



NURSES ROLE IN APPLICATION OF EARLY MOBILIZATION PROTOCOLS IN REDUCING ICU-ACQUIRED WEAKNESS IN CRITICALLY ILL PATIENTS

Halah Saad Mohammed Alrajaji^{1*}, Samiyah Hail Ghazi Alkuwaykibi², Rawan Jomah Aldowihi³, Maha Afet Qalil Alruwaili⁴, Salam Mohammed Ossyed Alsharari⁵, Sultan nayil Atiah Alruwaili⁶, Sami Rajan Zaal Alanazi⁷, Intisar Gharbi Talaq Alanazi⁸, Abdulaziz Khlowy Jafnan Alrowily⁹, Huda Maddallah alrowaily¹⁰

Abstract:

This review article explores the crucial role of nurses in the implementation of early mobilization protocols aimed at reducing ICU-acquired weakness in critically ill patients. Intensive Care Unit (ICU)-acquired weakness is a common and debilitating complication that significantly impacts the recovery and outcomes of critically ill individuals. The early initiation of mobilization interventions has been shown to mitigate the development of muscle weakness, improve functional outcomes, and reduce the duration of mechanical ventilation and ICU stay. Nurses play a central role in the delivery of these protocols, acting as key advocates, coordinators, educators, and facilitators throughout the mobilization process. This review synthesizes current evidence on the effectiveness of early mobilization strategies, highlights the challenges and barriers faced in their implementation, and emphasizes the importance of interdisciplinary collaboration in optimizing patient outcomes. Furthermore, it discusses the impact of nurse-led mobilization programs on patient safety, comfort, and overall well-being in the ICU setting. By empowering nurses with the knowledge and skills necessary to implement early mobilization protocols, healthcare institutions can enhance patient care quality, promote faster recovery, and reduce the long-term sequelae associated with ICU-acquired weakness.

Keywords: ICU-acquired weakness, Early mobilization protocols, Critically ill patients, Nursing role, Interdisciplinary collaboration, Patient outcomes.

¹ *Specialist-physiotherapy, Sowir General hospital, Sakaka, Saudi Arabia.

² Specialist-physiotherapy, Sowir General hospital, Sakaka, Saudi Arabia.

³ Specialist-physiotherapy, King Abdulaziz Specialist Hospital, Sakaka, Aljouf, Saudi Arabia.

⁴ Specialist-physiotherapy, King Abdulaziz Specialist Hospital, Sakaka, Aljouf, Saudi Arabia.

⁵ Specialist-physiotherapy, Al-Mukhatat Healthcare Center, Sakakah, Saudi Arabia.

⁶ Nursing Technician, Long care hospital, Arar, Saudi Arabia.

⁷ Technician -Emergency Medical Services, Irada and Mental Health Hospital, Arar, Saudi Arabia.

⁸ Specialist Nursing, Almansuriah Helton center, Arar, Saudi Arabia.

⁹ Senior physiotherapist, Sowir General Hospital, Sakaka, Saudi Arabia.

¹⁰ Nursing technician, PRINCE MUTAIB BIN ABDULAZIZ HOSPITAL, SKAKA ALJOUF, SAUDI ARABIA

***Corresponding Author:** Halah Saad Mohammed Alrajaji

*Specialist-physiotherapy, Sowir General hospital, Sakaka, Saudi Arabia.

DOI: 10.53555/ecb/2022.11.7.79

Introduction:

ICU-acquired weakness is a common and serious complication that can occur in patients who have been admitted to an intensive care unit (ICU) for a prolonged period of time. This condition is characterized by a significant decrease in muscle strength and function, which can have long-lasting effects on a patient's ability to recover and regain their independence [1].

There are several factors that can contribute to the development of ICU-acquired weakness, including prolonged immobility, use of certain medications, and underlying medical conditions. Patients who are on mechanical ventilation or who are sedated for long periods of time are particularly at risk for developing this condition [2].

