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What factors affect implementation of early rehabilitation into intensive care unit practice? - A qualitative study with clinicians

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**Title:** What factors affect implementation of early rehabilitation into intensive care unit practice? - A qualitative study with clinicians

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**ABSTRACT**

**Purpose:** To identify the barriers and enablers that influence clinicians' implementation of early rehabilitation in critical care.

**Materials and Methods:** Qualitative study involving 26 multidisciplinary participants who were recruited using purposive sampling. Four focus groups were conducted using semi-structured questions to explore attitudes, beliefs and experiences. Data were transcribed verbatim and thematic analysis was performed.

**Results:** Six themes emerged: 1) the clinicians' expectations and knowledge (including rationale for rehabilitation, perceived benefits and experience); 2) the evidence for and application of rehabilitation (including beliefs regarding when to intervene); 3) patient factors (including prognosis, sedation, delirium, cooperation, motivation, goals and family); 4) safety considerations (including physiological stability and presence of devices or lines); 5) environmental influences (staffing, resources, equipment, time and competing priorities); and 6) culture and teamwork. Key strategies identified to facilitate rehabilitation included addressing educational needs for all multi-disciplinary team members; supporting junior nursing staff; and potential expansion of physiotherapy staffing hours to closer align with the 24-hour patient care model.

**Conclusions:** Key barriers to implementation of early rehabilitation in critical care are diverse and include both clinician and healthcare system related factors. Research targeted at bridging this evidence-practice gap is required to improve provision of rehabilitation.

**Keywords:** intensive care; rehabilitation; barriers; qualitative; implementation, recovery of function

**Introduction:**

Survivorship following critical illness is associated with significant long-term morbidity including psychological, cognitive and physical impairments[1-4]. This impacts on the patient's quality of life and resumption of societal and family roles including return to work[1, 2]. Early mobilisation and rehabilitation forms a pivotal aspect of recovery after critical illness and has been demonstrated to be safe, feasible and potentially efficacious in improving patient outcomes [5-7].

Evidence translation is increasingly being prioritised as a key area of focus to ensure evidence-based interventions are implemented in a timely and effective manner into healthcare[8-11]. However, the time from research generation to clinical implementation can be up to two decades[8]. In an attempt to reduce the time lag and to effectively deliver evidence-based patient care it is important to consider the contextual factors in the specific clinical area, which may impact on effective practice change. In the intensive care unit (ICU) setting there is a body of evidence documenting issues with survivorship morbidity [3, 12-15] and the potential role for rehabilitation in minimising the ensuing impairments that develop as a result of being critically ill [5, 6, 16, 17]. Despite no clear consensus on timing and best modality for rehabilitation intervention, the evidence for delivery of some form of intervention is now recognised as a key aspect of ICU patient management [18, 19]. However, this is variably implemented into practice as shown by recent point prevalence and observational data from Australia and internationally demonstrating low levels of mobilisation occur in the ICU setting[20-23]. A recent review (predominantly consisting of quantitative studies) identified some of the barriers to implementation of early mobility in the ICU setting [24].

Qualitative research methodologies can be utilised to understand the challenges with implementing rehabilitation into clinical practice. This research methodology enables exploration of clinicians' perceptions and provides insight into clinician behaviour in their own words rather than constraining them to terms imposed on them by others (a limitation of quantitative research) [25]. It is important to understand perceptions of the clinicians working in the ICU setting in order to change behaviour, which is ultimately one facet, which is required in order to implement healthcare service delivery change.

There are a small number of qualitative studies (all single centre), which have explored potential factors impacting on mobilisation and rehabilitation [26-29], however it is unknown whether these findings are consistent and generalizable across different institutions. Therefore the objectives of this study were to identify factors (barriers and enablers) that influence clinicians' implementation of early rehabilitation in the ICU setting across two ICU tertiary hospitals.

## **Materials and Methods**

### *Study design, clinician selection and setting*

The 32-item consolidated criteria for reporting qualitative research (COREQ) guidelines [25] were followed in this study. In-depth, semi-structured focus group sessions were conducted based on the methodological orientation and theory of content analysis [30]. For inclusion in the study, clinicians were required to be working clinically in the ICU setting as a medical doctor, nurse or physiotherapist. The study was advertised via email to clinicians working in the ICU at two acute tertiary hospitals in Melbourne, Australia. Physiotherapy practices within both hospitals were similar with dedicated physiotherapy

staffing including junior rotational physiotherapy staff who provided both respiratory and rehabilitation management. Rehabilitation involved active and functional exercises which commenced generally once the patient was alert and cooperative including targeted strengthening and mobilisation. It is not routine practice for mechanically ventilated patients with an endotracheal tube to be mobilised. This is representative of Australian practice [21, 31]. There were standardised protocols for sedation and delirium management at both institutions.

