

REVIEW ARTICLE

The efficacy and safety of early mobilization in mechanically ventilated ICU patients: a systematic review of randomized controlled trials

Abdullah I. Aedh^{1,2}, Khalid Atyah Alharbi^{3*}, Norah Muidh Alwadai⁴, Ziyad Mohammed Alqurayqiri³, Ammar Abdulkhaliq Alshuaibi³, Muhannad Muslih Alhazmi³, Bandar Halil Alyoubi³, Abdulelah Mohammed Alotaibi³, Abdullah Hasan Mahallawi³, Sulaiman Shakir Alkayal³

ABSTRACT

Commonly recommended in the prevention of intensive care unit-acquired weakness (ICU-AW) in critically ill patients, early mobilization (EM) is an emerging therapeutic strategy, but its efficacy, harm, and optimal intensity remain poorly defined. Based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guidelines, 13 randomized controlled trials (RCTs) of EM compared to usual care were examined. The analyses assessed EM efficacy (ICU-AW frequency, clinical function) and safety (adverse outcomes). These data pools were incorporated to identify the overall effects of these outcomes and to evaluate the potential for bias in pooled studies. EM also showed improvement in decreasing ICU-AW. Pooled data incidence rates within intervention groups fell to as low as 2%, compared to a level of 16%-54% within control groups. As the Barthel Index tracks, functional status post-hospital discharge significantly improved with EM. That effectiveness was, however, partially countered by a strong safety signal. In the most extensive RCT, adverse events were observed in 9.2% of patients receiving EM versus 4.1% in controls. Higher-dose EM regimens did not improve primary outcomes (e.g., “days alive and out of hospital”) compared to standard care. There was no clear effect on mortality. EM was both a high-risk, high-return strategy and was recovery-related, as well as injury-promoting. They do not support the “more is better” mantra. Clinical practice should therefore focus on the use of EM that is standardized, safety-oriented, versus aggressive high-intensity EM techniques in medical treatment. Further research should focus on individualized rehabilitation, showing patient subgroups of patients more amenable to specific mobilization methods.

Keywords: Early mobilization, intensive care unit, ICU-acquired weakness, critical illness, systematic review.

Introduction

Prolonged mechanical ventilation and immobility in the intensive care unit (ICU) are strongly associated with neuromuscular weakness, delirium, extended hospitalization, and poor post-discharge recovery [1]. Intensive care unit-acquired weakness (ICU-AW) develops in up to 40% of mechanically ventilated patients and manifests as diffuse, symmetrical muscle weakness involving both limb and respiratory muscles, which often persists even for months after discharge [2]. This is very much in line with the findings of Yang et al. [3], who saw that mind-muscle dysfunction made patients stay

ventilated for longer and took too long to recover, some even dying, amidst high costs of care.

Correspondence to: Khalid Atyah Alharbi

*Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia.

Email: alharbikh22@gmail.com

Full list of author information is available at the end of the article.

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Medics have discovered early mobilization (EM), defined as the initiation of active or assisted physical activity within the first 24-72 hours of ICU admission or mechanical ventilation, as a good approach to counter the adversities mentioned above. EM is highly praised as the cornerstone method for rehabilitative care [4]. The common interventions in EM include passive and active range of motion exercises, in-bed cycling, sitting, standing, and ambulation under a doctor's supervision. Research showed that EM improves muscle strength, reduces the risk of ICU-AW, reduces mechanical ventilation duration, and quickens recovery [5,6]. Physiological outcomes include improved cardiopulmonary function, reduced venous stasis, enhanced oxygen utilization, and attenuation of inflammatory and catabolic pathways [7].

Several randomized controlled trials (RCTs) have demonstrated that EM shortened delirium duration and improved recovery but also increased adverse events at higher mobilization intensities [8-10]. Even Morris et al. [11] found that EM did not reduce hospital or 180-day mortality by any significant margins, only shortened ICU stay and ventilation duration by like 2 days each. Similarly, some reviews reported that EM is safe with many functional benefits [12,13]. Therefore, this study aimed to observe the evidence and evaluate the impact of EM on mortality, duration of mechanical ventilation, ICU and hospital length of stay, and adverse events.

Subjects and Methods

Search strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework was used with an aim to preserve the highest standards throughout this evaluation so as to maximize scientific transparency and clarity. First, a protocol was created so that the study objectives, search strategy, study criteria, and data gathering procedure could be determined. The search strategy used broad terms to capture all relevant studies. The English terms for the topic were combined, such as "EM," "physical therapy," "rehabilitation," "mechanically ventilated," "critically ill," and "ICU." To ensure a comprehensive search, any methodological filters were not applied.

Eligibility, data extraction, and management

Two of the study researchers independently reviewed every title and abstract. All full-text articles that were thought to be pertinent to the inclusion criteria were extracted and assessed. Discussion and, if needed, contact with a third reviewer were used to settle any disputes that arose throughout this selection process. Data extraction was completed using a template that was made previously.

Inclusion and exclusion criteria

RCTs and studies involving adults on mechanical ventilation in the ICU were included. Those who met the eligibility requirements were comparing standard treatment or postponed rehabilitation with an organized EM or physiotherapy program. Outcomes, including death, length of stay in the ICU and hospital, length of mechanical ventilation, functional recovery, and safety incidents, were observed. However, studies that were not published in English were excluded.

Statistical analysis

All continuous outcomes as mean differences with 95% confidence intervals (CIs) were pooled. Other outcomes, like mortality, were analyzed as risk ratios. A random-effects model was used to calculate pooled estimates. Statistical heterogeneity was quantified using the I^2 statistic and Cochran's Q test, with $P \geq 50\%$ indicating substantial heterogeneity. The studies with a high risk of bias were not considered when doing sensitivity analyses. Publication bias was examined using funnel plots. All analyses were conducted using Review Manager version 5.4.1 and R software, with $p < 0.05$ considered statistically significant.