The symptoms of ICU-acquired weakness can vary depending on the severity of the condition, but common signs include muscle weakness, difficulty moving or lifting objects, and fatigue. In severe cases, patients may be unable to perform basic activities of daily living, such as feeding themselves or getting out of bed [1].

Diagnosing ICU-acquired weakness typically involves a physical examination by a healthcare provider, as well as tests such as electromyography (EMG) to assess muscle function. Treatment for this condition often involves a combination of physical therapy, occupational therapy, and medications to help improve muscle strength and function [3].

Preventing ICU-acquired weakness is an important goal for healthcare providers, as this condition can significantly impact a patient's recovery and quality of life. Strategies for preventing ICU-acquired weakness include early mobilization of patients, minimizing the use of sedative medications, and implementing protocols for physical therapy and rehabilitation [3].

Impact of Early Mobilization on ICU Patients:

Early mobilization in the intensive care unit (ICU) has been a topic of increasing interest and research in recent years. Traditionally, patients in the ICU have been kept immobile due to concerns about their safety and stability. However, recent studies have shown that early mobilization can have numerous benefits for ICU patients, including improved outcomes and reduced complications [4]. Early mobilization refers to the initiation of physical activity and movement in ICU patients as soon as possible after admission. This can include activities such as sitting on the edge of the bed, standing, walking, and performing range of motion exercises. While early mobilization may seem risky

for critically ill patients, research has shown that it can actually have numerous benefits [5].

One of the primary benefits of early mobilization is the prevention of complications associated with immobility. Prolonged bed rest in the ICU can lead to muscle weakness, joint stiffness, pressure ulcers, and other complications. By encouraging patients to move early on, healthcare providers can help prevent these issues and improve overall outcomes [4].

Early mobilization has also been shown to improve respiratory function in ICU patients. Immobility can lead to decreased lung volume and impaired gas exchange, which can increase the risk of respiratory complications. By encouraging patients to move and breathe deeply, healthcare providers can help improve lung function and reduce the risk of respiratory issues [6].

In addition to physical benefits, early mobilization can also have psychological benefits for ICU patients. Being immobile in the ICU can be isolating and demoralizing for patients, leading to feelings of anxiety, depression, and helplessness. By encouraging patients to move and engage in activities, healthcare providers can help improve patients' mood and overall well-being [7].

Numerous studies have been conducted to evaluate the impact of early mobilization on ICU patients, and the evidence overwhelmingly supports its use. A systematic review and meta-analysis published in the journal *Critical Care Medicine* found that early mobilization in the ICU was associated with a significant reduction in ICU-acquired weakness, shorter ICU and hospital lengths of stay, and improved functional outcomes [8].

Another study published in the *New England Journal of Medicine* found that early mobilization in mechanically ventilated ICU patients was associated with a significant reduction in delirium, shorter duration of mechanical ventilation, and improved functional outcomes at discharge. The study concluded that early mobilization should be considered a standard of care for critically ill patients [9].

Early mobilization has numerous benefits for ICU patients and is supported by a growing body of evidence. By encouraging patients to move and engage in physical activity early on, healthcare providers can help prevent complications, improve respiratory function, and enhance patients' overall well-being. Early mobilization should be considered a standard of care in the ICU, and healthcare providers should work to implement protocols and guidelines to ensure that patients are mobilized as soon as possible [7].

Nurses' Role in Early Mobilization Protocols:

Nurses play a crucial role in the implementation of early mobilization protocols for patients in healthcare settings. Early mobilization refers to the initiation of physical activity and movement as soon as possible after a patient's admission to a healthcare facility. This practice has been shown to have numerous benefits for patients, including reducing the risk of complications such as pressure ulcers, muscle weakness, and pneumonia, as well as improving overall outcomes and shortening hospital stays [9].

Nurses are at the forefront of patient care in healthcare settings and are responsible for implementing early mobilization protocols for their patients. They work closely with other members of the healthcare team, including physical therapists, occupational therapists, and physicians, to develop and implement individualized mobilization plans for each patient. Nurses assess the patient's mobility status, set goals for their physical activity, and monitor their progress throughout their hospital stay [10].

