that nurse-led early mobility protocols significantly reduced ICU stay by 1.8 days (WMD: −1.813; 95% CI: −3.072 to −0.555) and hospital stay by 2.6 days (WMD: −2.622; 95% CI: −5.122 to −0.123). No significant effects were observed for mobility (SMD: −0.245), body function (SMD: 0.223), muscle strength (SMD: 0.385) or mortality (RR: 1.117). Heterogeneity was substantial for most outcomes. Nurse-led early mobility protocols effectively reduce ICU and hospital stay durations, suggesting their role in optimising critical care recovery. However, further high-quality studies are needed to determine their impacts on other functional outcomes and long-term recovery.

No patient or public contribution.

1 | Introduction

Critically ill patients admitted to intensive care units (ICUs) often experience extended periods of immobilisation due to the severity of their conditions, the need for invasive mechanical ventilation, and the use of sedative medications (Gitti et al. 2022). Prolonged bed rest, though often necessary in critical care, has significant negative implications, such as muscle atrophy, physical deconditioning, and increased risk of complications like deep vein thrombosis, pressure ulcers and pneumonia (Parry and Puthucheary 2015). These complications can contribute to longer ICU stays, delayed recovery and decreased quality of life post-discharge (Cho et al. 2023). The need to mitigate these detrimental effects has highlighted the importance of early mobilisation as a key intervention in critical care settings (Alaparthi et al. 2020).

Early mobility protocols are structured interventions aimed at getting critically ill patients to engage in physical activity as soon as it is deemed safe, often progressing through stages of passive range-of-motion exercises, active sitting, standing and eventually walking (Yang et al. 2023). Such protocols, particularly when led by nursing teams, are gaining traction as an effective strategy to improve patient outcomes (Mirza et al. 2024). Early mobility can help to reduce muscle weakness, improve respiratory function, and minimise the psychological effects of ICU care, such as delirium or anxiety (Azuh et al. 2016). Moreover, early mobilisation aligns with the concept of patient-centred care by actively involving patients in their own recovery and promoting autonomy to the extent possible, even within the ICU environment (Hodgson et al. 2018).

The pivotal role of nurses in the implementation of early mobility protocols cannot be overstated (Singam 2024). Nurses are at the forefront of patient care, particularly in ICUs, where continuous monitoring, individualised care planning, and prompt response to patients' changing needs are required (Academies 2021). As the healthcare providers who spend the most time with patients, nurses are uniquely positioned to drive early mobility interventions. They can assess patients' readiness for mobilisation, provide ongoing encouragement, manage any discomfort or anxiety associated with activity, and ensure that mobility goals are appropriately tailored to each patient's capabilities (Pan et al. 2023). Given their expertise in providing holistic, bedside care, nurse-led mobility initiatives have the potential to bridge the gap between medical directives and practical, day-to-day patient engagement in physical activity (Ambushe et al. 2023).

Recent studies have reported that early mobilisation can improve a wide range of clinical outcomes, including the reduction of ICU and hospital length of stay, decreased incidence of ventilator-associated pneumonia and better long-term functional recovery (Wang et al. 2020). However, the implementation of such protocols is often inconsistent, varying significantly between institutions due to differences in staff training, availability of resources, or cultural factors within healthcare teams (Mosadeghrad 2014). The complex ICU environment presents multiple barriers to early mobilisation, including patient sedation, concerns over the safety of mobilisation with invasive devices, and a lack of standardised guidelines (TEAM Study Investigators and ANZICS Clinical Trials Group 2022). In this context, nurse-led protocols have emerged as a solution that can facilitate more systematic and sustained mobilisation efforts, leveraging the nursing staff's central role in ICU care and continuity (Davis et al. 2019).

Despite these apparent benefits, questions remain regarding the optimal timing, intensity, and frequency of mobilisation activities. There are variations in practice regarding what constitutes "early" mobility and how to overcome barriers such as sedation or patient instability (Dikkema et al. 2023). Moreover, it is unclear how the presence of specific medical conditions—such as acute respiratory distress syndrome (ARDS) or multi-organ failure—should alter the approach to mobilisation (Matthay et al. 2019). There is also variability in the definitions of what outcomes should be measured, whether they be physical outcomes like muscle strength and independence in walking, or broader measures such as mental health and quality of life (Rodrigues et al. 2023). These uncertainties contribute to variability in practice, highlighting the importance of synthesising available evidence on nurse-led early mobility protocols in critically ill patients (Zhang et al. 2022). Hence, this review aims to address these gaps by evaluating the effectiveness of nurse-led early mobility protocols on a range of critical outcomes for ICU patients, including length of ICU stay, hospital stay, body function, mobility, muscle strength, and overall patient mortality.

2 | Methods

2.1 | Type of Study

Systematic Review and Meta-Analysis of Randomised Controlled Trials.

2.2 | Eligibility Criteria

The eligibility criteria were developed in accordance with the PICOS format (Population, Intervention, Comparator, Outcomes, Study Design) to identify relevant studies evaluating nurse-led early mobility protocols in critical care settings.

2.2.1 | Population (P)

The review focused on adult patients (≥ 18 years of age) admitted to intensive care units (ICUs) of any type (medical, surgical or mixed). There were no restrictions based on gender, ethnicity or specific critical care diagnosis. Studies were eligible if they included patients requiring any duration of ICU care and had the potential to benefit from early mobility interventions.

