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FEASIBILITY AND PERCEPTIONS OF HEALTH CARE PROFESSIONALS REGARDING THE IMPLEMENTATION OF EARLY MOBILIZATION OF PATIENTS IN INTENSIVE CARE UNITS

by
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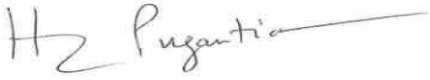

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ABSTRACT
OF THE THESIS OF

Noura Khaled Jannoun for Degree: Master of Science
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Title: Feasibility and Perceptions of Health care Professionals Regarding the Implementation of Early Mobilization of Patients in Intensive Care Units

Background: Early mobilization in the intensive care unit (ICU) has gained significant attention over the past years. Many ICU survivors are left with considerable consequences from their ICU stay even if they recover from the acute phase of illness. Complications survivors suffer from include muscle weakness, self-care deficits, hospital readmissions and poor quality of life. Early mobilization helps patients recover faster with better outcomes. However, despite the benefits of mobilization, barriers impede its implementation at the level of the patient, provider and institution. Anecdotal evidence suggests that ICU patients are rarely mobilized, mainly in terms of getting them out of bed. No published studies are available on this issue in Lebanon.

Aim: The main purpose of this study was to assess the feasibility of early mobilization of patients in ICUs from the clinicians' perspective and associated factors.

Methods: A descriptive correlational study design was used. The study was conducted at the intensive care, neuro-intensive care and respiratory care units of the American University of Beirut Medical Center (AUBMC). The target population included all ICU clinicians, including registered nurses, critical care physicians, physiotherapists, respiratory therapists, nurse managers, clinical nurse coordinators, clinical leader, clinical nurse specialist and the clinical educator for the selected critical care units at AUBMC.
The institutional review board (IRB) and AUBMC administration approvals to conduct the study were secured. An online survey was sent to the clinicians, including demographic questions and a modified version of the Mobility Survey Questionnaire by Koo et al. (2016). The mobility questionnaire includes 26 questions that ask about the importance of and barriers to early mobilization, its timing, eligibility and activities that ICU patients may engage in, in addition to knowledge and practices related to mobilization in intensive care, and an additional question about the feasibility of implementing it at AUBMC.

Analysis: Statistical analysis included descriptive statistics (means and standard deviations, and frequencies and percentages, depending on the level of measurement). Bivariate analyses included Spearman Rho correlation coefficient, t-tests and ANOVA to examine associations between variables. Multiple linear regression analysis was used

to predict perceived feasibility of implementing early mobility in ICUs at AUBMC from the perspective of clinicians.

Results: The final sample included 49 participants (40% response rate). The majority of the sample were nurses (70.7%), with 2 physicians, 4 physiotherapists and 4 respiratory therapists. Most participants work in the ICU (83%), have a bachelor's degree (63%), with up to 10 years of work experience (53%). Most clinicians (67%) perceived early mobility (EM) to be crucial or very important but 67% think that its implementation is only somewhat or not at all feasible.
Participants identified medical instability, intubation, the risk of dislodgment of lines and devices and excessive sedation as the most common patient barriers to implementation of EM in ICU. Moreover, lack of equipment or space, the requirement of a medical order for EM and lack of a champion for EM were the most common institutional barriers. In addition, provider barriers that were most commonly reported were inadequate training in EM, safety concerns, limited staffing, as well as lack of communication and coordination about EM among clinicians.
Over half the sample thought that mobility must be started as soon as possible in the ICU when the patient is conscious. However, when asked about activities done, participants mostly often reported range of motion or in bed activities as the most permissible or prescribed, with limited frequency and duration. The majority of participants (60%) reported lack of knowledge and training in EM, in addition to limited staffing and availability of physiotherapists, with a key role of nurses in assessing readiness for and participating in the mobilization of patients. Multivariate analysis showed that lack of equipment and lack of written guidelines predict the feasibility of implementing EM in the ICU.

Conclusion: The findings of this study suggest that the importance of implementation of early mobility is acknowledged and its implementation is feasible once the barriers are addressed. A multidisciplinary team led by a clinical nurse specialist can assess the physical and human resource needs for instituting EM and present a proposal for its implementation in intensive care to the administration at AUBMC.

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CHAPTER I

INTRODUCTION

Annually, millions of patients get admitted to intensive care units (ICUs) because of severe deterioration in their health condition. With the progress in treatment regimens, the survival rate of these critically ill patients has significantly improved (Schaaf et al., 2009). However, these survivors are left with considerable cognitive, physical and psychological disabilities because of their ICU stay, regardless of their admitting diagnosis (Engel et al., 2013). Follow-up studies on patients post ICU discharge have shown that these patients continue suffering from several restrictions that have a negative impact on their quality of life (Schaaf et al., 2009). These restrictions include muscle weakness, limited walking ability, cognitive dysfunction and signs of post-traumatic stress disorder. Moreover, these impairments affect the patients' ability to carry out daily life activities and impede their return to work (Schaaf et al., 2009). In a study of 254 survivors of ICU who were mechanically ventilated for more than 48 hours, 54% were still limited in performing their daily activities after one year; and 60% of patients who were restricted in their activities of daily living had severe functional limitations (Schaaf et al., 2009).

As part of the standard care at the ICU, bed rest was set for critically ill patients because it was supposed to be beneficial in preventing complications, in preserving metabolic resources, and for alleviating patient discomfort. Moreover, mobilization of critically ill patients was considered irrational or not feasible. However, studies have failed to validate the benefits of bed rest for critically ill patients. In contrast, immobility was found to lead to multiple complications such as muscle atrophy, joint

contractures, and thromboembolic disease among others and subsequently delay patients' recovery (Brower, 2009).

Due to the dire consequences of immobility, health care providers raised the need of addressing the diminished quality of life of these patients post ICU discharge. The Society of Critical Care Medicine (SCCM) stakeholders conference organized in 2010 identified the post-intensive care syndrome (PICS), which is the experience of physical, functional and cognitive outcomes that often last for 3-8 years post ICU discharge (Kayambu et al., 2013). The conference's goal was to develop cooperative interprofessional enhancements in the care provided in the ICU in order to diminish PICS. Several professional recommendations were considered such as the awakening and spontaneous breathing trials, coordination of delirium screening, early mobility bundle, the ICU Pain, Agitation, and Delirium (PAD) care bundle, in addition to the use of the World Health Organization's International Classification of Functioning, Disability and Health model of assessment and care. Similar recommendations were put by the European Respiratory Society and European Society of Intensive Care Medicine Task Force on Physiotherapy for Critically Ill Patients to help ensure faster and smoother recovery for ICU survivors. The aims of all of these recommendations were to prepare and implement programs to improve ICU patients' physical, cognitive, and mental health, with structured rehabilitative physical activity programs that are to be initiated once the patient is admitted to ICU, rather than waiting until after the patient's discharge (Engel et al., 2013).

Early mobilization of patients in the ICU has gained significant attention in the literature over the past years. Many studies reviewed by Adler and Malone (2012) assessed the effects of early mobilization on patients during their ICU stay and post

discharge. The variables that were studied include patient safety during ambulation, ambulation capability of the patient, muscle strength, carrying out activities of daily living, duration of mechanical ventilation, ICU length of stay, hospital length of stay, and mortality. However, despite the benefits of mobilization, barriers that impede its implementation were identified. The ICU itself is a complex setting in which mobilization seems to be difficult. Some of these barriers include the patients' weakness associated with sedation, hemodynamic instability, artificial airways, the multiple catheters and monitors attached, in addition to inadequate staffing, staff workload, and inadequate equipment available to aid in mobilization of patients, among others (Adler & Malone, 2012).

Based on anecdotal evidence from daily practice in a large tertiary care medical center in Beirut, it was noted that ICU patients mainly received passive range of motion exercises during their ICU stay but they were rarely mobilized, like sitting in bed or getting them out of bed. Moreover, no published studies are available on this issue in Lebanon. The aim of the proposed study is to assess the feasibility of early mobilization of patients in ICUs from the clinicians' perspective and associated factors.

CHAPTER II

LITERATURE REVIEW

Rest is a vital necessity for the survival of humans. Rest has several benefits; as a natural process, it permits muscles to modify and adjust to exercise demands, allows for natural restoration of injured body organs or tissues and is important for normal neurologic functioning and boosting the immune system. In the past, bed rest has been considered as part of the standard care provided at ICUs for critically ill patients in whom inactivity was thought to preserve the metabolic resources needed for healing and recovery. Moreover, by reducing blood pressure and oxygen demand, inactivity was judged to decrease metabolic stresses on the heart and avoid ischemia and dysrhythmias (Brower, 2009). Bed rest also was noted to relieve pain and discomfort and avoid hurtful falls. However, increased bed rest was shown despite its benefits to be by itself harmful, masking the beneficial effects of physical activity and causing serious complications (Brower, 2009). The complications associated with prolonged bed rest that is beyond the period of patient's instability are discussed below.