One of the key responsibilities of nurses in early mobilization is to educate patients and their families about the importance of early mobilization and the benefits it can have on their recovery. Nurses explain the risks of immobility, such as muscle atrophy and increased risk of falls, and encourage patients to participate in physical activity as soon as they are able. They also provide guidance on safe mobilization techniques and assist patients in performing exercises and activities that promote movement and strength [11].

Nurses also play a critical role in assessing and managing the barriers to early mobilization that patients may face. This includes addressing issues such as pain, fatigue, and fear of falling, as well as ensuring that patients have access to the necessary equipment and resources to support their mobility. Nurses work collaboratively with the healthcare team to develop strategies to overcome these barriers and support patients in achieving their mobilization goals [9].

The implementation of early mobilization protocols has been shown to have a significant impact on patient care and outcomes. Research has demonstrated that early mobilization can reduce the risk of complications such as pressure ulcers, muscle weakness, and pneumonia, which are common in patients who are immobile for extended periods. By promoting movement and physical activity, early mobilization can also improve patients' strength, endurance, and overall functional status, leading to faster recovery and shorter hospital stays [12].

In addition to the physical benefits, early mobilization has been shown to have positive effects on patients' mental and emotional well-being. Patients who are able to move and engage in physical activity are more likely to experience a sense of independence and control over their recovery process, which can improve their overall quality of life and satisfaction with their care. Early mobilization can also reduce the risk of delirium and other cognitive complications that are associated with prolonged immobility [13].

Nurses play a vital role in the implementation of early mobilization protocols for patients in healthcare settings. By working collaboratively with the healthcare team, educating patients and their families, and addressing barriers to mobility, nurses can support patients in achieving their mobilization goals and improving their overall outcomes. Early mobilization has been shown to have numerous benefits for patients, including reducing the risk of complications, improving functional status, and enhancing mental and emotional well-being. By prioritizing early mobilization in patient care, nurses can contribute to better outcomes and experiences for their patients [14].

Challenges and Barriers in Implementing Early Mobilization:

Early mobilization, which refers to the practice of getting patients up and moving as soon as possible after surgery or a medical procedure, has been shown to have numerous benefits for patients. However, despite the evidence supporting its effectiveness, there are several challenges and barriers that healthcare providers face when trying to implement early mobilization in their practice [15].

One of the main challenges in implementing early mobilization is the lack of awareness and education among healthcare providers. Many healthcare professionals may not be familiar with the benefits of early mobilization or may not have received adequate training on how to safely and effectively implement it. This lack of knowledge can lead to hesitation or resistance to incorporating early mobilization into patient care plans [16].

Another barrier to implementing early mobilization is the presence of physical and environmental limitations in healthcare settings. For example, some hospitals may not have the necessary equipment or resources to support early mobilization, such as specialized beds or mobility aids. Additionally, crowded or busy hospital wards may make it difficult for patients to move around safely and comfortably. These physical and

environmental barriers can make it challenging for healthcare providers to prioritize early mobilization for their patients [17].

Furthermore, there may be cultural or institutional barriers that prevent healthcare providers from implementing early mobilization. For example, some healthcare facilities may have established routines or protocols that do not prioritize early mobilization, making it difficult for providers to deviate from these practices. Additionally, there may be a lack of buy-in from hospital administrators or other key stakeholders, which can hinder efforts to implement early mobilization on a larger scale [16].

In addition to these challenges, there are also individual patient factors that can make early mobilization more difficult. Patients who are elderly, have multiple comorbidities, or are recovering from major surgery may be at higher risk for complications or may require more intensive support to mobilize safely. Healthcare providers must carefully assess each patient's individual needs and capabilities in order to develop a personalized early mobilization plan that is safe and effective [18].

Despite these challenges and barriers, it is important for healthcare providers to prioritize early mobilization in order to improve patient outcomes and reduce the risk of complications. By addressing the factors that may be hindering the implementation of early mobilization, such as lack of education, physical limitations, or cultural barriers, healthcare providers can work towards creating a healthcare system that prioritizes early mobilization for all patients [19].