2.2.2 | Intervention (I)

The intervention of interest was a nurse-led early mobility protocol. Nurse-led protocols were defined as structured programs initiated and/or led primarily by nursing staff to promote physical activity and mobilisation of critically ill patients. The protocols could range from passive exercises (e.g., limb movements) to more active interventions (e.g., standing, walking or bed-to-chair transfers). There was no restriction in terms of frequency, intensity and duration of protocols.

2.2.3 | Comparator (C)

The comparison was usual care, defined as standard ICU care without a structured nurse-led early mobility protocol. Studies comparing different types or intensities of mobility protocols led by nurses were also eligible for inclusion. Studies without a comparator group, such as those using pre- and post-intervention measures, were also excluded.

2.2.4 | Outcomes (O)

The outcomes of interest were as follows: Length of ICU Stay, Length of Hospital Stay, Body Function, Mobility, Muscle Strength and Overall Patient Mortality.

2.2.5 | Study Design (S)

Eligible studies were randomised controlled trials (RCTs) and cluster-randomised trials. Quasi-experimental studies, observational studies, case series and case reports were excluded, as were review articles that did not provide individual patient data.

2.3 | Information Sources

The literature search was conducted across multiple databases to identify relevant studies, including Medical Literature Analysis and Retrieval System Online (MEDLINE via PubMed), Cochrane Central Register of Controlled Trials (CENTRAL) (via Cochrane library), Embase (via Elseiver), Cumulative Index to Nursing and Allied Health Literature (CINAHL) (via EBSCOhost), and Web of Science (via Clarivate Analytics). Grey literature sources were reviewed using targeted searches of clinical trial registries such as ClinicalTrials.gov, WHO International Clinical Trials Registry Platform, conference proceedings such as proceedings from critical care nursing conferences, and theses repositories such as ProQuest database. Search modes included keyword-based searches and advanced search filters to identify relevant unpublished studies and conference abstracts. All databases were searched from inception to August 2024, without language restrictions. No date restrictions were applied in the search to ensure a comprehensive inclusion of all relevant studies, regardless of their publication date. This approach was adopted to capture the evolution of nurse-led early mobility protocols over time and to incorporate historical as well as contemporary perspectives on the topic.

2.4 | Search Strategy

The search strategy was designed to capture all relevant studies pertaining to nurse-led early mobility protocols. Keywords and medical subject headings (MeSH) were used to identify studies involving "early mobility," "nurse-led," "critical care," and the specific outcomes of interest. Boolean operators (AND, OR) were used to ensure inclusivity, and truncations were applied where necessary. The search strategy used for MEDLINE was: (*"nurse-led" OR "nurse-driven"*) *AND* (*"early mobility" OR "mobilisation"*) *AND* ("intensive care unit" *OR "ICU"*) *AND* ("length of stay" *OR "mortality" OR "muscle strength" OR "mobility" OR "body function"*). The search strategy in other databases are provided in Appendix S1. For grey literature, specific strategies were developed to search trial registries by intervention and outcome, retrieve conference proceedings using "early mobility" and "critical care" filters, and identify theses using databases like ProQuest. References of included studies and relevant systematic reviews were also screened for additional eligible studies.

2.5 | Selection Process

The selection process adhered to PRISMA guidelines (Page et al. 2021). All records identified through the search were exported into reference management software (EndNote) to manage citations and remove duplicates. Following this, the Rayyan web-based tool was used to facilitate the screening process. Two independent reviewers screened titles and abstracts within Rayyan, utilising its blind review feature to minimise bias. Studies meeting the inclusion criteria were then subjected to a full-text review within the tool. Any discrepancies in study selection were resolved through discussion, and if consensus was not achieved, a third reviewer was consulted to make the final decision. The use of Rayyan streamlined the selection process, ensuring consistency, transparency and adherence to PRISMA guidelines.

2.6 | Data Collection Process

Data extraction was performed independently by two reviewers using a standardised data extraction form. The extracted data included information on study characteristics (author, year, country), participant demographics (age, gender, health status), intervention details (type, frequency, duration), comparator details, and outcomes (length of ICU and hospital stay, body function, mobility, muscle strength, and mortality). Disagreements during data extraction were resolved by discussion between the reviewers or, if necessary, consultation with a third party. To ensure accuracy and consistency, data extracted by the two independent reviewers were cross-verified for completeness and accuracy. Discrepancies were identified and discussed between the reviewers until a consensus was reached. If disagreements persisted, a third reviewer was consulted to adjudicate and finalise the extracted data. All resolved data discrepancies and decisions were documented for transparency. The finalised data were entered into a shared electronic spreadsheet for further analysis, ensuring a systematic and traceable data pooling process.

2.7 | Risk of Bias Assessment

The risk of bias was assessed independently by two reviewers using the Cochrane Risk of Bias 2 (RoB 2) tool to assess the quality of included randomised controlled trials (Sterne et al. 2019). Studies were rated as having low, some concerns or high risk of bias based on sequence generation, allocation concealment, blinding, incomplete outcome data, and selective outcome reporting (Sterne et al. 2019). Any disagreements in the ratings were resolved through discussion between the reviewers, and if consensus could not be reached, a third reviewer was consulted for adjudication. For studies rated as having a high risk of bias, sensitivity analyses were conducted to evaluate their impact on the overall findings. High-risk studies were carefully reviewed, and their contribution to the pooled effect sizes was scrutinised to ensure robustness and reliability of the results.