Results

There were 406 articles found in the initial search from the various databases: PUBMED - 342, Web of Science - 28, Google Scholar - 32, and Cochrane - 4. The studies were then screened through the above eligibility criteria, with a final number of 27 studies eligible for inclusion and analysis (Figure 1).

Study characteristics

The essential characteristics of the studies included in this review were presented (Table 1).

Meta-analysis

Efficacy

Across the included trials, EM did not demonstrate a consistent benefit on continuous functional outcomes. Pooled analysis showed no significant improvement in overall functional ability, muscle strength, or physical health scores (SMD = 0.17; $p = 0.22$). The Barthel Index was not significantly useful for subgroup assessment (SMD = 0.10; $p = 0.69$). Likewise, muscle strength indices (MRC-SS) did not differ significantly among groups. These results were further complicated by substantial heterogeneity among the studies. Although these findings were concerning, EM had strong positive effects for a number of important clinical considerations. The intervention was associated with a significantly reduced rate of ICU-AW odds ratio (OR = 0.26; $p = 0.0007$). EM in patients was also associated with almost twice the odds of an independent functional status when the patient left the hospital (OR = 1.95, $p = 0.04$).

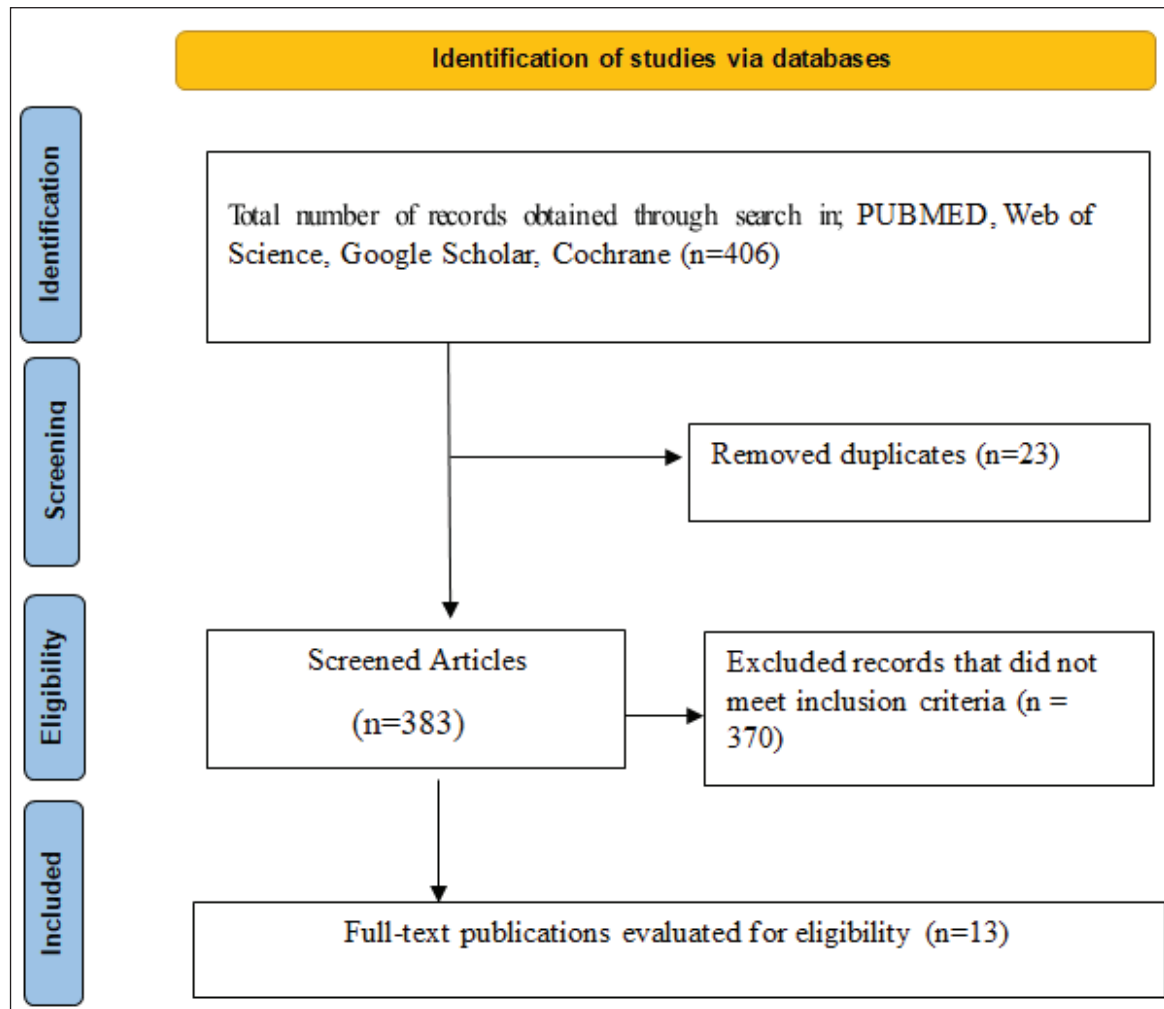


Figure 1. PRISMA flow diagram.

Although the data varied, the consistent direction and size of this effect across studies clearly support EM for these purposes (Figures 2 and 3).

Safety

According to pooled data from three studies, there was no significant difference between the EM and control groups. Although the point estimates implied greater risk with EM, the pooled (OR = 1.99; 95% CI: 0.41-9.60) was insignificant ($p = 0.39$). The large CI suggested a great deal of imprecision, and the actual direction of the effect remains uncertain. Moderate heterogeneity was present ($I^2 = 54\%$), reflecting variability among the included studies (Figure 4).