A. Complications of Prolonged Bed Rest

1. Muscle Weakness

Patients in the critical care unit usually stay for an extended period that could last from days to weeks. Many survivors complain of weakness after discharge from ICU and even from the hospital for a prolonged period. Objective measures of muscle strength have shown that limb muscles following patient discharge are significantly weaker than their baseline. Moreover, functional tests such as the 6-minute walk test,

confirm these deficits. There are multiple factors that contribute to weakening of skeletal muscles, which include sepsis- induced vascular and metabolic derangements, malnourishment, induced neuropathy and myopathy, use of corticosteroids, and immobility (Brower, 2009).

In addition to muscle weakness, experimental trials of immobility showed that muscle mass (assessed by computed tomography and magnetic resonance imaging) declines by approximately 1.5% to 2.0% per day during the first 2 to 3 weeks of bed rest. This is significantly seen in large muscles of the lower extremities, and this could be due to the diminished size of muscle fibers and to increased endoprotease activity that destroys proteins and trigger apoptosis. Finally, immobility of the human quadriceps was linked to increased messenger ribonucleic acid levels of atrogin1/M/afbx and MuRF1, the proteins that endorse atrophy of skeletal muscle (Brower, 2009).

2. Systemic Inflammation

Empirical evidence reveals that exercise of muscles can lessen systemic inflammation. Several cytokines were noted in plasma after exercise. The most frequent cytokine distinguished in plasma is interleukin (IL)-6. It was thought that IL-6 released after exercise represented inflammation in the damaged muscles; however, it is now known that nondamaging exercise is a major stimulus to IL-6 release, whereby IL-6 acts as an anti-inflammatory myokine. IL-6 is a major inhibitor of the pro-inflammatory cytokines IL-1 and tumor necrosis factor during exercise. Regular exercise is also related to decreased C-reactive protein, a marker of inflammation. Thus, regular

exercise may stop atherogenesis by reducing systemic vascular inflammation through its effects on IL-6 and C-reactive protein (Brower, 2009).

3. Atelectasis

Many critically ill patients develop atelectasis of their left lower lobe that is seen on chest radiography within 48 hours of enforced bed rest. This may be triggered by the cephalad shift of the diaphragm when they are in supine position, combined with the dorsal move of the heart from the force of gravity. Studies have shown elevation of esophageal pressure that is also an approximation of pleural pressure. Therefore, lung compliance of normal humans in the supine position is diminished noticeably. Atelectasis may predispose to respiratory infections such as pneumonia and contributes to raising pulmonary vascular resistance. Atelectasis causes intrapulmonary shunt, increasing necessities for supplemental oxygen, thus leading to oxygen toxicity (Brower, 2009).

4. Metabolic Complications of Bed Rest

Insulin resistance was noticed in critically ill patients who have no prior history of diabetes (Hamburg et al., 2007). In a study conducted by Hamburg et al. in 2007 at Boston Medical Center General Clinical Research Center on a sample of 20 healthy non-smoking volunteers, blood glucose and insulin responses to glucose loading were measured before and after five days of immobility in 20 healthy subjects. Body weight was unchanged by five days of bed rest, but blood glucose levels were significantly increased at 30, 60, 90 and 120 minutes after administering 75 g of glucose loading orally, and blood insulin concentrations were also higher (Hamburg et al., 2007).

Fasting levels of blood glucose and insulin were also significantly higher after five days of inactivity. These results suggest that insulin resistance occurs within days after enforced bed rest (Hamburg et al., 2007).

In addition, immobility was found to be associated with significant elevation of blood concentrations of total cholesterol and triglycerides (Hamburg et al., 2007). The pathophysiologic mechanism by which immobility leads to insulin resistance is not clear. The majority of insulin-induced glucose uptake usually occurs in skeletal muscle, so the inactivity induced insulin resistance may be limited to skeletal muscle and may be due directly to immobility (Hamburg et al., 2007).

5. Microvascular Dysfunction

Inactivity was also found to be related to impairment of the vascular system, leading to atherogenesis. In the previous study by Hamburg et al. (2007) done on 20 healthy adults, microvascular function was also assessed by ultrasound and venous occlusion plethysmography. Bed rest led to decreased reactive hyperemia in the forearm and the calf, suggesting that there was endothelial damage because normal hyperemic responses to vascular occlusion depends on endothelial function (Hamburg et al., 2007). Moreover, the brachial artery diameter that was assessed by ultrasound using two-dimensional images at baseline and one minute after a five minutes cuff occlusion of upper arm was noticed to be considerably smaller with inactivity, which in turn may lead to decreased brachial artery flow, elevated systolic blood pressure and increased systemic vascular resistance (Hamburg et al., 2007). The pathologic mechanism is not clear. However, microvascular dysfunction could be the result of multiple complications

such as multiple organ dysfunction, acidosis, bleeding, intestinal ischemia, and pressure injuries (Hamburg et al., 2007).

6. Thromboembolic Disease

Blood flow within extremities appears to change directly with activity of the skeletal muscles, which disrupts the Virchow's triad composed of endothelial injury, stasis of venous blood flow and hypercoagulable state. Therefore, prolonged bed rest leads to venous stasis and compression of veins, which occurs from contact of the limbs with the bed and subsequent compression of veins due to the effect of gravity, which may also contribute to stasis and could harm the vascular endothelium. Hence, immobility is a significant risk factor for thromboembolic disease (Brower, 2009).

7. Joint Contractures

Most patients in ICU were noticed to have loss of the range of motion and resultant contractures of their skeletal joints that could be due to immobility. Usually, the restricted motion could be avoided by simple passive or active range of motion exercises. In a recent retrospective analysis of clinical records done by Clavet et al. in 2008 at an academic urban hospital in Ottawa, joint contractures were noticed in 61 out of 155 patients who were discharged from ICU in an academic, urban hospital after staying for at least 14 days. At the time of discharge from ICU, 34% of patients had at least one functionally significant contracture, and 23% of patients had functionally significant contractures that lasted after being discharged home (Clavet et l., 2008). Although, these patients received physiotherapy sessions, however it was not enough to prevent joint contractures (Clavet et al., 2008)). Decreased ability to ambulate is one of

the most common complaints and this is attributed frequently to muscle weakness that persists for months to years after hospital discharge. It is also reasonable that the persisting mobility deficits could be due to persistent joint contractures in addition to muscle weakness (Clavet et al., 2008).

8. Skin Ulcers

Skin ulcers, also called pressure injuries, usually occur at areas where there is a pressure between the skin and bed especially over bony prominences. Multiple factors that could lead to skin breakdown include impaired circulation, malnourishment and humidity. Skin ulcers can be avoided when there is a good quality of nursing care provided where frequent positioning of the patient relieves this pressure and prevent prolonged contact of the skin to the bed. Most pressure injuries occur in the sacral area. Skin ulcers make the patient prone to cellulitis and osteomyelitis in the skin and surrounding tissues (Brower, 2009).

The stay at ICU is complex and it is hard to manage its consequences. The challenge is not about the acute phase of critical illness but about residual deficits post discharge. The complications the patients suffer from constitute a significant burden and need careful attention and care in order to be resolved over the shortest period possible. There are several follow up studies of ICU survivors in which the primary goal was to assess the consequences of ICU stay post discharge and the quality of life of these survivors. A prospective observational cohort study was done in 2009 by Schaaf et al. to assess the functional health status and physical impairments after critical illness at 3, 6 and 12 months at the Academic Medical Center, University of Amsterdam. The results have shown that physical functioning and social behavior were enhanced mostly within

the first six months, while impaired psychological functioning stayed unchanged within one year after discharge from the ICU. After one year, 69% of patients were still limited in carrying out daily activities and only 50% had returned work.

Another study was done by Herridge et al. (2011) to assess the extent of physical and psychological impairments in survivors of acute respiratory distress syndrome (ARDS) at 2,3,4 and 5 years after discharge and to determine factors associated with poor outcomes and quality of life at four academic medical–surgical ICUs in Toronto. Results have shown that young patients continued to exhibit exercise limitations and reduced quality of life after five years of critical illness. On the other hand, the psychological and emotional dysfunction remained in both the patient and caregivers up to five years post discharge. Regarding hospital costs, the burden of existing illness at the time of admission was linked to poor clinical outcomes and the cost has increased over time.

In addition, a prospective cohort study was conducted by Ehlenbach et al. in 2015 to examine relations between acute care and critical illness hospitalizations and performance on physical functional measures and activities of daily living for older adults residing in the Seattle area. Results have shown that there was a decline in the physical function and functional independence at 311 days after acute care hospitalizations and 359 days after critical care admissions. Also, these patients had worse physical function and more difficulty carrying out daily activities compared to their baseline. Moreover, after acute and critical illness hospitalizations there was a decline in their gait speed and less ability to walk or sit in chair, which indicates significant functional impairments (Ehlenbach at al., 2015).

The above reviewed studies provided the empirical evidence to support what is known about the physiologic sequelae of prolonged bed rest in ICU. The section below reviews the benefits of early mobility in ICU.