2.8 | Data Synthesis

A meta-analysis was conducted using STATA version 17 software. The outcomes were synthesised using the random-effects inverse-variance model to account for heterogeneity among studies. For continuous outcomes (e.g., length of stay, muscle strength), weighted mean differences (WMD) or standardised mean differences (SMDs) and 95% confidence intervals (CIs) were calculated. Dichotomous outcomes (e.g.,

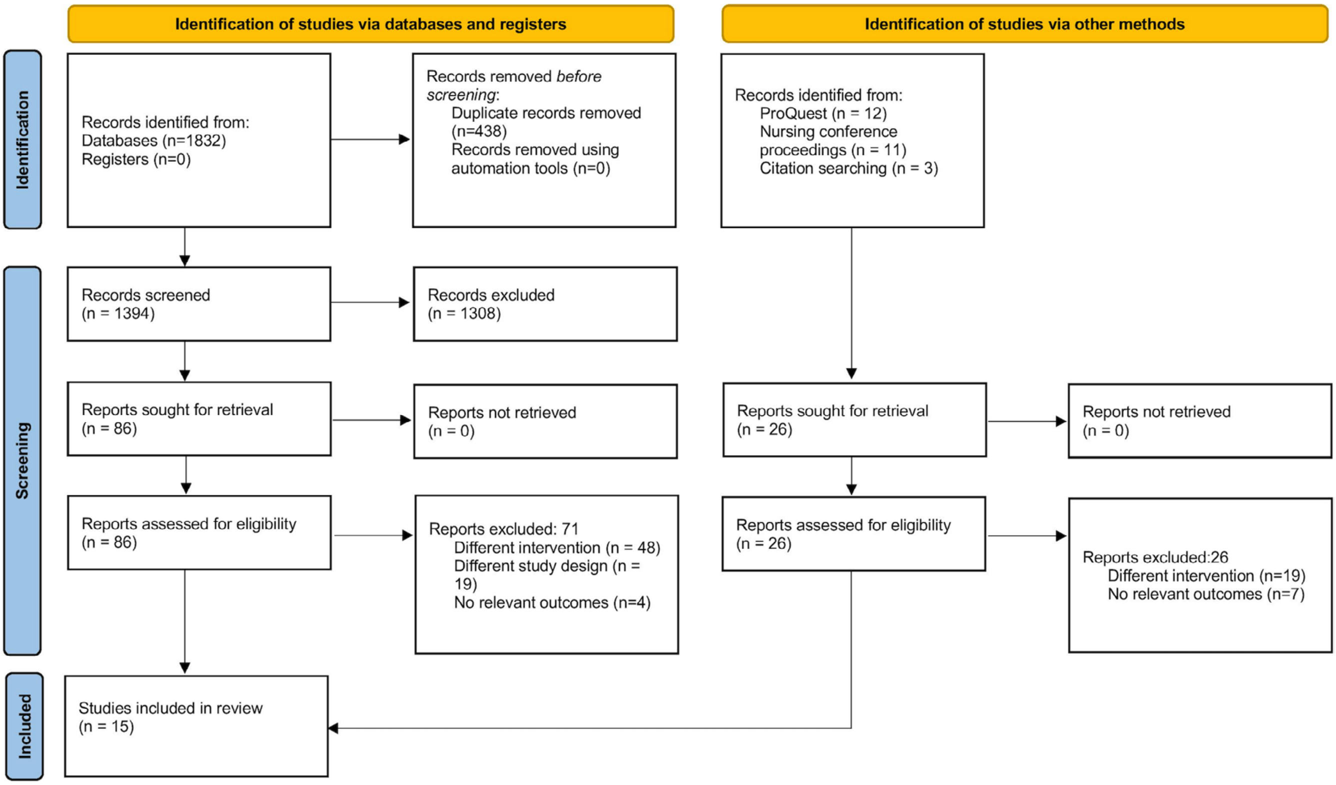

FIGURE 1 | PRISMA flowchart.

mortality) were pooled using risk ratios (RRs) with 95% CIs. Statistical heterogeneity was assessed using Cochran's Q and the I^2 statistic. Values of I^2 greater than 50% were considered indicative of substantial heterogeneity. Funnel plots were visually assessed, and Egger's test was conducted where applicable. p values less than 0.05 were significant publication bias (Cumpston et al. 2019).

3 | Results

3.1 | Search Result

A total of 1832 records were identified, and 438 duplicates were removed. After screening 1394 records, 86 full-text reports were assessed, with 71 reports excluded due to different interventions, study design, or irrelevant outcomes, resulting in 15 studies being included in the final review (Figure 1) (Andelic et al. 2012; Dong et al. 2014, 2016, 2021; Eggmann et al. 2018; Fossat et al. 2018; Gruther et al. 2017; Hodgson et al. 2016; Machado et al. 2017; McWilliams et al. 2018; Morris et al. 2016; Nydahl et al. 2020; Sarfati et al. 2018; Schaller et al. 2016; Schweickert et al. 2009).

3.2 | Characteristics of the Included Studies

The 15 included studies span multiple countries, including Norway, China, France, Australia, and the USA. Participants were typically ICU patients with severe conditions such as traumatic brain injury or those requiring mechanical ventilation, with sample sizes ranging from 38 to 314. Interventions mostly focused on early rehabilitation approaches compared to standard or delayed care. Control groups varied from receiving standard care without structured interventions to delayed rehabilitation. Risk of bias assessment rated 3 studies as high risk, 5 with some concerns and 7 as low risk (Table 1).

