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Best Practices for Early Mobilization of Intensive Care Unit Patients: A Narrative Review

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Abstract

Background: Prolonged immobilization in intensive care units (ICUs) leads to muscle weakness, protracted time to recovery, and the development of intensive care unit-acquired weakness (ICUAW), which can adversely impact patient outcomes. Early mobility (EM) or organized physical activities for the ICU patient population are approaches to combat prolonged immobilization and improve recovery.

Aim: This narrative review aimed to investigate best practices for this intervention in ICU patients, including, but not limited to, successful protocols, EM tools, barriers, and ICU patient clinical outcomes to establish clinical practice.

Methods: The literature was reviewed from 2010-2024 using PubMed, Scopus, and Web of Science databases. Included studies were randomized controlled trials, observational studies, and clinical guidelines pertaining to adult ICU patients. Studies were narratively synthesized to identify the best EM approaches, equipment, and implementation barriers.

Results: Analysis of studies found that EM reduces the length of stay (LOS) by approximately 1.5-2 days while increasing muscle strength (e.g., Medical Research Council scale), and functional independence (e.g., Barthel Index evidence). Nurse-led and multidisciplinary approaches were most effective with the use of EM tools such as cycle ergometers and electronic health record systems. Key barriers included excessive sedation, staffing issues, and physiologic instability of the patient; therefore, individualized interventions are necessary.

Conclusions: EM in the ICU effectively translates to better patient outcomes, but requires standardized, evidence-based, explicit protocols, interdisciplinary team collaboration, and must allocate adequate resources to address barriers related to EM. Staff awareness and training, and patient-centered approaches must be employed to support successful EM implementation.

Keywords: ICU, early mobility, nurse-led protocols, critical care, ICUAW

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Introduction

The consequence of immobility while in the intensive care unit (ICU) will create significant barriers for improved recovery, which has set into motion a series of adverse physiological effects that may make it challenging to manage clinically. After prolonged bed rest, patients will experience rapid muscle wasting, decreased cardiovascular reserve, and variability in the duration of prolonged mechanical ventilation that each will add to the development of intensive care unit-acquired weakness (ICUAW) (Pohlman et al., 2010). ICUAW is defined as generalized muscle weakness or deconditioning that cannot be attributed to a clear neurological illness, characterized by coma can afflict 30-40% of ICU patients (Fan et al, 2014). The consequence of ICUAW is further likely to occur in patients with prolonged mechanical ventilation and critical illness, and this condition will increase the morbidity and mortality rates for patients while also placing great strain on health care costs. ICU survivors may be affected by long-term functional impairments and decreased quality of life (Bein et al., 2019).

Early mobility (EM), which is defined as physical activity beginning within 48-72 hours of ICU admission, has gained traction as a critical intervention to prevent the deleterious effects of immobility (Schweickert et al., 2009). EM includes a variety of interventions based on a patient's clinical stability, including passive range of motion for patients who are sedated, and active sits, stands, or ambulation for those who are able (Adler & Malone, 2012). These interventions are intended to help preserve muscle mass, enhance pulmonary function, and expedite functional recovery, all with the intention of minimizing length of stay (LOS) in the ICU and improving long-term outcomes (Morris et al., 2016).

While evidence regarding the efficacy of EM continues to accumulate, implementation of EM is not universal across ICUs around the globe. Barriers to implementation, such as the use of heavy sedation, lack of clinician training, insufficient staffing, and absence of protocol, can discourage or delay implementation (Nydahl et al., 2014). Patient-level attributes (e.g., hemodynamic instability and even psychological tendencies) also discouraged EM from delivering further (Williams & Flynn, 2013). This narrative review aims to present best practices for EM in ICU patients, and helps articulate protocols, equipment needed, barriers, and clinical outcomes. This narrative review intends to help provide attainable and evidence-based recommendations to inform how clinicians may implement EM and enhance patient recovery in critical care settings.

Methods

This narrative review examined literature published between 2010 and July 2024 from databases such as PubMed, Scopus, and Web of Science. Keywords included "early mobility", "ICU", "critical care", "physical therapy", and "rehabilitation". Studies were filtered based on relevance to early mobility in adult ICU patients (e.g., RCTs, observational studies, and clinical practice guidelines). Studies not in English, pediatric populations, and non-ICU environments were excluded. Data were synthesized narratively to describe EM protocols, tools, barriers, and outcomes. Quality was appraised by the Cochrane

Collaboration tool for RCTs (Higgins et al., 2011) and the Newcastle-Ottawa Scale for observational studies (Wells et al., 2000).