While there are numerous challenges and barriers to implementing early mobilization in healthcare settings, it is essential for healthcare providers to overcome these obstacles in order to improve patient outcomes and enhance the quality of care. By addressing issues such as lack of awareness, physical limitations, and cultural barriers, healthcare providers can work towards creating a culture of early mobilization that benefits patients and healthcare systems as a whole [20].

Interdisciplinary Collaboration in Mobilization Practices:

Interdisciplinary collaboration in mobilization practices is a critical aspect of modern healthcare. It involves professionals from various disciplines working together to improve patient outcomes and enhance the overall quality of care. This collaborative approach brings together experts from different fields such as nursing, physical therapy, occupational therapy, social work, and

more, to address complex health issues and provide comprehensive care to patients [21].

One of the key benefits of interdisciplinary collaboration in mobilization practices is the ability to leverage the unique skills and expertise of each team member. For example, physical therapists can provide specialized knowledge and techniques for mobilizing patients, while nurses can offer insights into the patient's overall health and well-being. By working together, these professionals can develop individualized care plans that address the specific needs of each patient and promote faster recovery and improved outcomes [22].

Another advantage of interdisciplinary collaboration in mobilization practices is the ability to address the social and emotional aspects of patient care. Social workers, for example, can help patients navigate the challenges of transitioning back to their daily lives after a hospital stay, while occupational therapists can assist with adapting the patient's environment to promote independence and mobility. By integrating these different perspectives into the care plan, interdisciplinary teams can provide holistic care that addresses all aspects of the patient's well-being [20].

In addition, interdisciplinary collaboration in mobilization practices can lead to more efficient and effective care delivery. By working together, team members can streamline communication, coordinate care plans, and avoid duplication of efforts. This can result in faster mobilization of patients, reduced length of hospital stays, and improved patient satisfaction. Furthermore, interdisciplinary teams can also identify and address potential barriers to mobilization, such as staffing shortages or equipment limitations, and develop strategies to overcome these challenges [22].

Despite the numerous benefits of interdisciplinary collaboration in mobilization practices, there are also some challenges to overcome. One common obstacle is the potential for conflicts between team members with different professional backgrounds and perspectives. Effective communication, mutual respect, and a shared commitment to patient care are essential for overcoming these challenges and fostering a collaborative team environment [23].

Another challenge is the logistical complexity of coordinating care among multiple disciplines. This can require careful planning, clear communication, and strong leadership to ensure that all team members are working together towards a common goal. Additionally, interdisciplinary collaboration may require additional resources, such as training, technology, and support staff, to be successful [21].

Interdisciplinary collaboration in mobilization practices is a crucial component of modern healthcare that can lead to improved patient outcomes, enhanced quality of care, and more efficient care delivery. By bringing together professionals from different disciplines to work towards a common goal, interdisciplinary teams can provide comprehensive care that addresses all aspects of the patient's well-being. While there are challenges to overcome, the benefits of interdisciplinary collaboration far outweigh the obstacles, making it a valuable approach for improving patient care in today's healthcare system [24].

Nurse-Led Mobilization Programs: Impact on Patient Outcomes:

Nurse-led mobilization programs have been gaining attention in recent years as a way to improve patient outcomes. These programs involve nurses taking an active role in mobilizing patients, which can include helping them to walk, exercise, and engage in other physical activities. The goal of these programs is to prevent complications related to immobility, such as pressure ulcers, muscle weakness, and decreased lung function [25].

There are several benefits to nurse-led mobilization programs. One of the main benefits is that they can help to prevent complications related to immobility. For example, research has shown that immobile patients are at a higher risk of developing pressure ulcers, which can be painful and difficult to treat. By helping patients to move and exercise, nurses can reduce the risk of pressure ulcers and other complications [26].

In addition to preventing complications, nurse-led mobilization programs can also improve patient outcomes in other ways. For example, research has shown that patients who participate in these programs are more likely to experience a faster recovery time and have better overall health outcomes. This is because physical activity can help to improve circulation, strengthen muscles, and boost the immune system [27].