3.3 | ICU Stay

Analysis included data from 11 studies, comprising 1127 participants, to evaluate the effect of nurse-led early mobility protocols on length of ICU stay. The pooled WMD was −1.813 days (95% CI: −3.072 to −0.555, $p = 0.005$), indicating that early mobility interventions led to a significant reduction in ICU stay compared to standard care (Figure 2). This suggests that patients who received nurse-led early mobility protocols, on average, spent 1.8 fewer days in ICU. However, substantial heterogeneity was observed among the studies ($I^2 = 86.3\%$, Cochran's $Q = 73.18$, $p < 0.001$). Funnel plot was symmetrical (Figure S1) and Egger's test ($p = 0.31$) showed non-significant results indicating no publication bias.

3.4 | Hospital Stay

Analysis included data from 10 studies, comprising 1034 participants, to evaluate the effect of nurse-led early mobility protocols on length of hospital stay. The pooled WMD was −2.622 days (95% CI: −5.122 to −0.123, $p = 0.040$), indicating that early mobility interventions significantly reduced hospital stay compared to standard care (Figure 3). This suggests that patients who received nurse-led early mobility protocols, on average, spent

TABLE 1 | Characteristics of the included studies ($N = 15$).

Study identifier	Country	Participants details	Intervention details	Control group details	Sample size	Mean age (years)	Outcomes assessed	Risk of bias
Andelic 2012	Norway	Patients with severe traumatic brain injury	Early comprehensive rehabilitation in SICU	Inpatient brain injury rehabilitation in sub-acute rehabilitation departments after a waiting period at a local hospital or nursing home, or received no inpatient rehabilitation	61	29.4	ICU stay Hospital stay Body function Mortality	High
Dong 2014	China	Mechanically ventilated patients, with tracheal intubation or tracheostomy more than 48 h and less than 72 h	Early rehabilitation therapy performed twice daily, including various physical activities.	Routine treatment without specific rehabilitation intervention.	60	55.4	ICU stay Mobility Mortality	Some concerns
Dong 2016	China	Patients who underwent coronary artery bypass surgery (CABG)	Early rehabilitation therapy with six steps in the ICU after CABG.	Rehabilitation therapy started only after leaving the ICU.	106	$I = 62.6$ C = 60.2	ICU stay Hospital stay	Some concerns
Dong 2021	China	Patients who had mechanical ventilation (MV) for over 72 h in the ICU	Early rehabilitation therapy including six levels of exercises tailored to patient condition.	Standard care without rehabilitation exercises.	80	$I = 59.05$ C = 64.44	ICU stay	Low
Eggman 2018	Switzerland	Critically ill adults expected to stay on mechanical ventilation for at least 72 h.	Early, progressive endurance and resistance training combined with early mobilisation.	European standard physiotherapy	115	$I = 64 \pm 15$ $C = 63 \pm 15$	ICU stay Hospital stay Mobility Body function Muscle strength Mortality	Low
Fossat 2018	France	Patients admitted to the ICU, who were expected to need care for more than 48 h	Standardised early rehabilitation plus each weekday, 15-min session of leg cycling exercise on a cycle ergometer and a 50-min electrical stimulation session of the quadriceps muscles.	Standardised early rehabilitation only	314	66	Mobility Body function Muscle strength Mortality	Some concerns

(Continues)

TABLE 1 | (Continued)

Study identifier	Country	Participants details	Intervention details	Control group details	Sample size	Mean age (years)	Outcomes assessed	Risk of bias
Gruther 2017	Austria	Survivors of critical illness	Early rehabilitation program for 2h, 5 days a week	Standard care with single physical therapy sessions as ordered by the primary care team after transfer from the ICU to the general ward	53	$I=64$ C = 59	Hospital stay Muscle strength	High
Hodgson 2016	Australia	Critically ill adults expected to be invasively ventilated the day after tomorrow, more than 18 years old, and less than 48 h	Early goal-directed mobilisation based on the ICU Mobility Scale.	Standard care with no structured mobilisation protocol.	50	61	ICU stay Hospital stay Mobility Mortality	High
Machado 2017	Brazil	ICU patients (≥ 18 years) on mechanical ventilation, with stable hemodynamics.	Conventional physical therapy and engaged in passive exercise on a leg cycle ergometer.	Conventional physical therapy without passive cycling exercise.	38	$I=44.64$ C = 45.13	ICU stay Hospital stay Muscle strength	Low
McWilliams 2018	UK	Mechanically ventilated patients admitted to ICU for ≥ 5 days.	Early and enhanced rehabilitation with structured mobility program	Standard physiotherapy care	103	62	ICU stay Hospital stay Body function Muscle strength Mortality	Low
Morris 2016	USA	Adult patients (mean age, 58 years; women, 55%) admitted to the ICU with acute respiratory failure requiring mechanical ventilation	Daily therapy until hospital discharge, consisting of passive range of motion, physical therapy, and progressive resistance exercise	Weekday physical therapy when ordered by the clinical team	300	58	ICU stay Hospital stay Body function Muscle strength	Low
Nydahl 2019	Germany	Mechanically ventilated patients in the ICU, ≥ 18 years and order for mobilisation present.	Mobilisation protocol involving physiotherapy and occupational therapy	Usual ICU care	272	$I=51$ C = 71	Mortality	Some concerns
Sarfati 2018	France	ICU patients at least 18 years, and MV for 3 days or more with no expectation of weaning on the day of screening.	Passive tilting and rehabilitation therapy to minimise ICU-acquired weakness.	Standard care with no passive tilting interventions.	145	64	ICU stay Hospital stay Muscle strength Mortality	Low

(Continues)

TABLE 1 | (Continued)