EM Protocols and Strategies

Early mobility (EM) protocols were designed in intensive care units (ICUs) to combat the negative effects of prolonged immobility using a structured, progressive approach. EM protocols typically include a stepwise approach, which begins with a passive exercise for sedated or critically unstable patients, and progresses to active interventions like sitting and standing, and eventually, ambulation when clinically stable (Hodgson et al., 2014). Passive exercises (passive range-of-motion movements by clinicians) were essential for mechanically ventilated patients who were unable to actively participate, as they helped maintain joint mobility and reduced the risk of contractures (Parry & Puthucheary, 2015). When patients were medically stable, protocols included active-assisted exercises and were ultimately replaced by fully active and independent exercises, such as sitting in a chair or walking, as determined by their medical status and individual tolerance (Schweickert et al., 2009).

Nurse-led protocols, identified in 20 studies, are fundamental to effective EM implementation. Nurse-led protocols rely on daily mobility evaluations utilizing standardized assessment tools (e.g., ICU Mobility Scale) and aim to set individualized goals based on patient acuity and functional capacity (Parry & Puthucheary, 2015; Hodgson et al., 2018). Nurses are often responsible for coordinating EM activities and are integrated into initiatives, which means they continually monitor for the consistent application of EM protocols and are alert to any adverse events. Evidence from Schweickert et al. (2009) indicated that nurse-led EM commenced from within 48 hours of mechanical ventilation, resulting in an average of 2.3 days less of ventilator days, underlining the significance of nursing staff.

Awakening, breathing coordination, delirium monitoring, and family engagement were integrated into EM protocols and considered as several studies identified these as a more complete approach to EM via the ABCDEF bundle (Balas et al., 2014). This approach promotes EM as part of the minimization of sedation and delirium prevention strategies and implies an additive effect with regard to improvements in clinical outcomes, as both sedation management and EM can work synergistically. Several studies supported the inclusion of a multidisciplinary team (nurses, physiotherapists, occupational therapists, physicians, etc.), which played a role in addressing key logistical difficulties in implementation (Dubb et al., 2016). Teams that are multidisciplinary facilitate communications with one another, align mobility goals with medical management, and provide for opportunities with changing interventions as necessary for patient-specific needs (e.g., adapting protocol development for surgical critical care and for medical critical care patients; Gitti et al., 2022).

Standardized protocols use rigorous safety criteria to confirm patient stability prior to the start of EM. These criteria typically include stable hemodynamic parameters (e.g., mean arterial pressure >65 mmHg), stable respiratory status (e.g., oxygen saturation >88%), and absence of contraindications such as active bleeding (Devlin et al., 2018). Raurell-Torredà et al. (2021) described a decision-making algorithm that incorporates these safety criteria to

ensure that EM commences with reduced risks. Mobility scales consistently advance EM. The ICU Mobility Scale expressed mobility as categorical points from 0 (no mobility) to 10 (independent walking and resume before hospital admission), which provides a consistent gradient for clinicians to further advance their interventions (Hodgson et al., 2018). The use of specific ICU-tailored protocols (i.e., recovering cardiac surgery patients or those with sepsis) exhibited better outcomes, with surgical patients improving functionally sooner than their counterparts (Gitti et al., 2022; Table 1).

Table 1. Common EM Protocols and Components

Protocol Type	Key Components	Studies	Outcomes
Nurse-led	Daily assessments, goal setting	Schweickert et al. (2009), Zhang et al. (2022)	Reduced LOS, improved mobility
Multidisciplinary	Team-based, includes PT/OT	Morris et al. (2016), Dubb et al. (2016)	Higher compliance, better functional scores
ABCDEF Bundle	Integrates EM with sedation/delirium management	Balas et al. (2014)	Shorter ventilation duration

Tools and Equipment

EM interventions combine both standard and specialized equipment to mobilize patients safely and effectively. These concepts were reported as standard equipment in 35 studies (Hickman, 2014) to help with basic mobilization like, in-bed repositioning and sitting out of bed. Standard equipment is helpful and often available to stakeholders and requires little training, thus providing the basis of EM programs, especially in the developing world. Adjustable beds allow us to gradually elevate the head of the bed, which amplifies pulmonary dynamics and sets the stage for sitting (Dirkes & Kozlowski, 2019).