B. Benefits of Early Mobility in Intensive Care

The accumulation of evidence gained from the above studies and the limitations in the functional status and psychological burden of ICU patients, led to a paradigm shift in the care provided at ICU to tackle the long-term consequences associated with immobility. Bed rest is no longer recommended, as it was shown to cause serious complications. This drove the attention to early mobilization as it showed to be beneficial and if implemented correctly, would help reduce the burden post ICU discharge and help in healing and recovery. There were multiple studies that examined the effect of early mobilization at ICU and the following table summarizes the findings.

Table 2.1. Studies of early mobility in intensive care.

Author	Purpose	Design	Sample	Interventions	Findings
Burtin et al. (2009)	To examine whether daily session of bedside cycle ergometer is safe and effective in improving functional status.	Randomized controlled trial at medical-surgical ICU at University Hospital Gasthuisberg, Leuven, Belgium.	90 critically ill patients (age= 59 +- 17 years) who are expected to stay at least 7 days at ICU who are cardiorespiratory stable and referred by the ICU attending intensivist.	Both groups receive chest physiotherapy and passive or active motions sessions of upper and lower limbs. The treatment group received also training session of 20 mins\day using bedside ergometer.	- Better muscle coordination -Enhanced psychological status - Enhanced recovery of functionality. - Larger quadriceps force, and - Walk independently at time of discharge in the experimental group

					compared to the control.
Adler & Malone (2012)	To evaluate the literature regarding mobilization of critically ill patients on functional outcomes and safety.	Systematic review	Electronic databases of PubMed, CINAHL, Medline and The Cochrane Library from 2000-2011. Fifteen studies reviewed that included randomized and nonrandomized clinical trials, prospective and retrospective analyses and case series in peer reviewed journals.	Physical therapy interventions involved: - supine-to-sit - sitting at edge of bed - standing - transfer - ambulation.	- Mobilization can be done safely with minimal risk to patient. The major adverse event was decrease in oxygen saturation that was resolved with increased oxygen delivery. - Vital signs were within acceptable range during physical activity. - Muscle strength was improved post-acute care setting. - There was improvement in ambulation independence, reduced ventilation days, better ability to perform daily activities and improved respiratory status.
Kayambu, Boots, and Paratz (2013).	To review the evidence base for exercise in critically ill patients.	Systematic review	Electronic databases of PubMed, CINAHL, Medline and The Cochrane Library from 1980-2012. Ten randomized controlled trials were reviewed.	Exercise intervention from RCTs included: - active or passive limb mobilization - ambulation - electrical muscle stimulation - ergometry	The intervention group compared to control showed: - decrease in the inflammatory load - increase in anti-

				exercise.	inflammatory cytokines - improve micro-circulation - improve muscle strength - increase ventilator-free days - decrease in mortality - improve quality of life post discharge.
Castro-Avila et al. (2015).	To determine the effect of early rehabilitation on functional status in ICU\ high dependency unit patients.	Systematic review and meta-analysis	MEDLINE, EMBASE, CINALH, PEDro, Cochrane Library, AMED, ISI web of science, Scielo, LILACS searched for RCTs and non-randomized trials on rehabilitation compared to usual care in ICU\HDU from inception to April 2014. Seven articles were included in the narrative synthesis and six in the meta-analysis.	Rehabilitation included: - passive and active range of motion - active side to side turning - cycling in bed - exercises in bed - sitting on the edge of the bed - transferring from bed to chair - marching on the spot. - ambulation - hoist therapy. - tilt table - active resistance exercises - electrical muscle stimulation.	Compared to the controls, the experimental groups demonstrated: - increased walking without assistance at hospital discharge. - improved distance walked - reduced ICU-acquired weakness - greater isometric quadriceps strength - improved quality of life - decrease length of stay.
Seo et al. (2019).	To examine the rehabilitation characteristics, safety	Retrospective observational study.	Patients who were admitted to surgical ICU of the Asan Medical Center in Korea aged	Rehabilitation program included: - passive range of motion and postural	- Active rehabilitation is safe and feasible - shortened length of stay

	and functional recovery in surgical ICU patients.		less than or more than 65 years old.	change - active range of motion and head elevation more than 60 degrees. - upper and lower exercises conducted while sitting on edge of bed - sit-to-stand exercises - standing - transfer to chair - resistance exercises.	and - improved functional mobility were noted in the group that underwent rehabilitation activity compared to the group that did not.
Zhang et al. (2019)	Assess the effect of early mobilization on critically ill patients in the ICU.	Systematic review and meta-analysis.	Electronic databases searched from their inception to March 2019, RCTs searched from Cochrane Library.	Interventions from RCTs included: - in-bed cycling using ergometer. - intensive rehabilitation -physiotherapy interventions.	The experimental group, compared to the control had: - increased ability to stand -increased number of ventilator-free days - decreased incidence of ICU-acquired weakness - increased walking distance at discharge - increased discharged-to-home rate. - mobilization is feasible and safe.

As noted in the above table, these studies suggest that the benefits of early mobility in the ICU patients outweigh any risk incurred from these interventions.

However, these studies have some limitations. First, meta-analyses by Castro-Avila et al. (2015) and Zhang et al. (2010) showed heterogeneity in the studies examined, thus mandating caution in the interpretation of results. Second, there was no clear or consistent definition regarding early mobilization and rehabilitation among various studies and the timing, intensity and frequency of mobilization were not standardized. Third, not all studies used randomization as the sampling method so it might yield bias in the results. Fourth, the outcomes from the different studies may be difficult to generalize to other settings since outcomes are not measured in the same way in all the studies reviewed. Nevertheless, despite variation in methods and samples, studies concur that early mobilization is beneficial. However, one aspect or confounder to keep in mind in planning such intervention or change in practice is the health care setting, since instituting such interventions require resources both human (staffing) and physical (equipment). The section below describes barriers to the implementation of early mobility in intensive care.

C. Barriers to the Implementation of Early Mobility in Intensive Care

Despite the fact that mobilization is beneficial for post intensive-care syndrome and helps patients recover faster, it is still difficult to implement in the critical care units due to several barriers as well as apprehension regarding its safety implications. Several studies were conducted, and healthcare providers were surveyed regarding barriers to implementing mobilization programs at ICU (Jolley et al., 2014). The barriers are categorized into three main domains: patient, institutional and providers levels. Starting with the safety concern, there are multiple factors that need to be considered before taking the decision of mobilization. Moreover, there are several studies (Stiller et al.,

2004) and existing data verify that mobilization, which involves ambulation of mechanically ventilated patients can be safe.

A study by Stiller et al. was conducted in 2004 to assess the safety of mobilizing acutely ill patients and the effect of mobilization on their hemodynamic and respiratory status. Thirty-one patients in an ICU at the Royal Adelaide Hospital were involved in the mobilization program and 69 sessions were provided after a comprehensive screening process Figure 1 Below shows the screening plan used in the study.