Study identifier	Country	Participants details	Intervention details	Control group details	Sample size	Mean age (years)	Outcomes assessed	Risk of bias
Schaller 2016	Austria, Germany, USA	SICU patients who were aged 18 years or older, were mechanically ventilated for less than 48 h, and expected to require mechanical ventilation for at least another 24 h at the time of screening.	Early, goal-directed mobilisation therapy during ICU stay.	Standard treatment without goal-directed mobilisation therapy.	200	$I=66$ C = 64	Body function Mortality	Some concerns
Schweicker 2009	USA	Sedated adults (≥ 18 years) in ICU with mechanical ventilation for less than 72 h.	Early exercise and mobilisation during daily interruption of sedation.	Daily interruption of sedation with therapy as ordered by primary care team.	104	$I=57.7$ C = 54.4	ICU stay Hospital stay Body function Mortality	Low

Abbreviations: C, Control; CABG, coronary artery bypass surgery; I, Intervention; ICU, Intensive care unit; MV, Mechanical Ventilation; SICU, Surgical Intensive Care Unit; USA, United States of America.

approximately 2.6 fewer days in the hospital. However, substantial heterogeneity was observed among the studies ($I^2=92.3\%$, Cochran's $Q=117.38$, $p<0.001$). Funnel plot was asymmetrical (Figure S2). However, the Egger's test ($p=0.22$) was not significant. Nonetheless, publication bias is possible given the asymmetric nature of the funnel plot.

3.5 | Mobility

Analysis included data from 4 studies, comprising 485 participants, to evaluate the effect of nurse-led early mobility protocols on patients' mobility. The pooled SMD was −0.245 (95% CI: −1.725 to 1.234, $p=0.745$), indicating that early mobility interventions did not significantly improve or reduce mobility compared to standard care (Figure 4). Furthermore, substantial heterogeneity was observed among the studies ($I^2=97.2\%$, Cochran's $Q=105.87$, $p<0.001$). Publication bias assessment was not possible due to a limited number of studies.

3.6 | Body Function

Analysis included data from 7 studies, comprising 991 participants, to evaluate the effect of nurse-led early mobility protocols on patients' body function. The pooled SMD was 0.223 (95% CI: −0.331 to 0.777, $p=0.430$), indicating that early mobility interventions did not result in a significant improvement in body function compared to standard care (Figure 5). The findings suggest that the effect of nurse-led early mobility protocols on body function was variable and generally inconclusive. There was also substantial heterogeneity among the included studies ($I^2=94.0\%$, Cochran's $Q=100.32$, $p<0.001$). Publication bias assessment was not possible due to a limited number of studies.

3.7 | Muscle Strength

Analysis included data from 7 studies, comprising 847 participants, to evaluate the effect of nurse-led early mobility protocols on muscle strength. The pooled SMD was 0.385 (95% CI: −0.327 to 1.098, $p=0.289$), indicating no improvement in muscle strength due to early mobility interventions compared to standard care (Figure 6). Substantial heterogeneity was observed among the included studies ($I^2=95.6\%$, Cochran's $Q=136.46$, $p<0.001$). Publication bias assessment was not possible due to the limited number of studies.

3.8 | Mortality

Analysis included data from 10 studies, comprising 1446 participants, to evaluate the effect of nurse-led early mobility protocols on overall patient mortality. The pooled RR was 1.117 (95% CI: 0.897 to 1.389, $p=0.323$), indicating no difference in mortality between the intervention and control groups (Figure 7). Importantly, there was no evidence of heterogeneity among the included studies ($I^2=0.0\%$, Cochran's $Q=8.72$, $p=0.463$). Funnel plot was symmetrical (Figure S3) and Egger's test ($p=0.21$) showed non-significant results indicating no publication bias.

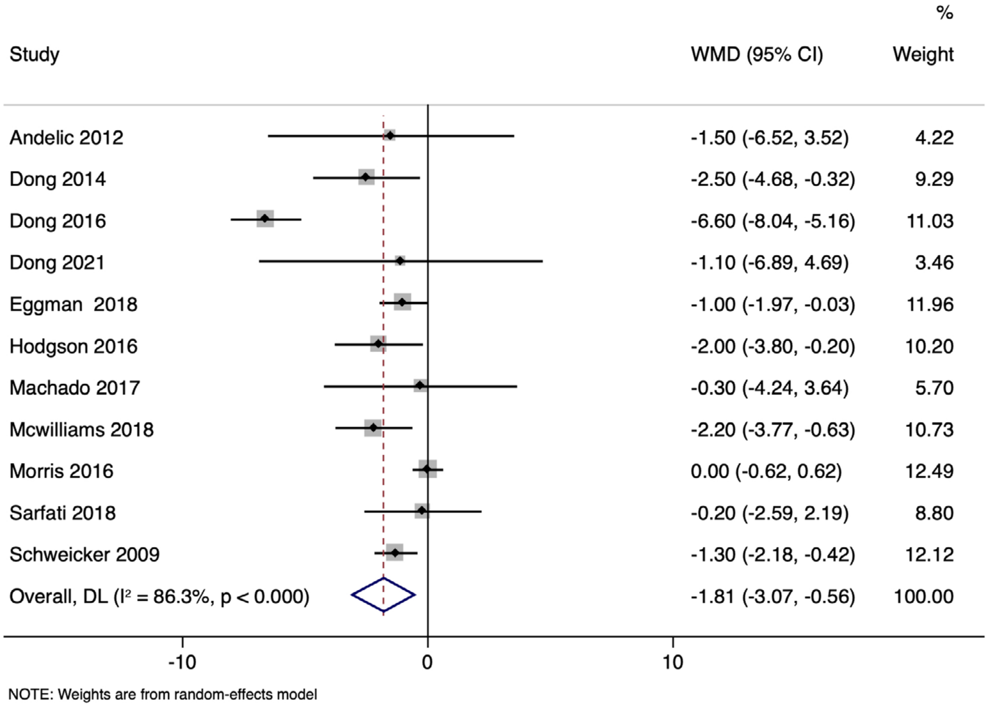

FIGURE 2 | Forest plot for ICU stay.