A sample size of 12-20 participants has been reported as sufficient for qualitative research methods and enables data saturation to be met [32, 33]. Therefore we aimed to recruit at least 20 participants in total. Data saturation was defined as the point in data collection when no new relevant information or themes had emerged from the focus groups conducted [30]. In attempt to maximise heterogeneity in terms of professional background and clinical experience in the ICU clinicians were selected using purposive sampling. All participants who responded to the advertisement were included. In order to stimulate openness in responses it was decided to run two separate focus groups in order to reduce potential bias and influence on participants based on professional background. There was concern that physiotherapy presence in medical/nursing focus group may have altered the transparency of thoughts regarding rehabilitation given physiotherapists are often the primary instigators of rehabilitation in these two institutions. Two focus groups (one for medical / nursing staff, and one for physiotherapy staff) were conducted at each of the two hospital sites in a quiet and private room to ensure confidentiality. Only the clinicians, facilitators and scribe (taking field notes) were present during the focus groups. Written

informed consent was obtained. The study was approved by The University of Melbourne Human Research Ethics Committee (Project Number: 1442944.1).

#### *Research team and reflexivity*

Two female PhD qualified physiotherapists (LR and SP) conducted the focus groups. One researcher (LR) had over 14 years of qualitative research methodology experience including formal training and provided training and mentorship to the second facilitator (SP). The facilitators may have known some of the clinicians but they did not work directly with them. Prior to commencement of the focus group, the clinicians were made aware that the facilitators were members of the research team, physiotherapists by background with qualitative research methodology expertise.

#### *Data collection methodology*

A semi-structured interview guide was developed and piloted prior to use (Online supplement Table E1). Four focus groups were conducted during 2014 and 2015. The focus group duration ranged from 25 to 71 minutes in duration. All sessions were audio-recorded and field notes were taken. Demographic characteristics collated about the clinicians included: age, gender, education and experience in ICU practice (Table 1). There were no repeat interviews.

#### *Qualitative data analysis and reporting*

The focus group recordings were transcribed verbatim and independently crosschecked by a second researcher. The recordings were de-identified from hospital site,



but were identifiable as either 'medical or nursing' or 'physiotherapy' to allow interpretation of data in the context of the professional group. Data saturation was defined as the point in data collection when no new relevant information or themes had emerged from the focus groups conducted [30]. Content analysis methodologies were used to analyse results [30]. Two researchers (SP and CG) independently performed data coding and crosschecked thematic analyses. Data were analysed using line-by-line analysis and assigning codes to key thoughts and ideas. No specific software programs were utilised to manage data collated. Themes were refined to reach consensus where necessary between the two researchers. Participant quotations were presented in conjunction with identified themes to help illustrate study findings and improve the dependability of the data.

## Results

Twenty-six clinicians working in ICU at two Australian tertiary hospitals agreed to participate in the study. There were no dropouts or withdrawals. The characteristics of the clinicians are summarised in Table 1.

### INSERT TABLE 1

Six themes and 14 subthemes around the factors (barriers and enablers) that influence clinicians' implementation of early rehabilitation in the ICU setting emerged from the focus groups. The six themes were: 1) clinician expectations and knowledge; 2) evidence for and application of rehabilitation; 3) patient factors; 4) safety considerations; 5) environmental influences; and 6) culture and teamwork (Figure 1). These themes and supportive quotations from clinicians are summarised in Table 2 and described in the subsequent sections.

**INSERT TABLE 2***Theme 1: Clinicians' expectations and knowledge*

This theme encompasses discussion of clinician expectations in terms of the rationale and benefits of rehabilitation for patients and their knowledge of rehabilitation strategies including where this was developed (e.g. clinical experience, university education). Clinicians expected positive outcomes for patients who participated in rehabilitation. This was seen as an enabler of rehabilitation with all clinicians regardless of discipline background (medical, nursing and physiotherapy) highlighting positive outcomes for patients as a result of participation in rehabilitation. Expected benefits for patients included regaining physiological and physical function including strength and independence; improving the respiratory system and assistance with weaning; prevention of deterioration of function; and psychological benefits for both patients and staff from seeing patients out of bed and moving, and for patients to feel they have some control and autonomy over their care. All professions noted that the medical care of patients to survive ICU was insignificant unless the patient can return to some form of physical ability, and justified the need and interaction of rehabilitation to achieve this desired goal of survival but with physical ability.

Clinicians perceived a need for the whole team to have knowledge about rehabilitation. In particular, to know how far to push patients, which they perceived was often not far enough. Both medical and nursing clinicians described a bias towards more senior staff (doctors or nurses) being involved or supporting rehabilitation over junior staff and felt this was primarily due to greater knowledge.

The medical doctors described their knowledge about rehabilitation had primarily developed from incidental learning whilst being immersed in the ICU. They described witnessing rehabilitation practices (particularly from physiotherapy colleagues) and noted concerns that the variable culture of rehabilitation and physiotherapy programs at different ICUs mean that some doctors are not provided with the opportunity to be exposed to rehabilitation practices and gain this knowledge. Whilst some doctors described gaining basic knowledge from the college curriculum, it was felt this was only at a 'superficial' level and hypothesized this may be due to the strength of evidence at present. They felt good medical practice required understanding of all multidisciplinary team roles within the ICU, and similarly they felt this was needed by the other professions in order to work cohesively as a team to achieve excellence in patient care.

Nurses described gaining knowledge about rehabilitation through experience, colleagues (and role models) and advice/communication with medical staff particularly around the appropriateness of rehabilitation. Nurses described differing practice based on experience level, with a perception that senior staff tend to be more pro-active in rehabilitating patients. The reluctance of junior staff to perform rehabilitation was hypothesised to be due to lack of knowledge, lack of confidence and feeling overwhelmed within the high acuity environment. Nurses described the need for strategies including junior support and delivery of education and practical sessions conducted by physiotherapists for nursing staff.