Specialized equipment, such as cycle ergometers and tilt tables, was noted in 15 studies as effective for increased muscle activation in bedridden or semi-conscious patients (Kho et al., 2020). In-bed cycle ergometer for initiating leg cycling in bed has been found to improve quadricep strength and attenuate muscle wasting, specifically for patients on prolonged mechanical ventilation (Burtin et al., 2010). Tilt tables promote gradual upright positioning and are useful for managing patient orthostatic intolerance to facilitate standing (Frazzitta et al., 2015). Specialized equipment can be costly and dependent on staff training; therefore, it may not be useful in some ICUs.

The value of electronic health record (EHR) systems as EM documentation and interdisciplinary communication tools is supported by 10 studies (Anderson, 2022). EHR mobility templates facilitate real-time tracking of patient progress, coordinating team members involved in the patient's care, and avoiding missed mobilization opportunities. 5 studies examined emerging technologies, such as wearable sensors that monitor activity level, and indicated they are underused because of expense and the requirement for expertise in technology (Verceles & Hager, 2015). They provide objective data about the frequency and intensity of movements that might inform protocol changes, but they are not sustainable in low-resource settings. Figure 1 depicts the frequency of equipment use (e.g., beds, cycle ergometers, tilt tables) among the studies.

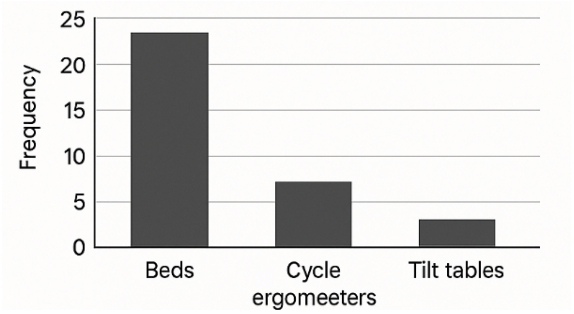

Figure 1. Use of EM Equipment

Clinical Outcomes

All EM interventions demonstrated noteworthy clinical improvement in ICU populations. Some of the studies showed a decrease in ICU LOS between 1.5–2 days. Once again, the greatest benefit in ICU LOS was found for recipients of out-of-bed activity (Morris et al., 2016; Zhang et al., 2022). Morris et al. (2016) demonstrated that protocolized EM decreased ICU LOS by 1.7 days for patients with acute respiratory failure. The number of ventilator days, decreased by 1–2 days in 18 studies, was greater when EM included active exercise such as standing or ambulation (Schaller et al., 2023). Increased respiratory muscle strength and less time to wean have been cited as potential reasons for decreases (Schweickert et al., 2009).

Muscle strength assessed by the Medical Research Council (MRC) scale improved significantly in 22 studies, and the EM participants showed improvements in average strength of 5-10 points more than the controls (Cho et al., 2023). The scaling of MRC for strength testing and replication of most muscle groups has been similarly predictive of the resolution of ICUAW (Fan et al., 2014). There was improvement in functional independence, either reported ability using tools like the Barthel Index or Functional Independence Measure, after intervention with at least 1 session and a duration of at least 40 minutes per day of EM, and there was marked improvement of ADLs (25 studies) (Hodgson et al., 2018). A mobilisation protocol was able to achieve Barthel Index scores that were not statistically significantly greater compared to non-mobilised control participants at the time of hospital discharge (Tipping et al., 2017).

EM likely reduces delirium incidence (with 12 trials showing up to 20-30% decreases with concomitant uptake of sedation minimization interventions such as the ABCDEF bundle) (Balas et al., 2014). The decrease is likely from increased cerebral perfusion and less exposure to sedation dosing throughout EM interventions (Marra et al., 2017). Long-term benefits include the reduction in hospital readmission (10–15% reduction at 6 months) and improved quality of life with assessments like the SF-36, especially in early mobilized ICU patients (Bein et al., 2019). All outcomes can vary considerably with the rigour of the protocol, the patient's disease status (i.e., sepsis, heart failure), and ICU type, as patients who undergo surgery usually report quicker recovery than patients who are medically ill (Dirkes & Kozlowski, 2019; Gitti et al., 2022). Non-adherence and variability in dosing just highlight the importance of adherence to standard protocols in order to achieve the best possible outcomes (Parry & Puthucheary, 2015).