Risk of publication bias assessment

An asymmetric funnel plot, indicating the presence of outliers on both sides, was observed. The clustering of studies on both sides indicated a low possibility of publication bias in both groups (Figure 5).

Risk of bias

The methodological quality of the included studies was evaluated using the Cochrane Risk of Bias tool. Overall, the evidence showed a mixed risk of bias, with strengths in some domains but significant problems in others that might impact the results.

A substantial majority of the studies were found to have a low risk of bias in the domains of random sequence generation and allocation concealment, indicating that the mechanisms for randomly allocating individuals to intervention and control groups were typically reliable. This gives more confidence that the groups were comparable at the start of the trials. Furthermore, most studies had a low risk of attrition bias (incomplete outcome data) and selective reporting bias, indicating that the data analysis was thorough and that pre-specified outcomes were reported as intended.

However, a significant methodological issue was discovered regarding blinding. A significant majority of the studies were found to have a high risk of performance

Table 1. Characteristics of the included studies.

Authors (year)	Study type	Intervention	Comparator	Sample size (N)	Timing	Outcome (Results)	Conclusion
Zhou et al. [4]	RCT (Single-center, 3-arm)	Early individualized progressive mobilization + guideline-based early nutrition (within 48 hours ICU admission), twice-daily 20-30 minutes sessions	EM alone or standard ICU care	150 (50 per group)	Mobilization within 24 hours of ICU admission; nutrition within 48 hours	ICU-AW at discharge. Incidence was 16% (control) versus 2% in both EM and EMN groups ($p = 0.014$). EMN also improved muscle strength ($p = 0.028$) and nutritional status ($p = 0.031$) with no difference in mortality or ventilation time.	Both early mobilization and mobilization plus nutrition reduced ICU-AW and improved functional independence vs standard care. EMN further enhanced muscle strength and nutrition but showed no major difference from EM alone in ICU-AW prevention
Eggmann et al. [5]	RCT	Early combined endurance and resistance training (ERT) integrated with EM, initiated within 48 hours of ICU admission; daily sessions (20-60 minutes) including cycling and resistance exercises	Standard physiotherapy with EM and respiratory therapy (usual care)	115 (58 intervention, 57 control)	Physiotherapy started within 48 hours of ICU admission (median 1.9 days), while 97% still ventilated	6-minute walk distance and functional independence measure at discharge showed no significant difference between groups (123 vs. 100 m; $p = 0.54$; FIM 98 vs. 98; $p = 0.31$). Adverse events were rare (0.6%), and sedation days were fewer in the intervention group.	Early endurance & resistance training during mechanical ventilation was safe but did not significantly improve functional capacity or independence compared to standard early physiotherapy. A minor benefit in long-term mental health was noted at 6 months.
Patel et al. [6]	RCT	Early physical and occupational therapy (progressive mobilization including out-of-bed activity, ADL simulation) was initiated within 96 hours of mechanical ventilation and continued daily until discharge	Usual care with physical and occupational therapy is provided when ordered by the ICU team or after extubation	198 (99 per group)	Therapy started a median of 1.1 days post-intubation versus 4.7 days in control	1-year cognitive impairment (MoCA < 26). Rates were 24.2% (intervention) versus 43.4% (control); difference - 19.2%, $p = 0.004$. EM also reduced ICU-AW (0% vs. 14%, $p < 0.001$) and improved physical-component QoL scores at 1 year.	EM within 96 hours of mechanical ventilation significantly improved long-term cognitive outcomes, neuromuscular strength, and physical quality of life without major adverse events, making it the first intervention to demonstrate durable cognitive benefits in ICU survivors.
Schweickert et al. [7]	RCT (Single-center)	Daily interruption of sedation combined with early physical and occupational therapy (PT/OT) beginning within 48-72 hours of mechanical ventilation; progressive activities from passive ROM to ambulation	Daily interruption of sedation with usual care and PT/OT initiated only after a physician's order or extubation	104 (49 intervention, 55 control)	Therapy started a median of 1.5 days post-intubation versus 7.4 days in control.	Return to independent functional status at hospital discharge (ability to perform 6 ADLs + walk independently). Achieved in 59% versus 35% ($p = 0.02$; OR 2.7, 95% CI 1.2-6.1). Duration of delirium was halved (2 vs. 4 days, $p = 0.02$) and ventilator-free days were greater (23.5 vs. 21.1, $p = 0.05$).	EM with concurrent sedation interruption was safe and resulted in faster recovery of functional independence, reduced delirium, and more ventilator-free days compared with standard care.

(Continued)