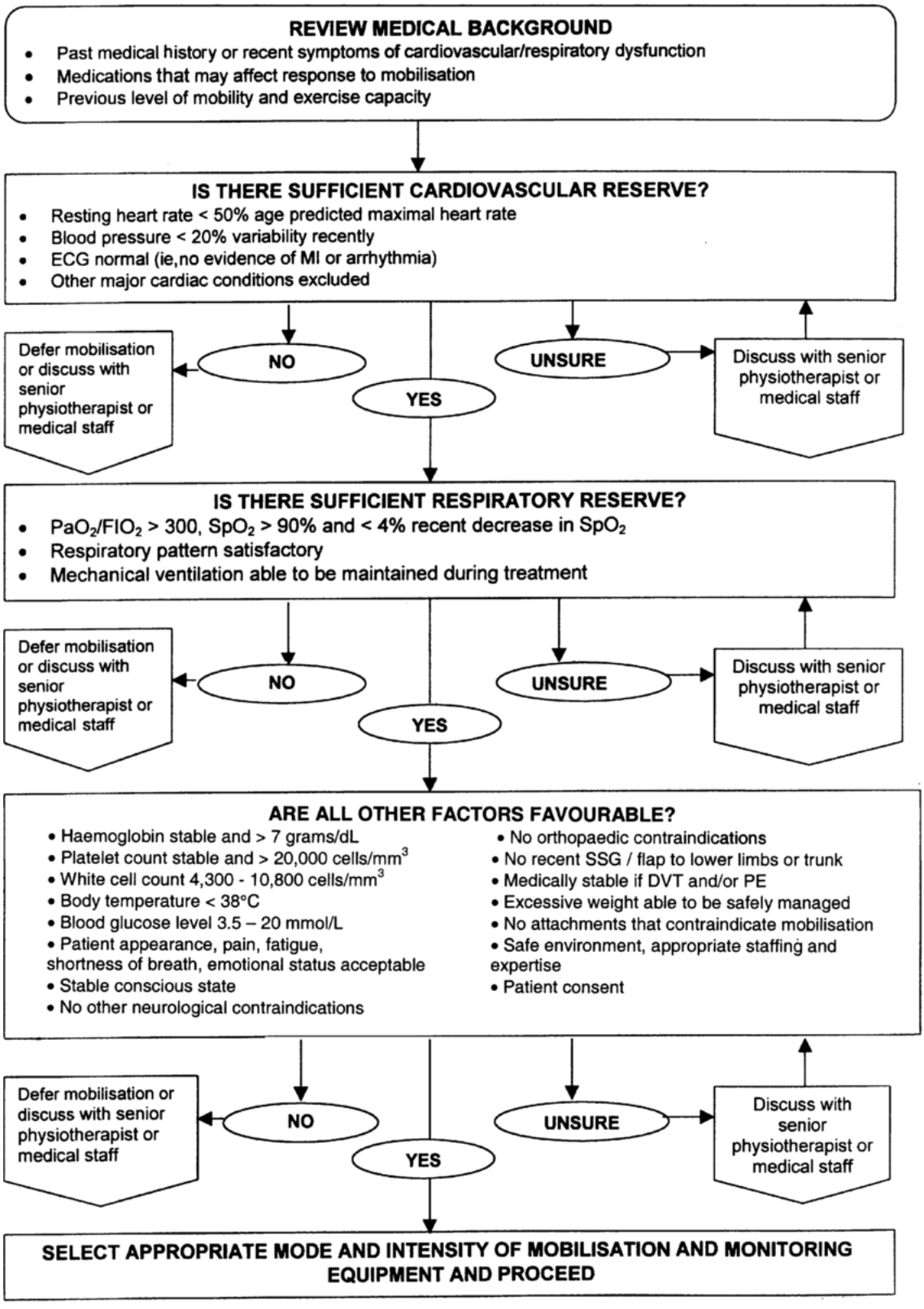

Figure 2.1. Retrieved from Stiller, K., Phillips, A., & Lambert, P. (2004). The safety of mobilisation and its effect on haemodynamic and respiratory status of intensive care patients. *Physiotherapy Theory and Practice, 20(3),* 175-185.

The mobilization program consisted of sitting on the edge of the bed and standing. Outcome measures including heart rate, systolic and diastolic blood pressure, and percutaneous saturation of oxygen were measured prior to, during and after mobilization. Additionally, any deviation in clinical status, and intervention required for it, were documented. During mobilization, significant increases were seen in heart rate and blood pressure, while percutaneous oxygen saturation decreased. These changes were not significant and did not require any intervention since they were still within an acceptable range. In about 4.3% of the mobilization sessions, there was decrease in oxygen saturation that required an increase in the delivered oxygen. Although this adverse event took place, it was not considered significant since it required only minimal intervention.

Studies were conducted by Anekwe et al.(2019), Barber et al. (2015), Dubb et al. (2016), Fontenla et al. (2018), Jolley et al. (2014), Koo et al. (2016), and Leditschke et al. (2012) to assess the barriers to and facilitators of early mobilization as well as the knowledge of health care providers regarding mobilizing patients, especially mechanically ventilated patients. The studies yielded similar results and showed that healthcare providers do recognize the importance of early mobilization and that benefits surpass the risks to patients. These benefits are preserving muscle strength and shorter duration of mechanical ventilation. Physicians who were surveyed agreed that they can adjust the ventilation parameters and reduce sedation given to patients to help them better mobilize. However, the barriers mentioned by physicians were the unavailability of professionals on the team and lack of sufficient time to routinely mobilize patients, as well as excessive sedation and delirium. The risk of musculoskeletal self-injury and extreme stress at work were also stated by nurses and physical therapists as barriers to

mobilization. The findings of the studies support the hypothesis that there is a gap between evidence-based knowledge and its implementation in clinical practice (Fontela et al., 2018).

The authors admitted that while knowledge improves, practice remains one step behind (Fontela et al., 2018). A study of nurses showed that avoiding complications is the most vital factor of their work, for most nurses stated that preventing deep vein thrombosis, pneumonia, and pressure ulcers are very important in providing quality care. Preventing consequences of immobility was not a priority that nurses meant to avert. This may be since deep vein thrombosis could be deadly and noticeable to the nurse, whereas the consequences of immobility happen after discharge and are not observable to the nurse. Nurses also eagerly discussed the benefits of ambulating patients. They demonstrated knowledge and awareness of the negative impact of inactivity; however, knowing that they should walk patients did not lead to their ambulation while the patient was unstable. It was not until the patient recovered from their acute phase of critical illness and became ready for discharge that nurses became worried about his\her functional status or ability to walk. Unfortunately, waiting till the time of discharge, the patient would have already lost a considerable ability to ambulate (Doherty-King and Bowers, 2011).

Nurses, physicians, and physiotherapists agreed that protocols would need to be implemented for daily sedation interruption to assess the feasibility and safety of mobilization, and some professional stated that formation and implementation of a dedicated ICU mobility team might provide an option to increase the mobility of patients and was proven safe and viable (Fontela et al., 2018). In conclusion, the literature provides evidence for long term negative outcomes associated with prolonged

immobility in ICU. Early mobility implemented based on accurate screening of the patients for hemodynamic stability and tolerance of mobility and availability of adequate staffing, and using protocols that are evidenced based, can prevent complications associated with prolonged bed rest in ICU.

CHAPTER III

THEORETICAL FRAMEWORK

The current study is based on the Donabedian's health care quality model as its theoretical framework. Donabedian's model was established in 1966 and since then it is one of the leading theories used in studies of nursing care quality. The model is composed of three domains: structure, process and outcome. Donabedian hypothesized that there is a link between the three domains that are dependent on each other. He suggested that good structure yields good process and good process should in return certify good outcome. Donabedian defines *Structure* as the professional and organizational resources related with the facility of health care, *Process* as the tasks provided to the patient and *Outcome* as the result of care provided to the patient. Donabedian differentiated between two types of outcomes: the technical outcomes, which are the physical and functional aspects of care, and the interpersonal outcomes which include patients' satisfaction with care and influence of care on the patient's quality of life as perceived by the patient (Ameh et al., 2017).

This study focuses on the domain "structure" of this model. As was discussed previously, early mobilization could be safe and feasible for implementation in the complex setting of critical care units. However, to be implemented successfully and to yield beneficial outcomes it should be based on consideration of relevant factors. This study emphasizes surveying healthcare providers about the barriers and the feasibility of implementing such program in the ICUs at the American University of Beirut Medical Center. The survey addresses three main aspects that are entailed in the structure of the program. These three aspects are perception, knowledge, and practice of the clinicians

related to early mobility in critical care (Koo et al., 2016), in addition the demographic characteristics of the participants. The main study outcome is the perceived feasibility of implementing early mobility in critical care units. Below is a figure (3.1) representing the study's conceptual model.

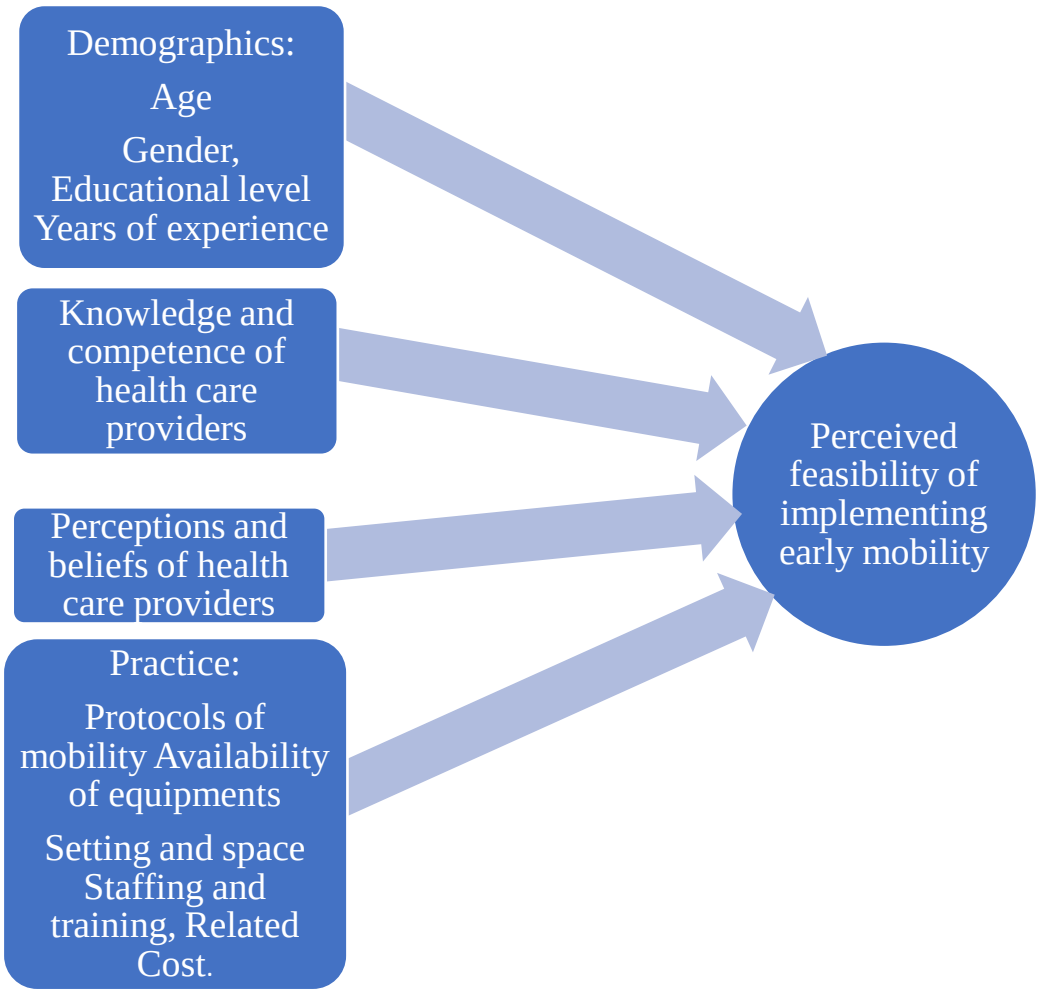

Figure 3.1. The conceptual model of the independent variables as perceived by the health care providers to affect the perceived feasibility of implementing EM in critical care units.