Furthermore, nurse-led mobilization programs can also have a positive impact on patients' mental health. Being immobile for long periods of time can lead to feelings of isolation, depression, and anxiety. By encouraging patients to move and engage in physical activities, nurses can help to improve their mood and overall well-being [25].

While nurse-led mobilization programs have many benefits, there are also some challenges associated with implementing them. One of the main challenges is that nurses may not always have the

time or resources to dedicate to these programs. In busy healthcare settings, nurses may be overwhelmed with other responsibilities and may not have the capacity to devote time to mobilizing patients [28].

Another challenge is that some patients may be resistant to participating in these programs. For example, patients who are in pain or who have mobility issues may be reluctant to engage in physical activities. Nurses may need to work closely with these patients to address their concerns and find ways to make mobilization more comfortable and accessible [29].

Despite these challenges, nurse-led mobilization programs have been shown to have a positive impact on patient outcomes. Research has consistently demonstrated that patients who participate in these programs are more likely to experience improved physical and mental health outcomes. For example, a study published in the *Journal of Nursing Care Quality* found that patients who participated in a nurse-led mobilization program had a lower incidence of pressure ulcers and were more likely to be discharged home rather than to a long-term care facility [30].

Furthermore, nurse-led mobilization programs have been shown to reduce the length of hospital stays and decrease healthcare costs. By preventing complications related to immobility, these programs can help to improve patient outcomes and reduce the burden on the healthcare system [31].

Nurse-led mobilization programs have the potential to significantly improve patient outcomes. By encouraging patients to move and engage in physical activities, nurses can help to prevent complications related to immobility, improve recovery times, and enhance overall health outcomes. While there are challenges associated with implementing these programs, the benefits far outweigh the drawbacks. Moving forward, it will be important for healthcare organizations to prioritize nurse-led mobilization programs as a way to improve patient care and outcomes [28].

Strategies for Enhancing Nurse Engagement in Mobilization Efforts:

In the healthcare industry, nurses play a crucial role in providing care to patients. They are at the forefront of patient care, and their engagement in mobilization efforts is essential for the success of any healthcare organization. Nurse engagement refers to the level of involvement, commitment, and enthusiasm that nurses have towards their work and the organization they work for. When nurses are engaged, they are more likely to be motivated, productive, and dedicated to their

roles, which ultimately leads to better patient outcomes [30].

Mobilization efforts in healthcare refer to the process of preparing and organizing resources, including personnel, equipment, and facilities, to respond to emergencies, disasters, or other critical situations. Nurse engagement in mobilization efforts is crucial for ensuring that healthcare organizations can effectively respond to such situations and provide the necessary care to patients [32].

There are several strategies that healthcare organizations can implement to enhance nurse engagement in mobilization efforts. These strategies are aimed at fostering a culture of engagement, providing support and resources for nurses, and ensuring that they are adequately prepared to respond to emergencies and critical situations [33].

One of the key strategies for enhancing nurse engagement in mobilization efforts is to create a culture of engagement within the organization. This involves promoting open communication, collaboration, and teamwork among nurses and other healthcare professionals. When nurses feel that their opinions are valued and that they are part of a supportive team, they are more likely to be engaged and committed to their work. Healthcare organizations can foster a culture of engagement by encouraging open dialogue, recognizing and rewarding nurses for their contributions, and providing opportunities for professional development and growth [34].

Another important strategy for enhancing nurse engagement in mobilization efforts is to provide support and resources for nurses. This includes ensuring that nurses have access to the necessary training, education, and equipment to effectively respond to emergencies and critical situations. Healthcare organizations can invest in ongoing training and education programs for nurses, providing them with the knowledge and skills they need to confidently and competently respond to emergencies. Additionally, providing nurses with the necessary resources, such as adequate staffing levels, appropriate equipment, and supportive leadership, can help to enhance their engagement and enable them to provide high-quality care during mobilization efforts [35].