Authors (year)	Study type	Intervention	Comparator	Sample size (N)	Timing	Outcome (Results)	Conclusion
Hodgson et al. [8]	Multicenter RCT (NEJM TEAM)	Increased early active mobilization (sedation minimization + daily physiotherapy sessions aimed at the highest safe mobilization level, up to 28 days)	The usual level of mobilization is normally provided in each ICU	750 randomized; analyzed 733 (369 intervention, 364 control)	Initiated during ongoing mechanical ventilation (median 60 hours after ICU admission)	Days alive and out of hospital to day 180 were 143 versus 145 (difference -2 days; 95% CI -10 to 6; $p = 0.62$). Mortality 22.5% versus 19.5% (OR 1.15; 95% CI 0.81-1.65). Adverse events potentially due to mobilization were more frequent (9.2% vs. 4.1%, $p = 0.005$).	Increased early active mobilization in mechanically ventilated adults did not increase survival or functional recovery but caused more adverse events, suggesting no net benefit over usual-care mobilization.
Higgins et al. [9]	Multicenter RCT (TEAM—economic/extended outcomes)	High-dose early active mobilization (TEAM protocol): progressive in-bed and out-of-bed activity delivered by multidisciplinary staff while under mechanical ventilation	Usual-care mobilization as practiced in each ICU (lower intensity, non-standardized frequency)	733 (369 intervention, 364 control)	Initiated during invasive mechanical ventilation once hemodynamically stable; typically within 48-72 hours of randomization	Days alive and out of hospital to day 180 showed no significant difference (108 ± 67 d vs. 111 ± 67 d; $p = 0.61$). Mortality 22.5% versus 19.5% ($p = 0.32$). EQ-5D-5L utility at 6 months not different (0.532 vs. 0.548; $p = 0.585$). Incremental costs \$1,823 (95% CI -10,552 to 12,027).	Higher-dose early active mobilization increased resource use without improving survival or quality of life and was not cost-effective compared with usual care. Sensitivity analyses showed possible cost-saving only if poorer outcomes were accepted.
Moss et al. [10]	RCT	Intensive physical therapy (PT) program: up to 28 days of progressive exercise 7 days/week in ICU, transitioning to home or outpatient continuation (breathing, strength, balance, and functional mobility training; 30-60 min/session)	Standard-of-care PT: range-of-motion, positioning, and mobility retraining 3 days/week during hospitalization; self-directed exercise post-discharge	120 (59 intensive, 61 standard)	PT started after ≥4 days of mechanical ventilation, median 8 days from intubation.	Continuous Scale Physical Functional Performance Test (CS-PFP-10) score at 1 month showed no significant difference (19 ± 3.7 vs. 21 ± 4.1; $p = 0.73$). No differences at 3 or 6 months ($p > 0.2$). Mortality and ICU/hospital-free days are similar.	Intensive PT during and after ICU stay did not improve long-term physical function versus standard care, despite greater therapy duration. The authors suggest benefits may require earlier initiation, longer duration, or patient stratification for response

(Continued)

Authors (year)	Study type	Intervention	Comparator	Sample size (N)	Timing	Outcome (Results)	Conclusion
Morris et al. [11]	RCT (JAMA)	Standardized Rehabilitation Therapy (SRT): daily passive range-of-motion, physical therapy, and progressive resistance exercises delivered 7 days/week by a multidisciplinary team until hospital discharge	Usual ICU care: weekday physical therapy when ordered by attending physician (median 1 day of therapy)	300 (150 SRT vs. 150 usual care)	Initiated within 1-4 days of ICU admission and continued through hospital discharge	Median hospital LOS 10 days (IQR 6-17) vs. 10 days (IQR 7-16); no difference ($p = 0.41$). No differences in ventilator-free days or ICU LOS. At 6 months, SRT showed higher scores for SPPB (+1.1, $p = 0.04$), SF-36 physical function (+12.2, $p = 0.001$), and FPI (+0.2, $p = 0.02$)	SRT was safe but did not reduce hospital stay or short-term outcomes. However, it produced modest functional benefits at 6 months, suggesting potential long-term recovery advantages.
Wright et al. [12]	Multicenter RCT (EPICC)	Intensive physical rehabilitation (additional daily mobilization and strength training sessions led by dedicated ICU physiotherapists, up to 90 min/day, 5-7 days/week)	Standard physical rehabilitation per local ICU practice (30 min/day, 3-5 days/week)	308 (153 intervention, 155 control)	Initiated once hemodynamically stable and within 48 hours of ICU admission; median 1.6 days after intubation	SF-36 Physical Component Summary score at 6 months showed no significant difference (37.2 vs. 36.0; adjusted mean difference 0.5, 95% CI -1.9 to 2.9; $p = 0.67$). No between-group differences in ICU/hospital LOS, mortality, or discharge destination.	Enhanced early physical rehabilitation for mechanically ventilated ICU patients was safe but did not improve long-term physical outcomes versus standard rehabilitation
Zhang et al. [13]	RCT	High-intensity EM (active + assisted exercises, posture changes, standing, and ambulation, 5x/week) initiated within 48 h of ICU admission for invasively ventilated patients	Conventional physiotherapy (position changes, passive range of motion, and bed exercises at the therapist's discretion)	132 (66 intervention, 66 control)	Initiated ≤ 48 hours of ICU admission	Barthel Index (BI) at 3 months post-ICU discharge was higher in intervention (90.6 ± 18.0) versus control (77.7 ± 27.9 ; $p = 0.005$); functional independence ≥ 85 BI: 76.3% versus 56.3% ($p = 0.028$). Muscle strength, Perme score, IMS, and MRC-SS all significantly improved; ICUAW 17.2% versus 54.4% ($p < 0.001$).	High-intensity EM improved functional independence, muscle strength, and mobility at discharge and 3 months without safety concerns, reducing ICU-AW, delirium, and mortality during ICU stay

(Continued)