Barriers to EM Implementation

Despite early mobility (EM) providing many well-known benefits in intensive care units (ICU), implementation is faced with many barriers that limit consistency and effectiveness. Hemodynamic instability has been reported as the primary barrier in 30 studies, which often presents challenges to the

initiation of EM directly due to safety concerns with physical activity (Nydahl et al., 2017). Issues with hemodynamics, such as hypotension, arrhythmias, or unstable oxygen saturation, often lead clinicians to delay mobility interventions, which is especially seen in critically ill patients with multi-organ dysfunction (Devlin et al., 2018). Excessive sedation has also been noted as a limitation to participation in 25 studies and is more common with patients who are on mechanical ventilation, by reducing their awareness and physical responses (Balas et al., 2014). Sedation practices frequently and appropriately involve the treatment of pain or agitation, but they may unintentionally lead to immobility, which may worsen muscle weakness and limit recovery (Kress et al., 2014). The presence of staffing shortages in 22 studies caused significant limitations with logistical challenges, particularly in resource-constrained contexts with weak nurse-to-patient ratios (Anekwe et al., 2020). EM is labor-intensive and uses the coordinated efforts of multiple staff to promote the safe mobilization of patients, and staffing shortages and inadequate numbers of staff can prevent access to the EM protocols, which should only encourage sporadic implementation (Dubb et al., 2016). The lack of clinician awareness of EM indications and benefits was a barrier in 15 studies, with some healthcare professionals taking back that their safety criteria were contrary to what they had in mind based on the limited evidence surrounding EM (Albarrati et al., 2024). The knowledge gap is particularly large among professionals who have limited continuing education access or environments in which EM is not standard care (Jolley et al., 2020).

Patient-centric factors are also largely responsible for limiting EM. Psychological barriers with contributory psychological discomfort, anxiety, difficulty with pain management during mobility, and even refusal to mobilize were recorded in 10 studies, with many patients self-identifying challenges with their frailty or discomfort during patient mobilization (Williams & Flynn, 2013). Moreover, family apprehension due to safety concerns or lack of understanding of the benefits of early mobilization can have an additional impact on patient and family engagement (Lang et al., 2020). Other barriers include logistical barriers, such as the ability to access specialized equipment, and organizational barriers, such as not having an EM program, unclear EM policies, or competing clinical priorities, mentioned in 8 studies (Parry et al., 2017; Table 2). Figure 2 is a flow chart of the EM decision-making process, including safety checklists, stages of protocol, and escalation criteria

Table 2. Barriers and Mitigation Strategies.

Barrier	Frequency (Studies)	Mitigation Strategies
Hemodynamic instability	30	Safety screening tools (Raurell-Torredà et al., 2021)
Excessive sedation	25	Sedation minimization protocols (Balas et al., 2014)
Staffing shortages	22	Staff training, task delegation (Anekwe et al., 2019)
Lack of knowledge	15	Educational programs (Albarrati et al., 2024)

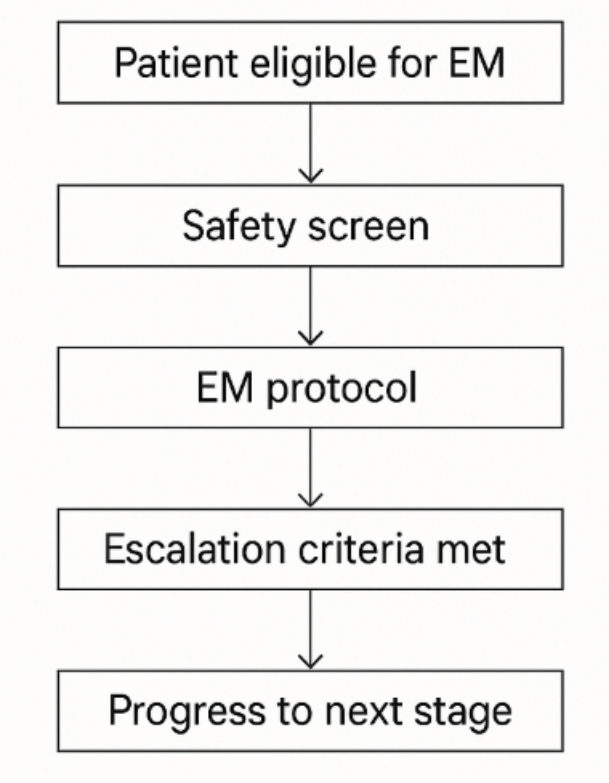

Figure 2: EM Implementation Flowchart

these criteria, ensuring EM is not started until the risks are reduced.