Furthermore, healthcare organizations can enhance nurse engagement in mobilization efforts by involving nurses in the planning and decision-making processes. When nurses are actively involved in the development of mobilization plans and protocols, they are more likely to be engaged and committed to their roles. Involving nurses in

decision-making can also help to ensure that mobilization efforts are tailored to the specific needs and challenges of the nursing staff, which can ultimately lead to more effective and efficient responses to emergencies and critical situations [34].

In addition to these strategies, healthcare organizations can also enhance nurse engagement in mobilization efforts by providing opportunities for nurses to participate in leadership roles and take on additional responsibilities. This can help to empower nurses, increase their sense of ownership and commitment to their work, and ultimately enhance their engagement in mobilization efforts [36].

Nurse engagement in mobilization efforts is essential for the success of any healthcare organization. By implementing strategies to foster a culture of engagement, provide support and resources for nurses, involve nurses in planning and decision-making, and provide opportunities for leadership and growth, healthcare organizations can enhance nurse engagement and ensure that nurses are prepared to effectively respond to emergencies and critical situations. Ultimately, enhancing nurse engagement in mobilization efforts can lead to better patient outcomes and a more resilient healthcare system [36].

Conclusion:

In conclusion, ICU-acquired weakness is a serious complication that can occur in patients who are admitted to an intensive care unit for an extended period of time. This condition can have long-lasting effects on a patient's ability to recover and regain their independence, making prevention and early intervention critical. By understanding the risk factors and symptoms of ICU-acquired weakness, healthcare providers can work to improve outcomes for patients in the ICU.

References:

1. Adler J, Malone D. Early mobilization in the intensive care unit: a systematic review. *Cardiopulm Phys Ther J.* 2012;23(1):5-13.
2. Bakhru RN, Wiebe DJ, McWilliams DJ, Spuhler VJ, Schweickert WD. An environmental scan for early mobilization practices in U.S. ICUs. *Crit Care Med.* 2015;43(11):2360-2369.
3. Berney SC, Harrold M, Webb SA, Seppelt I, Patman S, Thomas PJ, Denehy L. Intensive care unit mobility practices in Australia and New Zealand: a point prevalence study. *Crit Care Resusc.* 2013;15(4):260-265.
4. Denehy L, Skinner EH, Edbrooke L, Haines K, Warrillow S, Hawthorne G, Gough K, Vander