Physiotherapists described their knowledge had come from university education, reading the literature and significant exposure and practice in the ICU with mentoring from senior physiotherapy staff. Medical and physiotherapy clinicians felt it was important for

physiotherapists to have strong foundational knowledge of medical concepts such as ventilators, haemodynamic stability and devices/lines to ensure safety but also ensure patients are being challenged enough in rehabilitation to achieve the greatest benefits.

The desire for interdisciplinary education was evident from all clinicians. There was a desire for inter-disciplinary learning; teaching led by physiotherapists and also the use of interdisciplinary simulation training (for high risk rehabilitation practices such as moving patients with complex lines and devices).

### *Theme 2: Evidence and application of rehabilitation*

There were conflicting opinions on the strength of evidence for early rehabilitation and this influenced clinical decision-making. Some clinicians (from all professions) felt there was evidence for early rehabilitation; whereas others (medical or nursing only) felt there was either no evidence or insufficient strong data to support early rehabilitation in the ICU. There were no clear differences in age or experience between the two schools of thoughts. Generally, clinicians in the later category did not highly prioritise rehabilitation to commence early for patients during their ICU stay.

The rationale behind timing of rehabilitation provision varied amongst clinicians. It was highlighted that the concept of 'early rehabilitation' is newer in practice and there has been a culture shift in starting rehabilitation earlier. Some medical clinicians described being unsure if there is evidence on when to intervene. There were two conflicting opinions on when to intervene. The first group which included a combination of all professions felt it was beneficial to start soon as possible (as soon as considered safe, even in patients who are still critically ill). The rationale for this was to prevent patient deterioration and be pro-active

rather than wait to intervene at the end of the ICU stay. They also desired an ability to predict the sub-group of patients who will be in ICU for a prolonged period of time or those at risk of developing intensive care unit-acquired weakness in order to be able to target resources early towards this group (but noted lack of evidence for sub-groups at present). This group also acknowledged there is still a need for more evidence particularly around longer term or financial outcomes to be able to help strengthen the justification for early rehabilitation in ICU. The second group (combination of medical and nursing) felt rehabilitation was more appropriate once the patient is over their acute illness. They explained the need for medical recovery first (such as when patients are still sedated, intubated, on life saving support therapies such as extracorporeal membrane oxygenation), and then a desire to start to focus on recovery and rehabilitation only once patients are over this high acuity period of illness. Along with this argument was the thought that 'waiting for rehabilitation' is more similar to the body's natural adaption to illness (rest if ill) but noted waiting was balanced with the risk of deterioration in physical functioning during this time.

### *Theme 3: Patient factors*

It was perceived that the intention and role of rehabilitation varied in individual patients and this impacts on timing of delivery of rehabilitation. The prognosis of the patient strongly influenced clinical decisions around the appropriateness and priority of rehabilitation for all clinicians.

The ability of the patient to cooperate and engage was another factor, which strongly influenced the decision to provide rehabilitation. This included if they were sedated or delirious, as well as patient motivation. Whilst sedation practices were perceived to be changing to enable greater patient participation it was still recognised as a key barrier to

rehabilitation by all disciplines. Nursing clinicians described the need to sometimes 'convince' patients or negotiate with them to participate in rehabilitation, as they often felt too fatigued or unwell and the importance of conveying to patients and families the importance of rehabilitation as part of their recovery process. Family was sometimes seen as a barrier to rehabilitation due to their concern that the patient is too 'ill' to participate in rehabilitation and nursing clinicians particularly highlighted the importance of communication and education of family. An important strategy to facilitate rehabilitation was seen to be the setting of individualised patient goals with the patient and the involvement of family in goal setting.

#### *Theme 4: Safety considerations*

Safety was a significant determining factor as to whether or not rehabilitation was delivered. Physiotherapists predominantly raised the discussions around safety considerations in their focus group discussions. This included general patient safety, physiological stability and securement of lines and devices. Medical clinicians described a shifting culture of the safety boundaries and controversy about this in the area. Physiotherapists identified the removal of unnecessary lines, consideration of line placement and timing of treatments (such as filtration) were viewed as a positive enabler of patients being able to get out of bed or participating in rehabilitation.

#### *Theme 5: Environmental influences*

The issues regarding equipment, and staffing were predominantly raised within the physiotherapy focus groups. Equipment was noted as a barrier to rehabilitation, in particular for the bariatric population with lack of appropriate equipment blocking rehabilitation.

Insufficient staffing and resources were also barriers. Rehabilitation was described as labour intensive, particularly patient mobilisation or rehabilitation of weak patients, which generally needed at least two staff members (nurses or physiotherapists). Issues were raised by all clinicians about the lack of physiotherapy staffing outside of business hours. This meant the time for available rehabilitation to be delivered by physiotherapists was limited, during a short period of time when other competing priorities such as procedures, lines, imaging and medical consultations are also present. Medical and nursing clinicians expressed a desire for the physiotherapy-staffing model to be re-considered and potentially align more with the 24-hour care delivered to patients. However, there were contrasting opinions about the potential safety of delivering rehabilitation out of hours when there is less medical support (in particular senior medical staff) in case of emergencies.