Before initiating a program, it is important to assess if healthcare providers from nurses, physicians, physiotherapists and others are truly aware of the importance and benefits of this program. If they do not believe that this program might yield valuable

results, then they would not take it seriously and the investment in it will be lost. Moreover, it is essential to assess the barriers that would impede the implementation from their own perspective because they are the ones who are going to work through this program. The barriers are divided into three different categories: institution, patient and provider levels to cover all possible barriers, so gaps identified could be resolved before implementation.

Barriers represent the structural and some of the process components within Donabedian's framework. The institutional barriers constitute the most significant factors needed for successful implementation. These factors are availability of needed equipment and in enough quantity, the setting and adequate space, adequate staff to carry out the program, and the cost of the program. Moreover, the availability of well-defined protocols and guidelines on early mobilization and the authority that provides the approval or order to initiate mobilization need to be identified. The patient barriers addressed are the stability of the patient and safety to mobilize his\her, the presence of lines and monitor attached, cognitive and physical impairments, and adequate nutrition that helps in recovery. Lastly, the providers' barriers include perceived priority of mobilization, adequate staffing and training to prevent harm to both the staff and patients. Moreover, adequate communication and coordination between healthcare providers is needed to ensure that patient is stable and safe to mobilize.

In addition, healthcare providers' knowledge of the current literature on early mobilization, and their competence and training are important for successful implementation of mobilization. The third aspect is the current practice of nurses, physicians and physiotherapists in the proposed model, such that identification of who does the initial assessment and recognize the need of mobilizing patients, provides the

order and frequency of sessions and the activities to be carried out, and who participates during the sessions.

These three aspects (perception, knowledge, and practice) and especially the perceived barriers as identified by health care providers are very essential for any program before its initiation. Thus, it is fundamental to identify basic constructs in order to ensure successful implementation. The structure is vital as it affects the process and outcomes. If the program is not based on good structure and was not well prepared from staffing, training, equipment, resources, and other; program implementation may fail, as the main components would not have been addressed. Based on the above framework, the specific research questions of the study are:

1. What is the perceived importance and feasibility of early mobilization among physicians, nurses and allied professionals in critical care units?
2. What are the barriers to early mobilization implementation as perceived by physicians, nurses and allied professionals in critical care units?
3. What are the healthcare providers' beliefs about early mobilization in critical care units?
4. What is the level of knowledge and practice related to early mobilization among the health care providers in critical care units?
5. What are the health care providers' demographic factors associated with their perceived feasibility of early mobilization in critical care units?
6. Are the differences in the perceptions related to early mobility between physicians and nurses?
7. What are the institutional predictors of the perceived feasibility of implementing early mobilization in the critical care units?

CHAPTER IV

METHODS

A. Design and Setting

A descriptive correlational study design was used, and the study was conducted at the adult critical care units of the American University of Beirut Medical Center (AUBMC) that included intensive care, neuro-intensive care and respiratory care units. This design was appropriate to answer the research questions as beliefs, knowledge and attitudes related to early mobilization were being sought from the perspective of those likely to be engaged in its implementation. The cardiothoracic surgery unit was excluded since patients in that unit do not remain for a long enough period to warrant concern about prolonged immobility but are often transferred within 24 hours to 48 hours.

B. Sample

The survey addressed all clinicians who work in the above designated units, including registered nurses (total around 70), critical care attending physicians and fellows (total around 20), physiotherapists (around 2), respiratory therapists (around 3) and the nurse managers, clinical nurse coordinators, clinical leader, clinical nurse specialist and the clinical educator for the selected critical care units at AUBMC. All rotating fellows and attending physicians were invited to participate via email.

Registered nurses, nurse managers, clinical nurse coordinators, clinical leader, clinical nurse specialist, and clinical educator were identified with the help of the nursing administration and invited to participate through an email invitation. Physical

therapists and respiratory therapists were identified and invited too through email invitation. Clinicians were eligible if they had worked at the selected critical care units for at least one year.

C. Procedure and Data Collection

The institutional review board (IRB) of the American University of Beirut and AUBMC administration approvals to conduct the study were secured (See Appendix A). An online modified version of the Mobility Survey Questionnaire by Koo et al. (2016) was sent to the clinicians. The email addresses were provided by the administration to the IRB officer, who sent them to the information technology (IT) person responsible for the LimeSurvey so he included them in the survey participants' table. The survey was sent to a total of 136 email addresses in March 8, 2021, with four reminders (two weeks apart). Ten email addresses bounced back; these were mostly employees who left the institution at the time of study.

LimeSurvey was used after a pilot test of the tool with one physician and one nurse to examine its clarity and ease of administration as there was some concern about the length of the survey. The filling time was reported as 20 minutes and 27 minutes by the physician and registered nurse, respectively. LimeSurvey is authorized by AUB since it can be set up to make participant responses anonymous. The first page of the survey included the consent form (See Appendix B).

The survey tool used in this study was developed by Koo et al. (2016). The mobility questionnaire included 26 questions that ask about the importance of and barriers to early mobilization, timing, eligibility and activities that ICU patients may engage in, in addition to knowledge and practices related to mobilization in ICU. A

question about the feasibility of implementing early mobilization at AUBMC was added, where participants were asked to rate the feasibility of implementing early mobility in critical care units at AUBMC on a 5-point rating scale from not at all to extremely feasible. Definitions of mobilization and early mobilization were provided on the first page of the survey, in addition to distinguishing between non-mobility and mobility physiotherapy.

The modified mobility survey questionnaire was divided into three main sections: perception, knowledge and practice, besides the demographic questions. The first part that entailed the perceptions include questions regarding the participant's personal view about the importance of and barriers (at institutional, patient and provider levels) to early mobilization (EM). In addition, personal views regarding initiation of EM and permissive and maximum level of activity for each medical diagnosis were addressed. The second part entailed questions about knowledge of EM and recent relevant clinical studies. The third part was about the current practice, whether patients were routinely assessed for EM, who was the provider to identify readiness for mobilization, whether there were defined protocols for EM, staffing availability, as well as intensity and frequency of EM and sedation practices. The last part was about the demographic characteristics of the clinicians who filled the survey.

The mobility questionnaire has good reliability and validity (Koo et al., 2016). The analysis of each item was assessed by ten methodologists that included clinicians from critical care nurses, therapists and physicians, who revised the survey to determine its easiness, flow and prominence. Then, a modified clinical sensibility form was used to assess the comprehensiveness, clarity and face validity among 12 content experts with no previous role in the development or testing of the survey. After giving the

survey to 20 respondents, including critical care nurses, therapists and physicians, on two separate occasions, two weeks apart, the interrater reliability was estimated using Cohen's κ, which exceeded 0.4 on each item, indicating moderate to excellent interrater reliability across items (Koo et al., 2016).

The research team of the current study modified the questionnaire, considering the context of critical care at AUBMC where the study was conducted and the feedbacks from the pilot test. The questions in the knowledge section regarding the ICU -Acquired Weakness incidence in the population of ICU patients were deleted since some healthcare professionals may not be familiar with it due to the variability of their levels of experience and education. In the practice section, questions about whether patients with suspected ICU-Acquired Weakness are referred routinely to an outpatient clinic after discharge for long term rehabilitation and to whom they are referred were also deleted. In addition, questions regarding the champion of early mobilization and rehabilitation post ICU discharge were removed because there is no champion designated at AUBMC for early mobilization.

As for the questions about clinicians' demographics, these were rewritten such as for the type of clinician filling the survey, respiratory therapist, nurse manager, clinical nurse coordinator, clinical nurse specialist, clinical educator and leader were added. Moreover, the primary area of practice was modified and divided into three options: intensive care unit, neuro-critical unit and respiratory care unit to fit the setting where the current study was conducted. Questions about the educational level and years of experience were added. Feedback from the pilot test recommended adding to the question about the greatest permissible level of activity for patients with medical devices attached, the mechanical ventilation type for high frequency oscillation as not

everyone is familiar with it, and for the physiotherapy techniques the transfer method was replaced by transfer from bed to chair to be clearer. See Appendix C for a copy of the questionnaire.