- Hoorn S, Morris ME, Berney S. Exercise rehabilitation for patients with critical illness: a randomized controlled trial with 12 months of follow-up. *Crit Care*. 2013;17(4):R156.
5. Devlin JW, Skrobik Y, Gélinas C, Needham DM, Slooter AJ, Pandharipande PP, Watson PL, Weinhouse GL, Nunnally ME, Rochwerg B, Balas MC, van den Boogaard M, Bosma KJ, Brummel NE, Chanques G, Denehy L, Drouot X, Fraser GL, Harris JE, Joffe AM, Kho ME, Kress JP, Lanphere JA, McKinley S, Neufeld KJ, Pisani MA, Payen JF, Pun BT, Puntillo KA, Riker RR, Robinson BR, Shehabi Y, Szumita PM, Winkelman C, Centofanti JE, Price C, Nikayin S, Misak CJ, Flood PD, Kiedrowski K, Alhazzani W. Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. *Crit Care Med*. 2018;46(9):e825-e873.
 6. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc*. 2016;13(5):724-730.
 7. Engel HJ, Needham DM, Morris PE, Gropper MA. ICU early mobilization: from recommendation to implementation at three medical centers. *Crit Care Med*. 2013;41(9 Suppl 1):S69-S80.
 8. Hodgson CL, Stiller K, Needham DM, Tipping CJ, Harrold M, Baldwin CE, Bradley S, Berney S, Caruana LR, Elliott D, Green M, Haines K, Hird K, Fergusson DA, Webb SA. Expert consensus and recommendations on safety criteria for active mobilization of mechanically ventilated critically ill patients. *Crit Care*. 2014;18(6):658.
 9. Kayambu G, Boots R, Paratz J. Physical therapy for the critically ill in the ICU: a systematic review and meta-analysis. *Crit Care Med*. 2013;41(6):1543-1554.
 10. Morris PE, Goad A, Thompson C, Taylor K, Harry B, Passmore L, Ross A, Anderson L, Baker S, Sanchez M, Penley L, Howard A, Dixon L, Leach S, Small R, Hite RD, Haponik E. Early intensive care unit mobility therapy in the treatment of acute respiratory failure. *Crit Care Med*. 2008;36(8):2238-2243.
 11. Nydahl P, Sricharoenchai T, Chandra S, Kundt FS, Huang M, Fischill M, Needham DM. Safety of patient mobilization and rehabilitation in the intensive care unit. Systematic review with meta-analysis. *Ann Am Thorac Soc*. 2017;14(5):766-777.
 12. Parry SM, Knight LD, Connolly B, Baldwin C, Puthuchery Z, Morris P, Mortimore J, Hart N, Denehy L, Granger CL. Factors influencing physical activity and rehabilitation in survivors of critical illness: a systematic review of quantitative and qualitative studies. *Intensive Care Med*. 2017;43(4):531-542.
 13. Pohlman MC, Schweickert WD, Pohlman AS, Nigos C, Pawlik AJ, Esbrook CL, Spears L, Miller M, Franczyk M, Deprizio D, Schmidt GA, Bowman A, Barr R, McCallister KE, Hall JB, Kress JP. Feasibility of physical and occupational therapy beginning from initiation of mechanical ventilation. *Crit Care Med*. 2010;38(11):2089-2094.
 14. Schweickert WD, Pohlman MC, Pohlman AS, Nigos C, Pawlik AJ, Esbrook CL, Spears L, Miller M, Franczyk M, Deprizio D, Schmidt GA, Bowman A, Barr R, McCallister KE, Hall JB, Kress JP. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial. *Lancet*. 2009;373(9678):1874-1882.
 15. Tipping CJ, Harrold M, Holland A, Romero L, Nisbet T, Hodgson CL. The effects of active mobilisation and rehabilitation in ICU on mortality and function: a systematic review. *Intensive Care Med*. 2017;43(2):171-183.
 16. Zanni JM, Korupolu R, Fan E, Pradhan P, Janjua K, Palmer JB, Brower RG, Needham DM. Rehabilitation therapy and outcomes in acute respiratory failure: an observational pilot project. *J Crit Care*. 2010;25(2):254-262.
 17. Hodgson CL, Berney S, Harrold M, Saxena M, Bellomo R. Clinical review: early patient mobilization in the ICU. *Crit Care*. 2013;17(1):207.
 18. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med*. 2014;42(5):1178-1186.
 19. Morris PE, Berry MJ, Files DC, Thompson JC, Hauser J, Flores L, Dhar S, Chmelo E, Lovato J, Case LD, Bakhru RN, Sarwal A, Parry SM, Campbell P, Mote A, Winkelman C, Hite RD, Nicklas B, Chatterjee A, Young MP. Standardized rehabilitation and hospital length of stay among patients with acute respiratory failure: a randomized clinical trial. *JAMA*. 2016;315(24):2694-2702.
 20. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early

- mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
21. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
 22. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med.* 2014;42(5):1178-1186.
 23. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
 24. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med.* 2014;42(5):1178-1186.
 25. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
 26. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med.* 2014;42(5):1178-1186.
 27. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
 28. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med.* 2014;42(5):1178-1186.
 29. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
 30. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med.* 2014;42(5):1178-1186.
 31. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
 32. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med.* 2014;42(5):1178-1186.
 33. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
 34. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med.* 2014;42(5):1178-1186.
 35. Dubb R, Nydahl P, Hermes C, Schwabbauer N, Toonstra A, Parker AM, Kaltwasser A, Needham DM. Barriers and strategies for early mobilization of patients in intensive care units. *Ann Am Thorac Soc.* 2016;13(5):724-730.
 36. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, Kaltwasser A, Mende H, Rothaug O, Schuchhardt D, Schwabbauer N, Needham DM. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. *Crit Care Med.* 2014;42(5):1178-1186.