Nursing staff described strategies to facilitate patients being out of bed including timing procedures and the importance of communication and daily care planning to enable rehabilitation. Day night routine and adequate sleep were also valued highly.

#### *Theme 6: Culture and teamwork*

All clinicians perceived that rehabilitation was a team effort and needed multi-disciplinary team involvement to be successful. They described rehabilitation as being a broad concept encompassing physiotherapy, medical and nursing components, with all groups working towards a common goal of restoring function for the patient and optimising quality of life. However medical and nursing clinicians noted that physiotherapists were the main drivers of rehabilitation in their units.

The professional roles and identity were not clear in terms of 'who' should deliver rehabilitation and this was described as a grey area. Doctors generally felt unqualified to carry out the rehabilitation personally. The concept of nurses or nursing teams delivering rehabilitation for patients instead of physiotherapists was raised by nurses and doctors, however this was challenged by issues with nursing time (to complete other duties) and lack of specific training. Physiotherapists similarly viewed rehabilitation as being a team role and the desire to involve nursing staff in rehabilitation sessions.

Communication amongst the multi-disciplinary team members was seen as critical by all professions as was teamwork. Successful examples were described for communication between all team members on patient ward rounds where rehabilitation is discussed and planned when everyone is present. Discussing patient barriers for rehabilitation with other members of the team often was used to highlight changeable barriers (such as location of lines and timing of filtration).

Culture was described as a barrier and an enabler. Physiotherapists described occasions of lack of respect, or blame or humour being made towards them from nursing staff and a culture that filters down from senior to junior staff, however they noted that was less common now than historically. The improvement in culture was attributed to physiotherapy leadership in the ICU. There was a proactive view towards maintaining this positive culture and respect from other professions by being engaged in the ICU and demonstrating the benefits of rehabilitation through 'success' stories. Nurses self-described themselves as being the gatekeeper to the patient and sometimes blocking the physiotherapists; which physiotherapists echoed. Leadership from medical staff was viewed positively, and described by physiotherapists as promoting a positive culture of



rehabilitation in the unit. Physiotherapists attributed this medical leadership from their knowledge of the evidence base for rehabilitation.

## Discussion

The implementation of evidence into healthcare clinical practice is a complex and challenging issue [8-11]. There is growing evidence supporting the potential efficacy of early rehabilitation for patients in ICU [5, 7, 34, 35]; yet it appears that early mobilisation practices are not frequent and this is an issue across different international settings [20, 21, 23, 36]. Our study evaluated the barriers to early rehabilitation in ICU from the perspective of multi-disciplinary clinicians, and identified potential enablers to help promote rehabilitation for future care. Results demonstrated that key factors are the clinicians' expectations and knowledge (including rationale for rehabilitation, perceived benefits and experienced impact of the benefits); the evidence and application of rehabilitation (including when to intervene); patient factors (including prognosis, sedation, delirium, cooperation, motivation, goals and family); safety considerations (including patient physiological stability and presence of devices or lines); environmental influences (including available staffing, resources, equipment, time and competing priorities); and the culture and teamwork (including the multi-disciplinary team involvement, professional roles, communication and unit culture). Clinicians recommended key strategies to facilitate rehabilitation including addressing educational needs of the multi-disciplinary team about rehabilitation (both at the level of entry into practice and also up-skilling of clinicians in the workforce); mentorship and

support for junior nursing staff (to improve confidence and expertise); expansion of physiotherapy staffing and minimisation of patient related barriers through standardized protocols for sedation and delirium management to enable greater patient engagement in rehabilitation. These results provide insight into the factors that should be used to inform research, new clinical services, and policies in an attempt to improve ICU practices.

Our findings are similar to previous qualitative research studies particularly around the themes of: patient physiological stability, environmental influences, and culture and teamwork [26-29]. In contrast to previous qualitative studies we found a strong emphasis on the need and importance for educational training of the multidisciplinary team including integration of education about the burden of survivorship and importance of rehabilitation into both university curricula (at the point of entry into practice) as well as interdisciplinary clinical training in the hospital setting in order to equip the multidisciplinary team with the necessary knowledge and expertise to engage patients in rehabilitation. A recent international consensus statement on safety criteria for in-bed and out-of-bed rehabilitation in the ICU has been developed which may assist in the decision making particularly of junior or less experienced staff [37]. In order to improve training and education for the multidisciplinary team potential strategies may include: development of mobility guidelines, e-learning packages, dedicated interprofessional leaders and mentors, development of newsletters (with brief summaries of important research), and invited speakers to provide their views on successful models of rehabilitation in other ICU settings [38, 39].