Authors (year)	Study type	Intervention	Comparator	Sample size (N)	Timing	Outcome (Results)	Conclusion
McWilliams et al. [14]	RCT (Single-center)	Earlier and enhanced rehabilitation: individualized mobility protocol with structured goals, weekly progress meetings, and active physiotherapy by a specialized team until ward transfer	Standard care: physiotherapy based on clinician discretion, typically weekdays only, average 30-45 min/day	102 (50 standard, 52 intervention)	Mobilization was initiated earlier (median 8 vs. 10 days, $p = 0.035$) after ≥5 days of mechanical ventilation.	Median time to first mobilization was shorter (8 vs. 10 days, $p = 0.035$), greater mobility at ICU discharge (MMS 7 vs. 5, $p = 0.016$), and more walking ≥30 m (73% vs. 47%, $p = 0.006$). No differences in LOS, mortality, or MRC scores. SF-36 Mental Component at 3 months higher (57 vs. 51, $p = 0.042$)	Earlier and structured rehabilitation was feasible, safe, and significantly improved early mobility and 3-month mental-health outcomes, though no mortality or LOS benefit was observed. Supports a larger multicentre phase III evaluation
Suzuki et al. [15]	RCT (Single-center)	EM using a mobile patient lift (Golvo 9000 lowBase) in addition to the standard ICU rehabilitation protocol—patients assisted to sit, stand, transfer, and walk using the lift	Standard early rehabilitation protocol without the mobile lift, including sitting, standing, and transfers assisted manually	80 (39 intervention, 41 control)	Mobilization initiated after meeting predefined criteria: standing achieved a median of 1 day (IQR 1-2) vs. 3 days (2-6) after readiness	Time from readiness for rehab to standing (IMS ≥ 4) was significantly shorter with lift (1 vs. 3 days; $p < 0.01$). FSS-ICU at ICU discharge was higher (20.4 ± 4.4 vs. 17.9 ± 6.5 ; $p = 0.04$). No differences in Barthel Index, MRC score, LOS, delirium, or mortality	Using mobile patient lifts accelerated standing and improved functional status at ICU discharge without increasing adverse events; supports integrating assistive devices to enhance early mobility in ventilated ICU patients.
Ho et al. [16]	Before–after cohort RCT	Protocolized EM program: daily mobilization by physiotherapists and trained ICU nurses; progression from passive limb movements → sitting → standing → walking, with sedation titrated to RASS 0 to –2, applied to all ICU patients (mechanically ventilated and non-ventilated)	Conventional physiotherapy: non-protocolized, therapist-initiated care (mainly chest physiotherapy, passive movements as tolerated)	182 (92 control, 90 intervention)	Mobilization initiated within 24 hours of ICU admission; median day to out-of-bed 5 vs. 21	Primary outcome: Change in ICU Mobility Scale from admission to discharge improved by +2.63 points (95% CI 0.65–4.61; $p < 0.001$). Out-of-bed achieved day 5 versus 21 ($p < 0.001$); walking by day 14 versus >21 ($p < 0.001$). Mortality and ICU/hospital LOS unchanged	Protocolized EM significantly improved mobility scores and accelerated out-of-bed activity without increasing adverse events, though it did not reduce mortality or length of stay. Demonstrates the feasibility and safety of very-early multidisciplinary mobilization in mixed ICU populations

Efficacy & safety of early mobilization

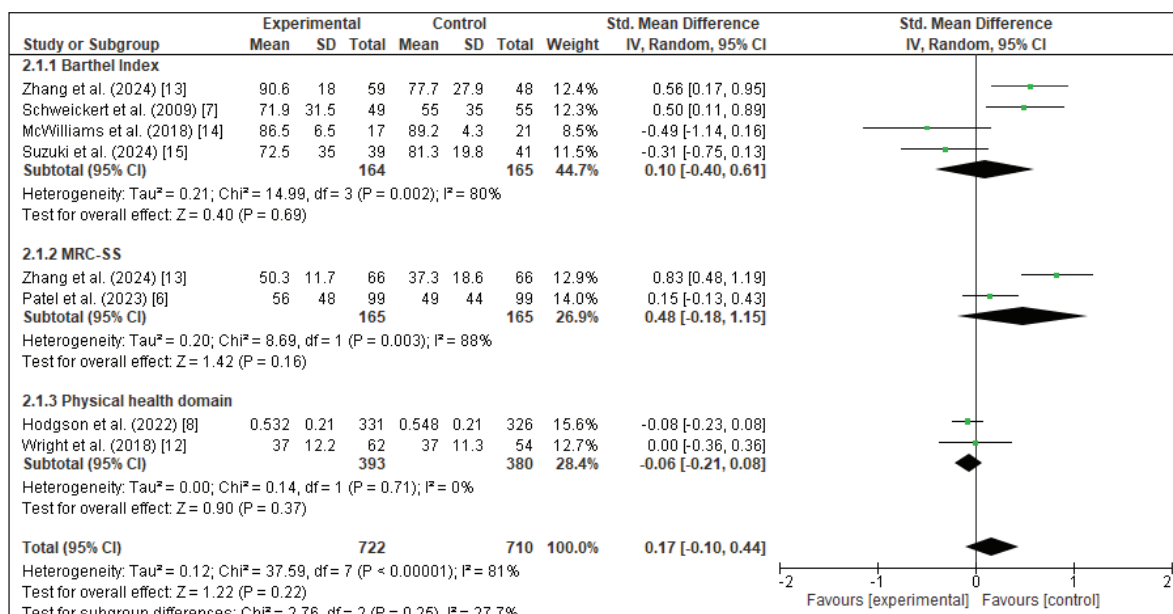


Figure 2. Continuous efficacy outcomes.