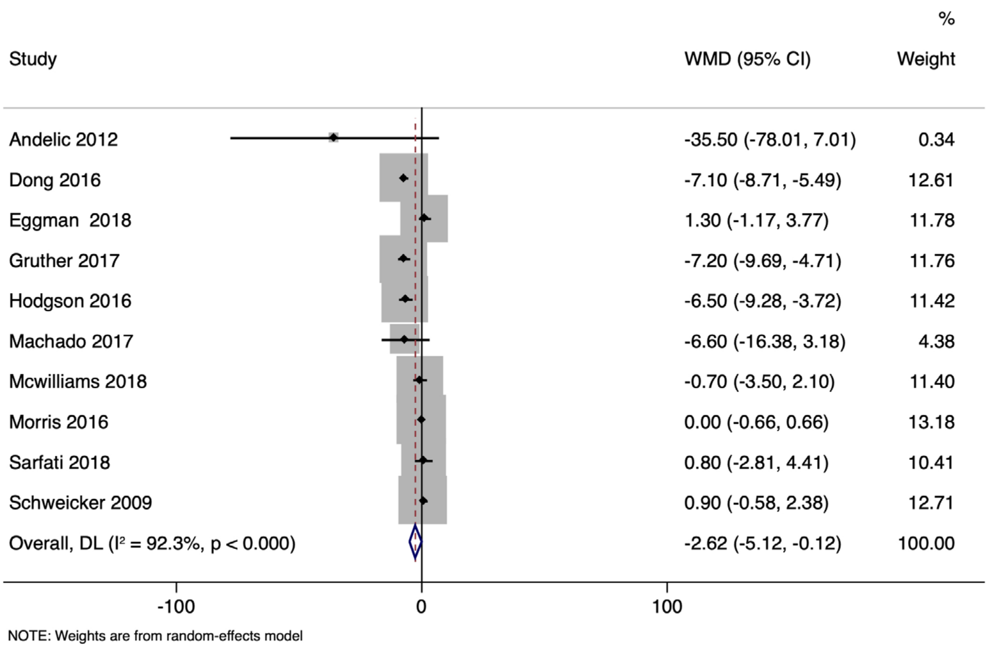

FIGURE 3 | Forest plot for hospital stay.

4 | Discussion

This systematic review and meta-analysis evaluated the effectiveness of nurse-led early mobility protocols on several key outcomes, including length of ICU stay, hospital stay, mobility, body function, muscle strength, and overall patient mortality. Overall, 15 studies involving critical care patients were included in the analysis. The findings indicated that nurse-led early mobility protocols significantly reduced the length of ICU stay and hospital stay but did not have a significant impact on mobility, body function, muscle strength, or mortality.

The most striking finding of this analysis was the significant reduction in both ICU and hospital stays among patients who received nurse-led early mobility interventions. Specifically, the pooled WMD for ICU stay was −1.813 days, indicating that these protocols were effective in reducing ICU duration. This is consistent with previous studies that suggest early mobility

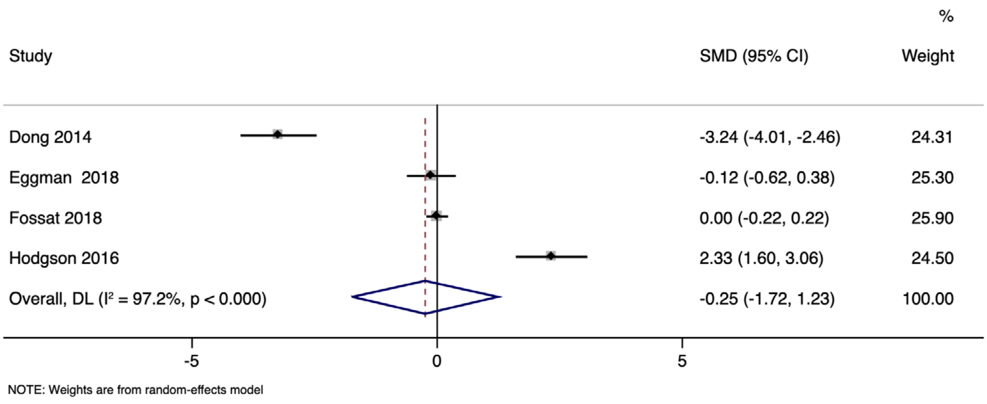

FIGURE 4 | Forest plot for mobility.