It is not surprising that themes arose around lack of time, staffing and resources. These barriers to evidence translation are evident in many aspects of healthcare [10] and are not easily changeable. The ability to potentially identify individuals at highest risk of

functional deterioration and therefore target specific sub-groups within the limited resources/staffing capacity is highly desired and an area of increasing research. In order to address the issue of lack of time and competing priorities it is important that rehabilitation is not seen as the responsibility of a single discipline, but rather the entire multidisciplinary team. A recent behavioural mapping study demonstrated that patients spend little to no time being physically active and outside of rehabilitation with a therapist no activities associated with ambulation were undertaken[31]. Therefore it is important to consider how as a team we can adopt strategies to increase physical activity levels in the ICU and integrate a culture of 'activity' rather than 'bedrest'. Central to making rehabilitation routine practice is the culture of the ICU unit. Quality improvement projects following an: engage, educate, execute and evaluation model have been demonstrated to improve patient mobility and rehabilitation within the ICU setting[40, 41].

#### *Critique of the method*

This study is strengthened by the fact the methodology followed guidelines for conducting qualitative studies [25] including the use of duplicate transcription and data analysis. The study is limited due to restriction to only two hospitals in one country and no inclusion of participant checking. Whilst the themes identified predominantly focused on barriers rather than enablers, future research could examine targeted strategies aimed at changing these barriers.

There was an imbalance in the number of individuals within each professional background with predominantly physiotherapists (n=16/25); this therefore may bias the overall findings of this study. However it is important to note that nursing and medical focus groups were conducted separate to physiotherapy to improve openness in responses within the focus groups.

There is also the potential for response bias in terms of clinicians who electively responded to the advertisement by email and thus may result in a more selective viewpoint within the

data collated and may not be representative of all views of clinicians within the two institutions examined. The average number of years of clinical experience was lowest for physiotherapists (median [IQR]: 4 [2-6]) compared to medical and nursing which had a median of 9 and 12 years respectively. It is possible level of experience may have influenced clinician beliefs around the potential barriers and enablers to rehabilitation in the ICU setting. This study did not compare barriers and enablers identified based on years of experience but is an important future question following on from this study.

### *Future Directions*

The barriers identified by our study should be addressed when developing new studies and clinical services in intensive care. Knowledge of the relative strength of each barrier would be beneficial to allow prioritisation of barriers to target first. Future research should investigate the strength and hierarchy of these barriers. In addition, the consumer perspective of our identified barriers and enablers is important, and needs to be investigated in future research. In order to improve knowledge translation of research into clinical practice it is important to develop strategies, which effectively facilitate timely and efficient engagement of patients in rehabilitation. Future research should focus on translational models of care to increase rehabilitation provision within the ICU and post ICU settings. The Capability, Opportunity, Motivation and Behaviour (COM-B) model is frequently utilised to facilitate evidence translation and implementation of interventions targeting specific behaviours – which may occur at patient, clinician or healthcare system level [38].

### **Conclusions**

Key barriers to implementation of early rehabilitation in ICU are diverse and include both clinician and healthcare system related factors. One key strategy identified was to address educational needs for all multidisciplinary team members with the knowledge, skill and

confidence through curricula design and training to increase rehabilitation delivery in the ICU. Research targeted at bridging this evidence-practice gap is required to improve provision of rehabilitation in ICU.

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**Abbreviations:** ICU, intensive care unit; COREQ, Consolidated criteria for reporting qualitative research