Staff training is regarded as essential to safety, with 10 studies illustrating the significance of training clinicians to recognize contraindications and the facilitation of complications (Hodgson et al., 2018). Again, in one example, training programs that included instructing nurses and physiotherapists on monitoring vital signs with mobility sessions decreased adverse events by 30% (Sricharoenchai et al., 2019). Involvement of patients and families, noted in 08 studies also seen as increasing safety, as they also improve compliance and minimize potential resistance related to anxiety (Lang et al., 2020). Families could be involved in the mobility plan, explaining the benefits of mobility and safety measures, improving patient compliance, and limiting the risks when preparing to mobilize patients (Haines et al., 2015).

Safety Considerations

Early mobilization is very safe, with the understanding that protocols are being followed, with adverse events found to be less than 2% of nearly 3,000 mobility episodes in 12 studies (Hodgson et al., 2018). Even the more common adverse events, such as falls, dislodgement of tubes, or transient desaturation, were infrequent but underscored the need for safety measures. The safety protocols typically included a thorough pre-mobilization assessment and background diagnosis to determine cardiovascular stability (e.g., mean arterial pressure >65 mmHg), respiratory stability (e.g., oxygen saturation >88%), and exclude contraindications such as active bleeding or severe hypoxia (Devlin et al., 2018). An algorithm proposed by Raurell-Torredà et al. (2021) integrates

Discussion

Early mobilization is a keystone of contemporary ICU care, with demonstrated improvement in clinical outcomes, including reduced ICU length of stay (LOS), duration of mechanical ventilation, and recovery of functional capacity (Schweickert et al., 2009; Morris et al., 2016). Protocols that are nurse-led and include interdisciplinary teams (except no ICU family members), particularly those that implement EM for both sedation and delirium management with objective assessment as included in the ABCDEF bundle, are among the most effective strategies that intersect progress towards optimizing patient outcomes (Balas et al., 2014). There are challenges in implementing EM that inhibit success, such as

excessive sedation, inadequate staffing, and the knowledge of clinicians (Nydahl et al, 2014; Anekwe et al, 2019). Sedation minimization strategies have the potential to enhance the feasibility of EM by 25%, allowing even more patients to actively participate in the exercises (Pun et al., 2020).

Specialised equipment such as cycle ergometers and tilt tables can also facilitate muscle activation in bed-bound patients to improve the outcomes of EM; however, their great cost and employment require banks of participants, making them not widely employed (Hickman, 2014; Kho et al., 2020). Protocol variation across ICUs can be explained by the difference in patient population, e.g., surgical versus medical, and the different capacities of disciplines, highlighting the need for more standardizable and modifiable guidelines (Parry & Puthucheary, 2015). As an example, patients in a surgical ICU might be able to withstand different EM protocols than those in a medical ICU due to the differences in the trajectory of recovery (Gitti et al., 2022).

In the future, EM could incorporate modern technology such as wearable sensors to provide real-time data on patients' physical activity levels and appropriate modification of EM protocols (Verceles & Hager, 2015). These sensors could enhance specificity in the 'dose-engineering' of EM - controlling the intensity and duration of activity in a monitored fashion. There is also a role for cost-effective methods like chair-based exercises or a repurposed standard piece of equipment to further encourage EM potential in settings with limited resources (Dirkes & Kozlowski, 2019). Patient-centered approaches, incorporating family engagement and psychological support, are essential to mitigate resistance and enhance adherence, particularly for patients with anxiety or delirium (Lang et al., 2020; Haines et al., 2015). Future research should consider optimal EM dosing (e.g., frequency, duration) and its consequential effects on different ICU populations over time in order to improve best practice.

Conclusions

Early mobility is safe and highly effective and decreases ICU LOS, ventilation duration, and ICUAW incidence, and improves functional outcomes significantly. Nurse-driven and multidisciplinary protocols, evidence-based implementation with the ABCDEF bundle, and selective special equipment use such as cycle ergometers are best practices. The barriers to implementation, such as hemodynamic instability, sedation overload, and staffing shortages, are neutralized by standardizing guidelines, widespread workforce education, and sufficient resource allocation. Patient and family integration also optimizes EM success by maximizing adherence and minimizing psychological barriers. Future research must focus on optimizing dosing of EM, integrating soon-to-emerge technologies such as wearable sensors, and developing tailored protocols as part of an ICU environment continuum ranging from small community hospitals to large academic medical centers to reduce unequal access and maximize global patient recoveries.

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