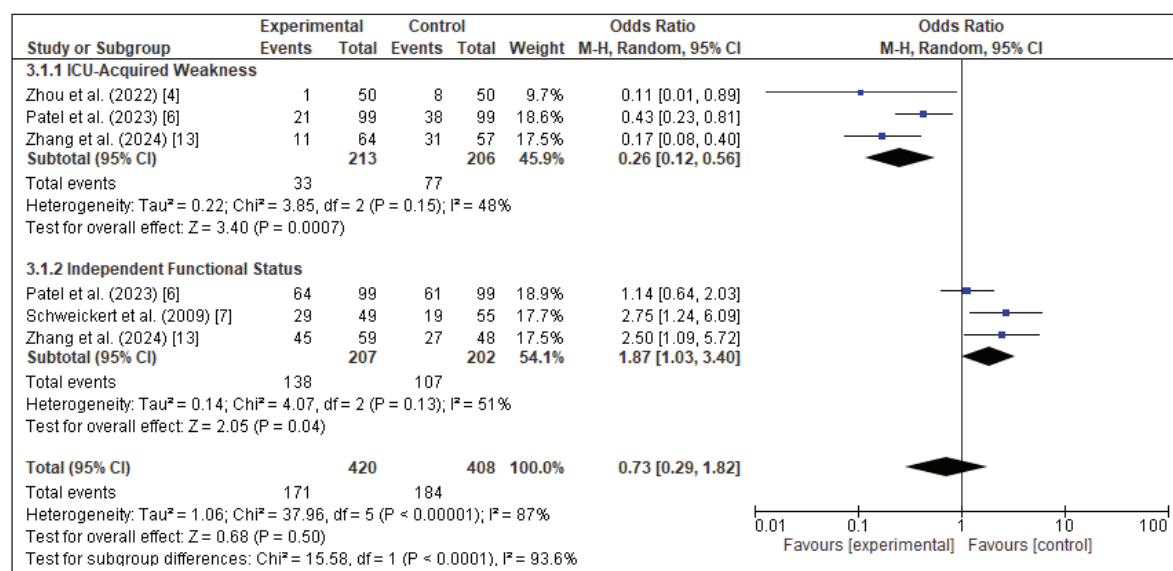


Figure 3. Dichotomous efficacy outcomes.

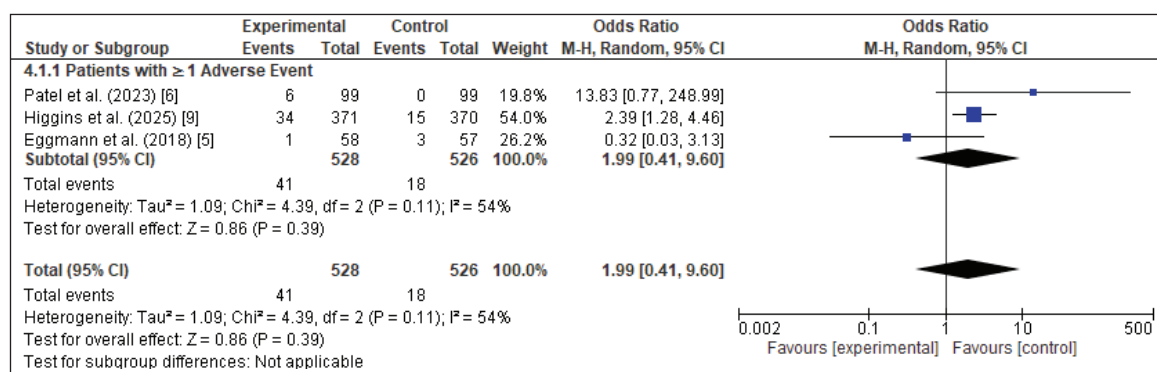


Figure 4. Safety outcome.

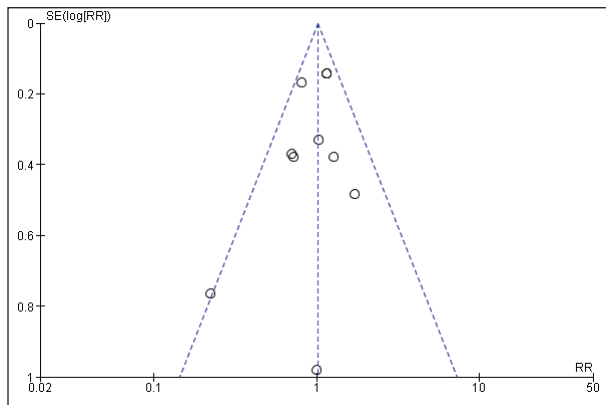


Figure 5. Funnel plot assessment of risk of public bias.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Eggmann et al. (2018) [5]	+	?	-	?	+	?	?
Higgins et al. (2025) [9]	+	?	-	+	+	?	?
Hodgson et al. (2022) [8]	?	?	-	?	+	?	?
Ho et al. (2022) [16]	-	-	-	?	?	?	-
McWilliams et al. (2018) [14]	+	?	-	?	+	?	?
Morris et al. (2016) [11]	?	?	-	+	+	?	?
Moss et al. (2016) [10]	?	?	-	?	+	?	?
Patel et al. (2023) [6]	+	+	-	+	+	?	?
Schweickert et al. (2009) [7]	+	?	-	+	+	?	?
Suzuki et al. (2024) [15]	?	?	-	?	+	?	?
Wright et al. (2018) [12]	+	?	-	+	-	?	?
Zhang et al. (2024) [13]	+	?	-	?	+	?	?
Zhou et al. (2022) [4]	+	?	-	?	+	?	?

Figure 6. Risk of bias assessment for included study.

bias, as blinding the participants and healthcare workers giving the intervention (typically a physical therapy or mobility treatment) was frequently not possible. The nature of such interventions makes it difficult to keep the

treatment group hidden from either patients or therapists. In contrast, the risk of detection bias was more variable; while some studies effectively employed blinding for the assessors who measured the outcomes, others did not, resulting in a possibility for bias in outcome assessment, particularly for subjective endpoints. In conclusion, while the evidence was solid due to proper randomization and low attrition, the frequent inability to blind participants and personnel introduced a potential source of bias that should be considered when interpreting the results, particularly for patient-reported or functionally assessed outcomes (Figures 6 and 7).

Discussion

Long-term mechanical ventilation and immobility in the ICU are highly related to neuromuscular weakness, delirium, long duration of admission, and poor post-discharge recovery [1]. ICU-AW occurs in up to 40% of mechanically ventilated patients and presents as diffuse, symmetrical muscle weakness of the limbs and respiratory muscles for months (or longer) following discharge [2]. This is very much in line with Yang et al.'s [3] observation that, despite the high cost of care, patients with mind-muscle dysfunction required more ventilation, took longer to recover, and some even died.