## References:

1. Herridge, M.S., C.M. Tansey, A. Matté, G. Tomlinson, N. Diaz-Granados, A. Cooper, C.B. Guest, C.D. Mazer, S. Mehta, T.E. Stewart, P. Kudlow, D. Cook, A.S. Slutsky, and A.M. Cheung, *Functional Disability 5 Years after Acute Respiratory Distress Syndrome*. New England Journal of Medicine, 2011. **364**(14): p. 1293-1304.
2. Needham, D.M., J. Davidson, H. Cohen, R.O. Hopkins, C. Weinert, H. Wunsch, C. Zawistowski, A. Bemis-Dougherty, S.C. Berney, O.J. Bienvenu, S.L. Brady, M.B. Brodsky, L. Denehy, D. Elliott, C. Flatley, A.L. Harabin, C. Jones, D. Louis, W. Meltzer, S.R. Muldoon, J.B. Palmer, C. Perme, M. Robinson, D.M. Schmidt, E. Scruth, G.R. Spill, C.P. Storey, M. Render, J. Votto, and M.A. Harvey, *Improving long-term outcomes after discharge from intensive care unit: Report from a stakeholders' conference*. Crit Care Med, 2012. **40**: p. 502-9.
3. Pandharipande, P.P., T.D. Girard, J.C. Jackson, A. Morandi, J.L. Thompson, B.T. Pun, N.E. Brummel, C.G. Hughes, E.E. Vasilevskis, A.K. Shintani, K.G. Moons, S.K. Geervarghese, A. Canonico, R.O. Hopkins, G.R. Bernard, R.S. Dittus, and E.W. Ely, *Long-term cognitive impairment after critical illness*. N Engl J Med, 2013. **369**(14): p. 1306-16.
4. Hough, C.L., *Improving function during and after critical care*. Current Opinion in Critical Care, 2013. **19**(5): p. 488-495.
5. Morris, P.E., A. Goad, C. Thompson, K. Taylor, B. Harry, L. Passmore, A. Ross, L. Anderson, S. Baker, M. Sanchez, L. Penley, A. Howard, L. Dixon, S. Leach, R. Small, R.D. Hite, and E. Haponik, *Early intensive care unit mobility therapy in the treatment of acute respiratory failure*. Critical Care Medicine, 2008. **36**(8): p. 2238-2243.
6. Kayambu, G., R. Boots, and J. Paratz, *Physical Therapy for the Critically Ill in the ICU: A Systematic Review and Meta-Analysis*. Critical Care Medicine, 2013. **41**(6): p. 1543-1554.
7. Schweickert, W.D., M.C. Pohlman, A.S. Pohlman, C. Nigos, A.J. Pawlik, C.L. Esbrook, L. Spears, M. Miller, M. Franczyk, D. Deprizio, G.A. Schmidt, A. Bowman, R. Barr, K.E. McCallister, J.B. Hall, and J.P. Kress, *Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial*. The Lancet, 2009. **373**(9678): p. 1874-1882.
8. Morris, Z.S., S. Wooding, and J. Grant, *The answer is 17 years, what is the question: understanding time lags in translational research*. Journal of the Royal Society of Medicine, 2011. **104**(12): p. 510-520.
9. Grimshaw, J.M., M.P. Eccles, J.N. Lavis, S.J. Hill, and J.E. Squires, *Knowledge translation of research findings*. Implementation Science, 2012. **7**(1): p. 1-17.
10. Lau, R., F. Stevenson, B.N. Ong, K. Dziedzic, S. Treweek, S. Eldridge, H. Everitt, A. Kennedy, N. Qureshi, A. Rogers, R. Peacock, and E. Murray, *Achieving change in primary care—causes of the evidence to practice gap: systematic reviews of reviews*. Implementation Science, 2016. **11**(1): p. 1-39.
11. Woolf, S.H., *The meaning of translational research and why it matters*. JAMA, 2008. **299**.
12. Herridge, M., C. Tansey, A. Matte, G. Tomlinson, N. Diaz-Granados, A. Cooper, C. Guest, D. Mazer, S. Mehta, T. Stewart, P. Kudlow, D. Cook, A. Slutsky, and A. Cheung, *Functional Disability 5 years after Acute Respiratory Distress Syndrome*. New England Journal of Medicine, 2011. **364**: p. 1293-1304.
13. Needham, D., J. Davidson, H. Cohen, R. Hopkins, C. Weinert, H. Wunsch, C. Zawistowski, A. Bemis-Dougherty, S. Berney, J. Bienvenu, S. Brady, M. Brodsky, L. Denehy, D. Elliott, C. Flatley, A. Harabin, C. Jones, D. Louis, W. Meltzer, S. Muldoon, J. Palmer, C. Perme, M. Robinson, D. Schmidt, E. Scruth, G. Spill, C. Storey, M. Render, J. Votto, and M. Harvey, *Improving long-term outcomes after discharge from intensive care unit: Report from a stakeholders' conference*. Critical Care Medicine, 2012. **40**(2): p. 502-509.
14. Hough, C.L., *Improving physical function during and after critical care*. Current Opinion in Critical Care, 2013. **19**(5): p. 488-495.
15. Iwashyna, T., *Survivorship will be the defining challenge of critical care in the 21st century - Editorial*. Annals of Internal Medicine, 2010. **153**: p. 204-205.