The survey comprises several question formats (true/false; yes/no; nominal, ordinal and Likert scales) with no open-ended questions. In addition, the respondents were asked to state the following: clinical role, and years of work experience. As per instructions for the original validated survey, scores were calculated for the overall barriers scale and three subscales (perceptions, knowledge, and practice), with each ranging from 0 to 100, with higher scores indicating greater barriers to mobility. Questions answered as "not sure" were not included in the scores. However, scores were not calculated in this study because the aim was to look at each barrier category in details rather than adding barriers overall scores.

D. Statistical Analysis

Descriptive statistics of the demographic characteristics, perceived beliefs, barriers and knowledge questions included means and standard deviations, frequencies and percentages, depending on the level of measurement, to answer research questions 1 through 4. The distribution of continuous variables was examined for normality, skewness and kurtosis. The feasibility variable was normally distributed. Bivariate analyses included Spearman Rho correlation coefficient, t-tests and ANOVA to test the associations between the perceived feasibility and the other variables under study as per the conceptual framework. (Research question 5). Research question 6 could not be answered statistically because there were only two physicians and eight allied health professionals. The level of education variable was recoded into two categories (1 for

Bachelor degree and 2 for Masters and above). The years of experience variable was recoded into three categories: one to 5 years; six to 15 years; and 16 years and above. For comparisons between clinician groups, we recoded the clinician type variable into three categories: physicians as one group; registered nurses, nurse manager and clinical educator as a second group; and physiotherapist and respiratory therapist as allied health professional group.

Multiple linear regression analysis was used to predict the perceived feasibility of implementing early mobility in ICUs at AUBMC from the perspective of clinicians (research question 7). Assuming a moderate effect size for a regression analysis with six predictors (health professional group, contextual barriers, patient barriers, health professional barriers, training, years of experience), $\alpha = 0.05$ and power of 0.8, a minimum sample of 92 was needed (Polit & Beck, 2011).

CHAPTER V

RESULTS

A. Response Rate and Respondents

A total of 126 surveys were sent and received by potential participants, and 51 were returned, yielding a 40.48% response rate. However, only 49 questionnaires were analyzed because of missing data. The questionnaires with more than 50% missing data were not included. Table 4.1 shows the sample characteristics. The majority of the sample (70.7%) were registered nurses, work in the ICU (83.3%), are graduates of a bachelor degree (63.4%), and with less than 10 years of experience (53.6%).

Table 4.1. Sample Characteristics (N = 49)

Variable	Frequency	Percent
Clinician type*		
Registered Nurse	29	70.7%
Respiratory therapist	4	9.8%
Physiotherapist	4	9.8%
Physician	2	4.9%
Nurse manager	1	2.4%
Clinical educator	1	2.4%
Unit of work		
Intensive care unit	30	83.3%
Neurosurgery unit	3	8.3%
Respiratory care unit	3	8.3%
Highest level of education		
Bachelor	26	63.4%
Masters or other graduate degree	15	36.6%
Years of experience		
1 – 5 years	14	34.1%
6 – 10 years	8	19.5%
11 -15 years	9	22.0%
16 – 20 years	7	17.1%
21 years and above	3	7.3%

*** There were 8 participants who did not indicate what type of clinician they were. The percentages are out of those who answered the question.**

B. Perception on Early Mobility

1. Perceived Importance and Feasibility of Early Mobility in Critically Ill Patients

Results about the perceived importance and feasibility of implementing early mobility are shown in Table 4.2. One fifth of the sample considered early mobility as crucial in the care of critically ill patients, and almost three fourths (74%) that it was important or very important. In terms of feasibility, one half (52.2%) of the participants considered early mobility to be somewhat feasible, 17.4% that it was very feasible, 15.2% that it was not at all feasible and 13.0 % were not sure. Only one participant considered implementation of early mobility to be extremely feasible. Figure 4.1 represents the perceived importance and feasibility of early mobilization by health care professionals.

Table 4.2 Perceived Importance and Feasibility of Early Mobility in critically Ill Patients (N = 49)

Variable	Frequency	Percent
Importance		
Crucial, should be top priority	9	20.9%
Very important, should be top priority	20	46.5%
Important, should be a priority	12	27.9%
Somewhat important, should be considered	2	4.7%
Feasibility		
Somewhat feasible	24	52.2%
Very feasible	8	17.4%
Not at all feasible	7	15.2%
Unsure	5	13.0%
Extremely feasible	1	2.2%

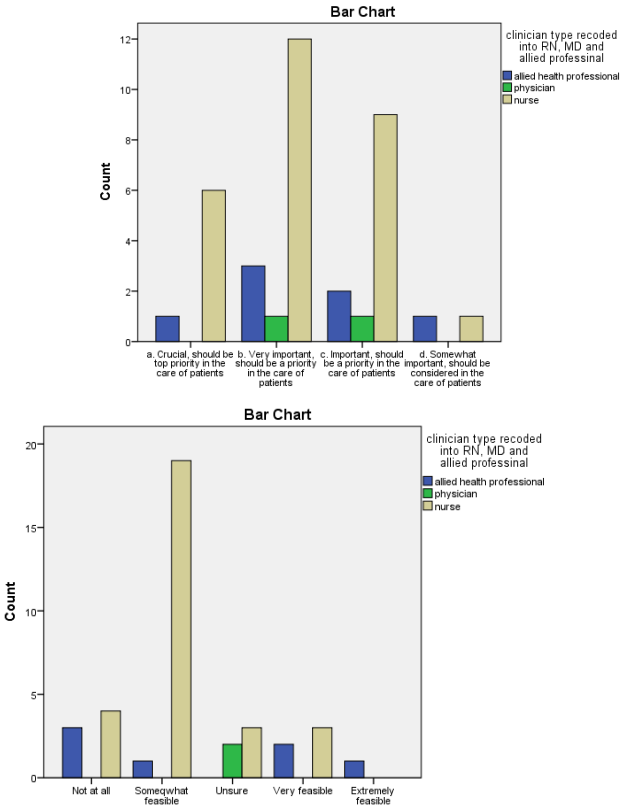

Figure 4.1. Perceived importance and feasibility of early mobilization by health care professionals.

2. Perceived Barriers to Early Mobility

Barriers to early mobility (EM) related to patients, providers and the institution were solicited from the participants. Results of patient, institutional and provider barriers are shown in Tables 4.3, 4.4 and 4.5 respectively. In terms of patient barriers, medical instability (82.6%), endotracheal intubation (76.1%), risk of dislodgment of lines or devices (71.1%), and excessive sedation (67.4%) were the most frequently cited patient barriers to EM in the sample (see Table 4.3). It is worth noting that physicians considered excessive sedation as significant barrier as medical instability, whereas it is the second most often reported patient barrier by nurses and allied health professionals.

Table 4.3. Patient barriers of early mobility by nurses, physicians and allied professionals (N = 49).

Variable	Total N (%)	Physician n=2	Nurse n=31	Allied health professional n=8
Medical instability	38 (82.6%)	2 (100%)	26 (89.7%)	6 (85.7%)
Endotracheal intubation	35 (76.1%)	1 (50.0%)	25 (86.2%)	4 (57.1%)
Physical restraints	16 (34.8%)	2 (100%)	10 (34.5%)	0
Risk of dislodgement of devices or lines	33 (71.7%)	1 (50.0%)	23 (79.3%)	3 (42.9%)
Cognitive impairment	23 (50.0%)	1 (50.0%)	16 (55.2)	5 (28.6%)
Excessive sedation	31 (67.4%)	2 (100%)	21 (72.4%)	5 (71.4%)
Inadequate analgesia	11 (23.9%)	1 (50.0%)	7 (24.1%)	1 (14.3%)
Obesity	19 (41.3%)	2 (100%)	11 (37.9%)	3 (42.9%)
Frailty	6 (13.0%)	1 (50.0%)	4 (13.8%)	0
Inadequate nutritional status	9 (19.6%)	1 (50.0%)	7 (24.1%)	1 (14.3%)

NB. The percentages are out of the total number of participants in each group who answered.

In terms of institutional barriers to EM, insufficient equipment was the most frequently endorsed institutional barrier in the sample overall (80.4%), followed by the lack of space or guidelines (69.6%), as well as having medical order as a requirement for mobility and lack of champion for EM (54.3%). (see Table 4.4). The allied health professionals, including physiotherapists, considered also the administration's perceiving early mobility as an expensive intervention also to be a significant institutional barrier (57.1%).

Table 4.4 Institutional Barriers of early mobility by nurses, physicians and allied professionals (N = 49).