A key intervention method to counteract these negative effects is EM, which is defined as starting (active or assisted) physical activity during the first 24-72 hours following ICU admission or mechanical ventilation [4]. This systematic review and meta-analysis seek to synthesize evidence only from RCTs that focus on investigating the effect of EM on mortality, duration of mechanical ventilation, length of stay in the ICU and hospital, and adverse events.

The most convincing and persistent evidence for EM is its remarkable efficacy in avoiding and minimizing physical impairment. One of the key targets is the epidemic of ICU-AW, a symmetric, flaccid paralysis that greatly challenges rehabilitation. Several studies have found that EM considerably reduces its incidence. Zhou et al. [4] discovered that patients who received either EM or early mobilization combined with nutrition (EMN) had a much lower risk of ICU-AW at discharge (2% in each intervention group) than the control group (16%). To add on to that, Patel et al. [6] found the intervention group had a lower incidence of ICU-AW after hospital discharge (21.2%) than the regular treatment group (38.4%). The best results came from Zhang et al. [13], who showed that a high-intensity early mobility regimen cut ICU-AW in half (17.2% vs. 54.4% in controls). The combined results of these trials showed a robust, multi-study consensus that ICU-AW's catastrophic muscle atrophy and neuropathy can be avoided by challenging the neuromuscular system early in critical illness.

This mobilization leads to functional improvements that are patient-focused and clinically quantifiable. This improvement impacts a patient's basic capacity for independence rather than only their muscle strength

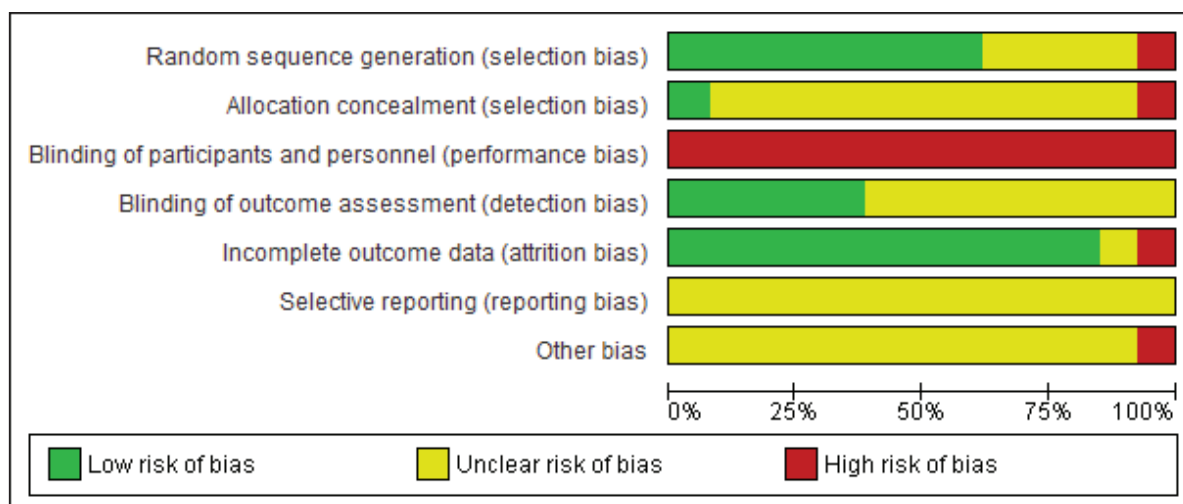


Figure 7. Summary of risk of bias assessment for included studies.

ratings. According to Schweickert et al. [7], integrated interventional pharmacotherapy resulted in a statistically significant increase in the Barthel Index score (75 vs. 55) and a statistically significant increase in the rate at which patients return to functional independence at hospital discharge (59% vs. 35%).

Such a functioning improvement is more than just a short-term impact. The intervention group maintained a considerably higher Barthel Index (90.6 vs. 77.7), thus a long-term return of independence in activities of daily living [13]. Zhang et al. [13] discovered that the effects of high-intensity movement continued and lasted for 3 months. The idea that EM naturally resets the course of recovery and allows patients to restore their functional independence is supported by the variable's consistency across studies. According to Higgins et al. [9] large, global TEAM study, patients in the EM group had more than twice as many adverse events that were thought to be possibly related to the intervention (9.2% of patients vs. 4.1% in the standard treatment group).

These events included episodes of oxygen desaturation, cardiac arrhythmias, and hemodynamic disorders that were clinically severe. Similar to this, Patel et al. [6] reported a range of adverse events that only happened in the intervention group and impacted 6% of patients, such as hemodynamic abnormalities, respiratory distress, and unexpected line removal. Even the Eggmann et al. [5] investigation, which showed that the intervention was safe, discovered a numerical rise in adverse events that was not statistically significant. This recurring pattern across trials highlighted a crucial point that there is a genuine risk of physiological instability from a vigorous search for early mobility. This changes the intervention from a straightforward "mobilization order" to a complex, protocol-driven physiological challenge, requiring a clinical setting with strict monitoring and staff trained to identify and address any issues.

The concept of declining returns was a key finding of larger, more methodologically sound experiments. The earliest single-center studies frequently reported a significant, dose-dependent benefit. However, when this concept was tested in big, multi-center randomized controlled studies, a more complex picture emerged. The TEAM experiment by Higgins et al. [9] is the most definitive example, in which over 700 patients were randomly assigned to receive early aggressive mobilization or normal treatment. Despite successfully delivering a substantially larger "dose" of mobility, nearly 21 minutes per day in the intervention group versus 9 minutes in the control group, the trial revealed no change in the primary outcome of days alive and out of the hospital after 180 days [9].