16. Puthuchery, Z., S. Harridge, and N. Hart, *Skeletal muscle dysfunction in critical care: wasting, weakness, and rehabilitation strategies*. Critical Care Medicine, 2010. **38**(10 Suppl): p. S676-682.
17. Parry, S. and Z. Puthuchery, *The impact of extended bed rest on the musculoskeletal system in the critical care environment*. Extreme Physiology and Medicine, 2015. **4**(16).
18. National Institute for Health and Clinical Excellence, *Rehabilitation after critical illness. NICE Clinical Guideline*. National Institute for Health and Clinical Excellence 2009. **83**.
19. Agency for Clinical Innovation, *Physical Activity and Movement: A Guideline for Critically Ill Adults*, in *SHPN*, N. Lyons, Editor 2014.
20. Berney, S.C., J.W. Rose, J. Bernhardt, and L. Denehy, *Prospective observation of physical activity in critically ill patients who were intubated for more than 48 hours*. Journal of Critical Care, 2015. **30**(4): p. 658-663.
21. Berney, S., M. Harrold, S. Webb, I. Seppelt, S. Patman, P. Thomas, and L. Denehy, *Intensive care unit mobility practices in Australia and New Zealand: a point prevalence study*. Critical Care and Resuscitation, 2013. **15**(4): p. 260-265.
22. Nydahl, P., A. Ruhl, G. Bartoszek, R. Dubb, S. Filipovic, H.-J. Flohr, A. Kaltwasser, H. Mende, O. Rothaug, D. Schuchhardt, N. Schwabbauer, and D. Needham, *Early Mobilization of Mechanically Ventilated Patients: A 1-Day Point-Prevalence Study in Germany*. Critical Care Medicine, 2014. **42**(5): p. 1178-1186.
23. Jolley, S., M. Moss, D. Needham, E. Caldwell, P. Morris, R. Miller, N. Ringwood, M. Anders, K. Koo, S. Gundel, S. Parry, and C. Hough, *Point prevalence study of mobilization practices for acute respiratory failure patients in the United States*. Critical Care Medicine, 2016. **Accepted: In Press**.
24. Dubb, R., P. Nydahl, C. Hermes, N. Schwabbauer, A. Toonstra, A. Parker, A. Kaltwasser, and D. Needham, *Barriers and strategies for early mobilization in intensive care units*. Annals of ATS, 2016. **Epub ahead of print**.
25. Tong, A., P. Sainsbury, and J. Craig, *Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups*. International Journal for Quality in Health Care, 2007. **19**(6): p. 349-357.
26. Barber, E., T. Everard, A. Holland, C. Tipping, S. Bradley, and C. Hodgson, *Barriers and facilitators to early mobilisation in Intensive Care: a qualitative study*. Australian Critical Care, 2015. **28**(4): p. 177-182.
27. Winkelman, C. and K. Peereboom, *Staff-perceived barriers and facilitators*. Critical Care Nurse, 2010. **30**(2): p. S13-S16.
28. Eakin, M., L. Ugbah, T. Arnautovic, A. Parker, and D. Needham, *Implementing and sustaining an early rehabilitation program in a medical intensive care unit: A qualitative analysis*. Journal of Critical Care, 2015. **30**(4): p. 698-704.
29. Williams, N. and M. Flynn, *An exploratory study of physiotherapists' views of early rehabilitation in critically ill patients*. Physiotherapy Practice and Research, 2013. **34**(2): p. 93-102.
30. Hsieh, H.F. and S.E. Shannon, *Three approaches to qualitative content analysis*. Qual Health Res, 2005. **15**(9): p. 1277-88.
31. Berney, S., J. Rose, J. Bernhardt, and L. Denehy, *Prospective observation of physical activity in critically ill patients who were intubated for more than 48 hours*. Journal of Critical Care, 2015. **30**(4): p. 658-63.
32. Creswell, J., *Qualitative inquiry and research design: choosing among five traditions*. 1998, London: SAGE Publications.
33. Guest, G., A. Bunce, and L. Johnson, *How many interviews are enough? An experiment with data saturation and variability*. Field Methods, 2008. **18**(1): p. 59-82.
34. Kayambu, G., R.J. Boots, and J.D. Paratz, *Early rehabilitation in sepsis: a prospective randomised controlled trial investigating functional and physiological outcomes The i-PERFORM Trial (Protocol Article)*. BMC Anesthesiol, 2011. **11**: p. 21.
35. TEAM Study Investigators, C. Hodgson, R. Bellomo, S. Berney, M. Bailey, H. Buhr, L. Denehy, M. Harrold, A. Higgins, J. Presneill, M. Saxena, E. Skinner, P. Young, and S. Webb,

- Early mobilization and recovery in mechanically ventilated patients in the ICU: a bi-national, multi-centre prospective cohort study.* Critical Care, 2015. **19**: p. 81.
36. Nydahl, P., A. Ruhl, G. Bartoszek, R. Dubb, S. Filipovic, H.-J. Flohr, A. Kaltwasser, H. Mende, O. Rothaug, D. Schuchhardt, N. Schwabbauer, and D. Needham, *Early mobilisation of mechanically ventilated patients: a one day point prevalence study in Germany.* Critical Care Medicine, 2014. **42**(5): p. 1178-1186.
37. Hodgson, C., K. Stiller, D. Needham, C. Tippng, M. Harrold, C. Baldwin, S. Bradley, S. Berney, L. Caruana, D. Elliott, M. Green, K. Haines, A. Higgins, K. Kaukonen, I. Leditschke, M. Nickels, J. Paratz, S. Patman, E. Skinner, P. Young, J. Zanni, L. Denehy, and S. Webb, *Expert consensus and recommendations on safety criteria for active mobilization of mechanically ventilated critically ill adults.* Critical Care, 2014. **18**(658).
38. Michie, S., M. van Stralen, and R. West, *The behaviour change wheel: A new method for characterising and designing behaviour change interventions.* Implementation Science, 2011. **6**(42).
39. Needham, D.M., R. Korupolu, J.M. Zanni, P. Pradhan, E. Colantuoni, J.B. Palmer, R.G. Brower, and E. Fan, *Early physical medicine and rehabilitation for patients with acute respiratory failure: a quality improvement project.* Archives of Physical Medicine & Rehabilitation, 2010. **91**(4): p. 536-542.
40. Needham, D.M., R. Korupolu, J.M. Zanni, P. Pradhan, E. Colantuoni, J.B. Palmer, R.G. Brower, and E. Fan, *Early physical medicine and rehabilitation for patients with acute respiratory failure: a quality improvement project.* Archives of physical medicine and rehabilitation, 2010. **91**(4).
41. Engel, H.J., S. Tatebe, P.B. Alonzo, R.L. Mustille, and M.J. Rivera, *Physical therapist-established intensive care unit early mobilization program: quality improvement project for critical care at the University of California San Francisco Medical Center.* Physical therapy, 2013. **93**(7).