Variable	Total N (%)	Physician n=2	Nurse n=31	Allied health professional n=8
Routine bed rest orders upon admission	22 (47.8%)	0	16 (55.2%)	3 (42.9%)
Physician orders required prior to mobilization	25 (54.3 %)	1 (50.0%)	15 (51.7%)	4 (57.1%)
Insufficient equipment for early mobilization (e.g. ceiling lifts, chairs, walkers etc).	37 (80.4%)	2 (100%)	25 (86.2%)	4 (57.1%)
No written guidelines or protocols for early mobilization.	32 (69.6%)	1 (50.0%)	23 (79.3%)	3 (42.9%)
Not enough physical space	32 (69.6%)	1 (50.0%)	23 (79.3%)	4 (57.1%)
No clinician champion/advocate to promote early mobilization at critical care units	25 (54.3%)	2 (100%)	18 (62.1%)	2 (28.6%)
Perceived to be an expensive intervention by administrators or unit leaders	10 (21.7%)	0	6 (20.7%)	4 (57.1%)

NB. The percentages are out of the total number of participants in each group who answered.

Table 4.5 shows the provider barriers reported and the contribution of each provider to each barrier. The most frequently reported barriers were inadequate training (primarily contributed by nurses, 68.1%), safety concerns (mostly nurses and physicians), and limited staffing to mobilize patients (primarily nurses, respiratory therapists and physiotherapists). Moreover, lack of communication to facilitate EM was a concern (59.6% by physicians), lack of communication about rehabilitation (59.6% by nurses), lack of coordination among providers (mostly nurses at 58.7%), conflicting perceptions about suitability of early mobility (57.4% by nurses), and delay in

recognition when to start EM (55.3% by nurses). It is worth noting that physiotherapists were not often perceived by the participants to contribute to the listed provider barriers, except for 'limited staffing to mobilize patients".

Table 4.5 Provider barriers of early mobility by nurses, physicians and allied professionals (N = 49).

Health care provider barrier	MD	PT	RN	RT	CS	None
Limited staffing to mobilize patients	19 (39.6%)	28 (58.3%)	29 (61.7%)	29 (61.7%)	7 (15.9%)	5 (11.9%)
EM is not perceived as a priority in the care plan	22 (46.8%)	9 (19.1%)	23 (48.9%)	23 (48.9%)	16 (34.0%)	6 (12.8%)
EM is not supported by some specific individuals	17 (36.2%)	12 (25.5%)	16 (34.0%)	21 (44.7%)	17 (36.2%)	7 (14.9%)
Lack of communication to facilitate EM	28 (59.6%)	15 (31.9%)	25 (53.2%)	21 (44.7%)	14 (29.8%)	8 (17.0%)
Lack of communication about rehabilitation during handover at shift change	26 (55.3%)	13 (27.7%)	28 (59.6%)	16 (34.0%)	15 (31.9%)	6 (12.8%)
Lack of coordination among providers	25 (53.2%)	16 (34.0%)	27 (58.7%)	21 (44.7%)	19 (41.3%)	6 (12.8%)
Slow to recognize when patients should begin EM	17 (36.2%)	10 (21.3%)	26 (55.3%)	21 (44.7%)	11 (22.4%)	4 (8.5%)
Lack of decision-making authority to initiate EM.	22 (46.8%)	18 (38.3%)	22 (46.8%)	6 (12.8%)	6 (12.8%)	4 (8.5%)
Conflicting perceptions about suitability of EM	16 (34.0%)	7 (14.9%)	27 (57.4%)	19 (40.4%)	11 (23.4%)	7 (14.9%)
Safety concerns about EM	26 (55.3%)	9 (19.1%)	31 (66.0%)	24 (51.1%)	13 (27.7%)	4 (8.5%)
Inadequate training to facilitate EM	26 (55.3%)	10 (21.7%)	32 (68.1%)	22 (46.8%)	17 (36.2%)	6 (12.5%)

Legend: MD: physician; RN: registered nurse; PT: physiotherapist; RT: respiratory therapist; CS: consultant/surgeon
The percentages add to more than 100 because participants could select all that apply.

3. Perceptions on Initiation of EM.

Table 4.6 shows the perceptions on the time of initiation of EM. The majority of respondents (58.7%) felt that EM should be started as soon as a patient's cardiorespiratory status has been stabilized and as soon as the patient is conscious and cooperating (57.8%), whereas 42.2% responded when the patient is off all vasoactive drugs, followed by patients who are extubated or off sedative infusion (37.8%). All groups did not endorse frequently EM as soon as possible after admission. Allied professionals did not also frequently consider extubation or discontinuation of vasoactive drugs as indications for early mobilization.

Table 4.6 Healthcare providers' beliefs about early mobilization in the intensive care unit (N=49).

Mobilization should be initiated in critical care units…	Total N (%)	Physician n=2	Nurse n=31	Allied professional n=8
As soon as possible following admission	15 (33.3%)	1 (50.0%)	8 (28.6%)	1 (14.3%)
As soon as the patient's cardio-respiratory status has stabilized (i.e. no escalation in hemodynamic or ventilatory support	27 (58.7%)	2 (100%)	17 (58.6%)	4 (57.1%)
As soon as the patient is extubated	17 (37.8%)	1 (50.0%)	13 (46.4%)	1 (14.3%)
As soon as the patient is off all vasoactive infusions	19 (42.2%)	2 (100%)	13 (46.4%)	1 (14.3%)
As soon as the patient is conscious and can cooperate	26 (57.8%)	1 (50.0%)	17 (60.7%)	4 (57.1%)
As soon as all sedative infusions are discontinued	17 (37.8%)	1 (50.0%)	10 (35.7%)	2 (28.6%)
As soon as the patient is ready to be transferred out	11 (24.4%)	0 (0)	7 (25%)	2 (28.6%)

Legend: MD: physician; RN: registered nurse; PT: physiotherapist; RT: respiratory therapist; CS: consultant/surgeon
NB. The percentages are out of the total number of participants who answered the question

An additional investigation was made into the medical instability of ICU patients in several scenarios with varying diagnoses/conditions, devices/ drugs, and physiologic states in mechanically ventilated patients. Results are presented below.

4. Greatest Permissible Level of Activity

As shown in Table 4.7, for the greatest permissible level of activity in *various conditions* in mechanically ventilated stable patients who are not on vasopressors, the majority of respondents agreed that bed rest was mostly permissible for patients with cervical spine injury (71.4%), thoraco-lumbar spine injury (68.3%), within 24 hours of treated myocardial infarction in patients with elevated cardiac enzymes (57.3%), and head trauma with increased intracranial pressure (ICP) (52.4%). On the other hand, passive range of motion was most commonly reported as the greatest permissible level of activity in patients with delirium (48.8%), head trauma patients without increased ICP (46.3%), and in slightly over one third of those with coagulopathy with INR more than 3 (33.3%) or thrombocytopenia (32.6%), and those on full anti-coagulation (31.7%).

Active range of motion was most commonly allowed within 24 hours of treated myocardial infarction with decreasing cardiac enzymes (33.3%), obese patients (31%), in cases of deep venous thrombosis (29.3%), those on full anti-coagulation (26.8%), and patients within 24 hours uncomplicated coronary bypass surgery (agreed on both active and passive ROM equally (26.2%). Transfers to the chair was most frequently cited as the most permissible for patients within 24 hours of an uncomplicated coronary artery bypass surgery (26.2%) and those with coagulopathy (21.4%). Free ambulation was considered most permissible for obese patients (40.5%).

Table 4.7 Frequency of clinicians perceiving specified level of activity in different medical conditions. (N=49).

Level of Activity by Medical Condition	Frequency	Percent
Bed Rest		
Cervical Spine Injury	30	71.4%
Thoracic-Lumbar Spine Injury	28	68.3%
MI in 24 hours (increased cardiac enzymes)	23	57.3%
Head Trauma with increased ICP	22	52.4%
Passive ROM		
Delirium	21	48.8%
Head Trauma without increased ICP	19	46.3%
Coagulopathy	14	33.3%
Thrombocytopenia	14	32.6%
Active ROM		
MI in 24 hours (decreasing enzymes)	14	33.3%
Obesity	13	31.0%
Deep Venous Thrombosis	12	29.3%
Full anti-coagulation	12	26.8%
Uncomplicated CABG in 24 hours	11	26.2%
Gravitational Activities*		
Obesity	17	40.5%
CABG in 24 hours	11	26.2%
Coagulopathy	9	21.4%
Frailty	7	17.5%
Deep Venous Thrombosis	6	14.6%
Thrombocytopenia	6	14.0%

*** Gravitational Activities: standing, transfer to chair and ambulation.**
CABG=coronary artery bypass graft; ICP= intracranial pressure; MI=myocardial infarction; ROM=range of motion

With regards to the *devices* and *drugs* used on patients, results are shown in Table 4.8. The respondents most commonly considered bed rest to be the greatest permissible activity level for patients with high frequency oscillation (57.5%%), continuous renal replacement therapy (56.1%), extracorporeal membrane oxygenation (55%), intra-aortic balloon pump (53.7%), pulmonary artery catheter (33.3%), followed by those with femoral central venous catheter (28.6%). Passive range of motion

exercises were most commonly reported in patients with mechanical ventilation with endotracheal tube (35.7%) and those with chest tube (31%).