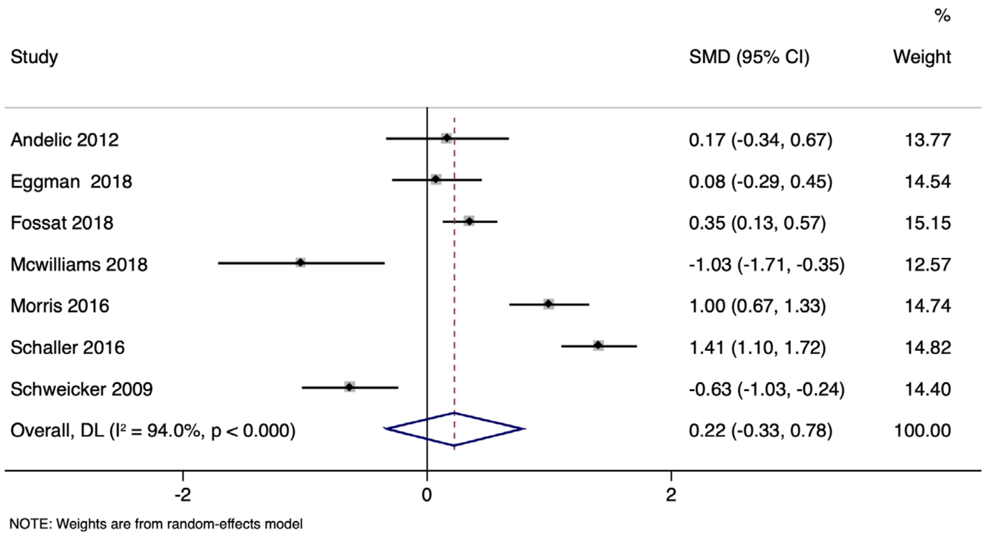

FIGURE 5 | Forest plot for body function.

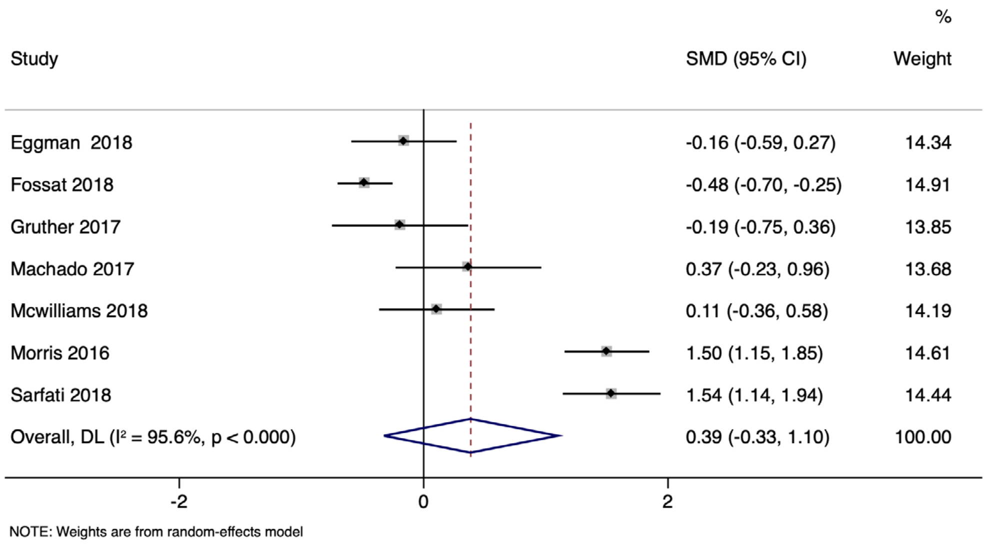

FIGURE 6 | Forest plot for muscle strength.

can lead to better outcomes in critically ill patients, such as improved respiratory function and decreased ICU-acquired weakness, thereby reducing ICU time (Zhang et al. 2019). Similarly, the pooled WMD for hospital stay was −2.622 days, suggesting that early mobility not only shortens ICU stay but also reduces overall hospitalisation. These results align with prior studies

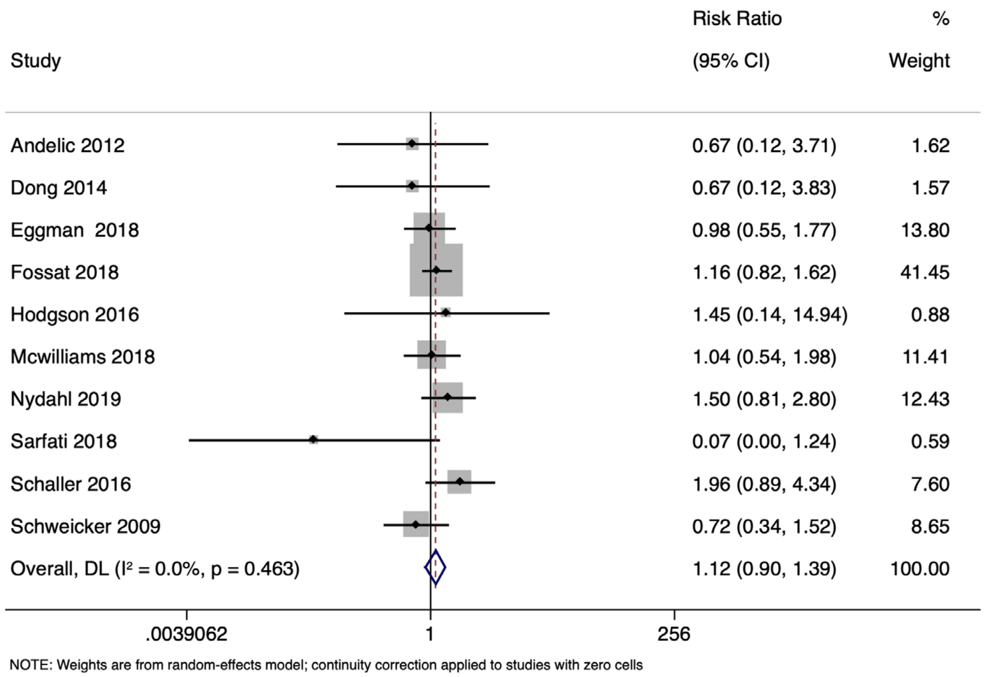

FIGURE 7 | Forest plot for mortality.

that have shown early mobility interventions can enhance recovery and reduce healthcare costs through earlier discharge (Zhang et al. 2019). However, while the findings indicate positive effects on stay durations, the substantial heterogeneity observed across the studies suggests that variability in protocols, patient characteristics, and implementation methods could impact these outcomes. Variability in training, staffing, and adherence to protocols is likely contributing factors, as demonstrated in previous literature highlighting barriers to early mobilisation (Alaparthi et al. 2020).