Figure 1: Summary of the six major themes identified from focus group discussions



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**Table 1: Characteristics of clinicians (n=26)**

	Median [IQR]* or n (%)
Age (years)	28 [25 – 32]
Gender, female	19 (73%)
Profession	
Medical doctor	6 (23%)
Nurse	4 (15%)
Physiotherapist	16 (61%)
Years working in profession	5 [3 – 9]
Medical doctor	9 [7-18]
Nurse	12 <sup>#</sup>
Physiotherapist	4 [2-6]
Years working in area of ICU	3 [1 – 7]
Medical doctor	5 [1-15]
Nurse	11 <sup>#</sup>
Physiotherapist	3 [1-5]
Highest educational level obtained	
Bachelor or medical degree	19 (79%)
Post-graduate or Masters' degree	4 (17%)
PhD	1 (4%)

*Abbreviations: ICU, intensive care unit; IQR, inter-quartile range; n, number; PhD, Doctor of Philosophy.*

*\* Non-parametric data analysed using SPSS Windows Version 22.0.0 (SPSS, Chicago, IL, USA)*

*<sup>#</sup> Two participants chose not to disclose years working in profession and specifically in ICU*

**Table 2: Overview of themes and subthemes and supporting quotations**

Theme	Subthemes	Quotations by clinicians
Clinician expectations and knowledge	Rationale and expected benefits of rehabilitation	<p><i>“There’s no point in us doing what we do from the medical side if there’s no rehab, we can get people to survive their ICU stay but often a cost of significant functional impairment” – MD</i></p> <p><i>“Trying to get their function from where it is at that moment, to where it used to be or close to” - PT</i></p>
	Knowledge and education of clinicians	<p><i>“[We need] confidence and experience, so you know how far you can push patients” – NS</i></p> <p><i>“I think the experienced intensive care nurse does know that, they have a much greater drive and aptitude to get people out of bed and moving and perhaps people who are a bit overwhelmed by the ICU environment in their early nursing care are a bit resistant to do so” - NS</i></p>
Evidence for and application of rehabilitation	Evidence	<i>“I think we probably need to continue to grow...a body of evidence, we can show really important benefits in terms of morbidity, mortality, LOS, you know less MV then you can start to argue it’s as important as some of those other lifesaving therapies. And I think we are starting to get that body of literature, but we probably need more” - PT</i>
	Timing of delivery	<p><u>Early:</u></p> <p><i>“It’s probably the start of a long process and starting when they are still acutely unwell and thinking about they’re long term recovery and initiating that as early as possible” - MD</i></p> <p><u>Late:</u></p> <p><i>“You have to get the clinical side of things right initially, right nursing care, right antibiotics, right investigations, right surgical procedures, but once you put all of that in play for the longer term patient the people who get them well and get them home, are bed side nursing staff assisting with other allied health staff with getting out of bed and getting them moving” – MD</i></p>
Patient factors	Patient prognosis	<i>“You know if a patient is not going to survive well there is no point in us talking about early rehab” - PT</i>
	Sedation, delirium and cooperation	<i>“The sedation level is something that is changing, but it’s still a main barrier” - PT</i>
	Motivation and goals	<i>“We have our own goals, the patient probably has their short term goals, and we have the long term goals, and you’ve got to combine the two together” – MD</i>

	Family	<i>"Sometimes family members will be very concerned about what we are going to do, things like sitting out of bed is a classic one, for us we think it's important, but the families will be a bit like 'but they're so sick'" - NS</i>
Safety consideration	General considerations	<i>"As long as it's safe to do so, it comes down to the question of patient safety" – MD</i>
	Patients' physiological stability	<i>"If they're haemodynamically unstable then you're not going to get them up and about in bed but you can do bed based rehab" – MD</i>
	Presence of lines or devices	<i>"Prioritizing what lines need to be in, whether we can pull things out that don't need to be there" - NS</i>
Environmental influences	Staffing, resources and equipment	<i>"I think the resources and time is the barrier as the main thing, you might have every intention in the world but you know when it gets really busy that rehab plan might get pushed back" – NS</i>
	Time and competing priorities	<i>"I don't know how many times the physio comes past and it's like 'no he's on his way to CT' or no we're going to do a lumbar puncture now, and I think that's a common theme throughout ICU that we are trying to achieve for care within 24 hours a day" – MD</i>
Culture and team	Multi-disciplinary team and professional roles	<i>"I see the medical component as being only one component to rehabilitation, so we have rehabilitation as the overarching goal in therapy, we've also got medical goals in therapy, physio goals in therapy, as well as nursing, OT goals in therapy" - MD</i>
	Communication	<i>"The plan for physio will be discussed on the medical rounds, the medical rounds include doctors, bedside nurses, another senior nurse on that side and the physio, so that will be discussed as a team and the physio might have a strong opinion like 'I want to start doing this' but clinically medical staff might be saying we want to do x,y or z , so there will be a bit of negotiation" – NS</i>
	Culture of unit	<i>"There are some staff in ICU that are all for it and are very keen for their patients to get physiotherapy and then there are some staff that might be a little bit more reluctant" - PT</i>

*Abbreviations: CT, computed tomography; ICU, intensive care unit; LOS, length of stay; MD, medical doctor; MV, mechanical ventilation; NS, nursing staff; PT, physiotherapist.*

**Highlights:**

- Key barriers to implementation of early rehabilitation are diverse
- Barriers include clinician, patient and healthcare system related factors
- Need ongoing research to bridge the evidence practice gap to improve provision of rehabilitation

ACCEPTED MANUSCRIPT