Moss et al. [10] studied and directly compared an intensive physical therapy program to a standard-of-care program and found that while the intensive group received substantially more therapy (408 vs. 86 minutes), there was no improvement in long-term physical functional performance at 1, 3, or 6 months. Wright et al. [12] similarly found that a target of 90 minutes of daily rehabilitation failed to improve physical health scores at 6 months compared to a 30-minute target. This aggregated data implies that, while a baseline level of activity is critical to preventing functional decline, there is a ceiling effect beyond which additional, high-intensity mobilization yields no further improvement in broad, patient-centered outcomes and might only serve to increase the risk-to-benefit ratio.

Furthermore, the evidence strongly suggested that EM is a rehabilitative, not life-saving, strategy. Across the body of evidence, no study found a statistically significant reduction in mortality due to the mobilization strategy. In Higgins et al. [9] study, the intervention and control groups had nearly comparable mortality rates at 180 days (22.5% vs. 19.5%). Similarly, Hodgson et al. [8] discovered no

difference in mortality in their cost-effectiveness study of TEAM trial data. This was a constant finding throughout the early experiment by Schweickert et al. [7] and the more recent study by McWilliams et al. [14]. Its primary contribution is to improve the quality of survival rather than the quantity of life. Its goal is to ensure that patients who survive severe illness do not face a life of profound physical dependency, but rather have the ability to reintegrate into their homes and communities.

The intention to mobilize does not ensure success; instead, it requires overcoming enormous systemic and patient-level challenges. McWilliams et al. [14] found that a systematic rehabilitation program caused patients to mobilize considerably faster (at 8 vs. 10 days) and during a more intense period of their illness, resulting in a higher level of mobility at ICU discharge. Technology use can also be a useful enabler. Suzuki et al. [15] discovered that the use of a mobile patient lift enabled ventilated patients to stand significantly more quickly (1.0 vs. 3.0 days) than the control group, illustrating how equipment can overcome the physical challenges of moving sedated, heavy patients.

Heavy sedation, on the other hand, is a major obstacle and is frequently used in critical care. Daily sedation interruption was specifically linked to the successful intervention in Schweickert et al.'s study [7], a technique that was adopted less frequently in the following negative experiments.

As a result, the data from the 13 investigations presented a nuanced and useful perspective. EM is neither extremely damaging nor a straightforward, generally good move. It is a strong tool with a particular function. It offers a demonstrated, substantial benefit in preserving bodily function and reducing the extreme weakness that has long been acknowledged as an inevitable consequence of critical illness. However, there is a quantifiable and substantial risk of physiological side effects associated with this benefit, necessitating a therapeutic setting of knowledge and observation. The most important finding for clinical practice is that, compared to moderate, protocolized procedures, maximum, high-dose mobilization methods do not seem to offer any additional functional benefits. It necessitates a comprehensive approach that determines which patients would benefit the most, determines the ideal timing and intensity for their disease, and carefully monitors sedation and safety to walk the tightrope between repairing function and inflicting harm.

This systematic review had a fundamental strength in its comprehensive analysis of 13 trials, which provides strong evidence that EM dramatically reduces ICU-AW (from 54% to 17% in one study) and increases functional independence. However, its limits were significant. The substantial possibility of performance bias across studies, as blinding therapists and patients was impossible, might lead to exaggeration of treatment outcomes. Furthermore, the great variation in rehabilitation treatments, as well as

the constant signal of increased adverse events, hinders treatments.

The consequences have a significant impact on practice. The data confirmed that EM is an important part of ICU recovery, but they also disproved the “more is better” approach, as higher-intensity protocols provided no additional benefit. Clinicians must favor standardized, safety-focused methods above forceful mobilization. Future research should focus on determining the appropriate, tailored “dose” of mobility that promotes functional gains while reducing the risk of injury to critically sick individuals.

Conclusion

Based on a synthesis of 13 RCTs, this systematic review found that EM in critically sick people is a high-risk, high-reward strategy. It delivers a definitive functional advantage by considerably lowering the incidence of ICU-AW and increasing independence in daily activities. However, this efficacy is offset by a statistically significant increase in the incidence of adverse events such as hemodynamic instability and arrhythmias. Critically, higher-dose, more intensive mobilization procedures do not produce better patient-centered outcomes than normal protocols, showing that there is a benefit ceiling.

Clinical practice ought to avoid the one-size-fits-all, maximalist approach to EM in favor of controlled, moderate-intensity, safety-focused regimens. These procedures must include strong safety criteria for patient preparation (e.g., physiological stability), require the presence of qualified staff for monitoring, and prioritize consistent, attainable functional goals above the duration or intensity of treatment. Future research must shift from examining whether EM helps in determining who benefits and how much. The primary goal should be to create and validate predictive models or clinical decision rules that can identify which patient subgroups are most likely to benefit from, and least likely to be harmed by, specific mobilization strategies, allowing for a truly personalized and safer implementation of this intervention.

List of Abbreviations

CI	Confidence Interval
EM	Early Mobilization
ICU	Intensive Care Unit
ICU-AW	Intensive Care Unit–Acquired Weakness
LOS	Length of Stay
OR	Odds Ratio
OT	Occupational Therapy
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PT	Physical Therapy
RCT	Randomized Controlled Trial

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Author details

Abdullah I. Aedh^{1,2}, Khalid Atyah Alharbi³, Norah Muidh Alwadai⁴, Ziyad Mohammed Alqurayqiri³, Ammar Abdulkhaliq Alshuaibi³, Muhannad Muslih Alhazmi³, Bandar Halil Alyoubi³, Abdulelah Mohammed Alotaibi³, Abdullah Hasan Mahallawi³, Sulaiman Shakir Alkayal³

1. Professor, Internal Medicine, Najran University, Najran, Saudi Arabia

2. Consultant, Medicine and Critical Care, Najran University Hospital, Najran, Saudi Arabia

3. Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

4. College of Medicine, Najran University, Najran, Saudi Arabia

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