In terms of patient mobility, this meta-analysis showed that nurse-led early mobility interventions did not result in significant improvement in mobility, with a pooled SMD of −0.245. This result contrasts with some previous studies that have reported improved functional independence and mobility among patients receiving early mobilisation (Zang et al. 2020). The high level of heterogeneity observed ($I^2 = 97.2\%$) may partly explain the discrepancy. Differences in how mobility was assessed, including the use of diverse functional scales, as well as patient populations with varying baseline physical statuses, likely contributed to these mixed results. The effect of early mobilisation on mobility might also depend on the duration and intensity of the intervention, which varied significantly across the included studies (Escalon et al. 2020). Additionally, factors like patient motivation and pre-existing comorbidities could have influenced the ability to improve mobility, which was not always accounted for in the included studies.

For body function and muscle strength, the pooled results did not demonstrate significant improvements. The body function outcome had a pooled SMD of 0.223, while muscle strength had a pooled SMD of 0.385, neither of which was statistically significant. These findings are surprising, as previous research has indicated that early mobility can maintain or even improve muscle strength and physical function in critically ill patients (Zang et al. 2020). The lack of observed benefit could stem from the relatively short duration of follow-up in many of the included studies, as improvements in body function and muscle strength may require more extended periods of intervention to become apparent. Additionally, variations in how body function and muscle strength were assessed across studies, along with differing patient baseline conditions, may have led to inconsistent findings. Moreover, it is possible that early mobility alone might not suffice to counteract muscle atrophy in critically ill patients without complementary interventions such as targeted physiotherapy or nutritional support (Yang et al. 2023).

Regarding mortality, the meta-analysis found no significant difference between patients who received early mobility protocols and those who did not ($RR = 1.117$, $p = 0.323$). This finding aligns with some previous reviews that found early mobility may improve functional outcomes without necessarily impacting mortality rates (Wang et al. 2023). The lack of mortality benefit could be because early mobility primarily affects quality of life and physical function rather than directly influencing survival (Alaparthi et al. 2020). Additionally, factors such as the severity of underlying conditions, variability in ICU practices and differing levels of patient frailty could have masked the potential effect on mortality (de Biasio et al. 2020). Previous literature suggests that while early mobility may mitigate complications and improve recovery, mortality is influenced by numerous other factors, including the nature of the critical illness, comorbid conditions, and overall healthcare quality, which might not be directly addressed by early mobility alone (Zang et al. 2020).

In comparison to previous literature, this review reinforces the importance of early mobilisation in reducing ICU and hospital stay duration but raises questions regarding its impact on other key outcomes like mobility, body function, and mortality. The mixed results for mobility, body function, and muscle strength might highlight the challenges in generalising these interventions across different patient populations and settings. Furthermore, while the reduction in ICU and hospital stay durations is promising, the limited impact on other outcomes underscores the need for a more nuanced understanding of how early mobility protocols can be optimised to benefit a broader range of patient outcomes. The significant heterogeneity observed across most outcomes also indicates a need for more standardised protocols and greater consistency in intervention delivery, which could enhance the generalisability and effectiveness of these interventions across various critical care settings.

The key strength of this review lies in its comprehensive inclusion of only RCTs, providing a robust and high-level evidence with regard to the effectiveness of nurse-led early mobility protocols across multiple outcomes in critical care settings. The inclusion of both ICU and hospital length of stay as primary outcomes offers valuable insights into the impact of early mobility on healthcare resource utilisation. However, significant limitations include the high heterogeneity observed across the studies and the inclusion of a limited number of studies for certain outcomes, which may reduce the robustness of the findings. Additionally, differences in intervention protocols, patient populations and outcome measures posed challenges for synthesising consistent conclusions.

Nonetheless, this study has several implications. Nurse-led early mobility protocols represent a practical, scalable approach to improving outcomes in critically ill patients. This review provides a clearer understanding of the effectiveness of these protocols and offers actionable insights that can be used to develop standardised guidelines. These findings will inform ICU practice, empowering nurses to adopt early mobility as a core component of patient care and ultimately enhance the quality of life for critically ill patients both during and after their ICU stay.

Future research should focus on conducting larger, well-designed randomised controlled trials that standardise early mobility protocols across diverse ICU settings to reduce heterogeneity. Studies should also include longer follow-up periods to assess the sustained effects of early mobility on muscle strength, mobility, and body function. Investigations into complementary interventions, such as tailored physiotherapy and nutritional support, would help determine if these can enhance the benefits of early mobility. Finally, a greater focus on assessing quality of life and functional independence post-ICU discharge is needed.

5 | Conclusion

This review indicates that nurse-led early mobility protocols significantly reduce ICU and hospital stays, highlighting their importance in critical care. However, no significant effects were observed on mobility, body function, muscle strength, or mortality, reflecting the need for standardised and multifaceted interventions. While early mobility appears effective for reducing hospital duration, more rigorous studies are necessary to evaluate its broader impacts on patient recovery and long-term outcomes.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

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

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.