Active range of motion exercises, were most commonly reported as the most permissible level of activity for patients with dialysis line inserted at femoral site during non-dialysis period (37.2%), those on noninvasive positive pressure ventilation (33.3%) and those on mechanical ventilation with tracheostomy (31. Transfer to chair was less frequently endorsed, mostly for patients with chest tube (26.2%), those on BiPAP (19%), those with Foley catheter (19%), and radial arterial catheter (14%). Ambulation was recommended most commonly for patients with dialysis line inserted at subclavian site during non-dialysis (54.8%) and those with Foley catheter (47.6%), followed by those with radial arterial catheter (32.6%). For patients on full anticoagulants, intravenous heparin infusion or warfarin, passive range of motion was most commonly reported as the maximum activity allowed (31.7%). Standing was endorsed less than 10% of the times for all conditions and devices.

Table 4.8 Frequency of clinicians perceiving specified level of activity with different devices and drugs (N=49).

Level of Activity by Devices and Drugs	Frequency	Percent
Bed Rest		
High Frequency Oscillation	23	57.5%
Continuous Renal Replacement	23	56.1%
Extracoporeal Membrane Oxygenation	22	55.0%
Intra-aortic Balloon Pump	22	53.7%
Pulmonary Artery Catheter	14	33.3%
Femoral Central Catheter	12	28.6%
Passive ROM		
MV with Endotracheal Tube	15	35.7%
Heparin Infusion/ Warfarin	13	31.7%
Chest Tube	13	31.0%
Active ROM		
Femoral Dialysis Line	16	37.2%
Noninvasive Pressure Ventilation	14	33.3%

MV with Tracheostomy	13	31.0%
Heparin Infusion/ Warfarin	11	26.8%
Continuous Renal Replacement	10	24.4%
Gravitational Activities*		
Subclavian Dialysis Line (ambulation)	23	54.8%
Foley Catheter (ambulation)	20	47.6%
Radial Arterial Line (ambulation)	14	32.6%
Chest Tube (transfer)	11	26.2%
Femoral Dialysis Line (transfer)	11	25.6%
Noninvasive Pressure Ventilation (transfer)	8	19.0%
Foley Catheter (transfer)	8	19.0%
Radial Arterial Line (transfer)	6	14.0%

*** Gravitational Activities: standing, transfer to chair and ambulation.**
MV=mechanical ventilation; ROM=range of motion

5. Maximum Level of Activity Prescribed

Respondents were also asked about the maximum activity they would prescribe for mechanically ventilated patients with various conditions (see Table 4.9). They most commonly reported that bed rest would be prescribed for patients who are on three or more vasopressors or inotropic infusions (55%), two vasopressors or inotropic infusions (42.5%), those on advanced mode of mechanical ventilation such as high frequency oscillation (41%) and those on one high dose vasoactive drug (35%). Passive range of motion was most commonly reported as the maximum prescribed level of activity for patients unresponsive to verbal or motor stimulation (67.5%), patients with purposeful motor response who do not obey verbal commands (65%), and those with one high dose vasopressor or inotropic infusion (40%) or two vasoactive drugs (35%).

On the other hand, active range of motion would be most commonly prescribed for patients on minimal pressure support on conventional mode of mechanical ventilation (50.0%), patients with purposeful motor response who obey verbal commands (47.5%), and those on one medium or low dose of vasopressor or inotropic infusion, or on

moderate pressure support on conventional mode of mechanical ventilation such as with FiO_2 0.5 and PEEP 10 (42.5%). Ambulation was most commonly reported as the maximum level of prescribed activity in patients with no vasopressor infusion (30.0%) and similarly for standing (22.5%) and transfers to chair (15%).

Table 4.9 Frequency of clinicians perceiving specified level of activity in different physiologic conditions. (N=49).

Level of Activity by Physiologic Conditions	Frequency	Percent
Bed Rest		
Three or More Vasopressors or Inotropes	22	55.0%
Two Vasopressors or Inotropes	17	42.5%
Advanced Mode of MV	16	41.0%
One high dose Vasopressor	14	35.0%
Passive ROM		
Unresponsive to Verbal or Motor stimulation	27	67.5%
Purposeful Motor Response (not obeying)	26	65.0%
One high dose Vasopressor	16	40.0%
Two Vasopressors or Inotropes	14	35.0%
Active ROM		
Minimal Pressure Support on MV	20	50.0%
Purposeful Motor Response (obeying)	19	47.5%
Medium or Low Dose Vasopressor	17	42.5%
Moderate Pressure Support on MV	17	42.5%
Gravitational Activities*		
No Vasopressor (ambulation)	12	30.0%
No Vasopressor (standing)	9	22.5%
No Vasopressor (transfer)	6	15.0%

*** Gravitational Activities: standing, transfer to chair and ambulation.**
MV= mechanical ventilation; ROM=range of motion

C. Perceived Knowledge and Training

Table 4.10 shows the results of the perceived knowledge and training of EM. Only 13 participants (39.4%) reported being familiar with the literature on EM in the

ICU. Sixty percent reported that clinical trials of EM showed it to improve functional independence, 50% that it reduces DVT incidence, 45.8% that it is associated with reduced mortality, 35.4% that it reduces time on mechanical ventilation and 31.3% that it reduces incidence of delirium. Only six clinicians (13.3%) reported being well trained and informed to mobilize mechanically ventilated patients, whereas the majority (60.5%) reported not being sufficiently trained or informed about mobilizing ventilated patients.

Table 4.10. Perceived knowledge and training on EM

Variable	Frequency	Percent
Familiar with literature on early mobilization	13	39.4%
Knowledge of Clinical studies findings:		
Not sufficiently familiar	21	43.8%
EM of ICU patients can improve their functional	29	60.4%
independence	22	45.8%
EM associated with reduced mortality at discharge	15	31.3%
EM associated with reduced incidence of delirium	24	50.0%
EM reduces incidence of DVT	17	35.4%
EM of ICU patients reduces time on mechanical ventilation		
Training in mobilizing patients on mechanical ventilation		
I feel well trained and informed	6	13.3%
I feel somewhat trained and informed	12	26.7%
I do not feel sufficiently trained or informed	27	60.0%

Legend: DVT = deep vein thrombosis; EM = early mobility; ICU: intensive care unit
NB. The percentages are out of the total number of participants who answered the question

D. Practice

Table 4.11 shows the practice of EM. Only seven respondents (17.5 %) believed that critically ill patients are screened automatically by the physiotherapists for appropriateness to begin mobilization. The majority (87.5%) reported that the initial assessment for mobilization requires medical order of a physician. Almost half the

clinicians (42.1%) responded that the registered nurse is the first to identify when a patient is ready for mobilization, followed by the physiotherapist (28.9%). Only three clinicians (7.5%) reported that a written protocol to guide EM exists in the ICU. The majority of respondents (79.1%) reported that nurses, or physical therapists (79.1%), or health aids (46.5%) participate in EM in the ICU. As shown in Table 4.11, daily sedation interruption in the ICU and use of standardized sedation scales to titrate sedation were reported to be done routinely or frequently by over 90% of the sample.

Table 4.11. Early mobilization practice (N = 49)

Variable	Count	Percent
All patients are automatically assessed by PT for readiness to mobilization	7	17.5%
The first provider to identify mobilization readiness:		
Registered Nurse	16	42.1%
Physician	9	23.7%
Physiotherapist	11	28.9%
Respiratory Therapist	1	2.6%
Medical order for mobilization is required	35	87.5%
Written protocols on mobilization of patients in ICU are available	3	7.5%
Who participates in mobilization of ICU patients		
Registered Nurse	34	79.1%
Physician	14	32.6%
Physiotherapist	34	79.1%
Respiratory Therapist	9	20.9%
Health care aide	20	46.5%
Family member	8	18.6%
Other	1	2.3%
Daily sedation interruption use in the ICU		
Routinely	20	52.6%
Frequently	15	39.5%
Sometimes	2	5.3%
Infrequently	1	2.6%
Use of standardized sedation scales to titrate sedation		
Routinely	28	73.7%
Frequently	8	21.1%
Never or unsure	1	2.6%

NB. The percentages are out of the total number of participants who answered the question

1. Physiotherapist Availability, Workload and Practices

In terms of availability of designated physiotherapists in their unit, the majority of respondents (64.1%) reported that a designated physiotherapist is available for full assessment and mobilization from Monday till Friday during regular hours. On the other hand, 51.3% reported that physiotherapists are not available after 5 pm Monday till Friday, and the majority of those (60%) were available only for limited assessment and mobilization. As for Saturday, Sunday and holidays, only 7.5% reported that physiotherapists were available for full assessment and mobilization and 12.5% that they were available for limited for assessment and mobilization.

Of the four physiotherapists who answered the survey, two reported working part time and one full time. Three physiotherapists worked 6-hour shifts and one 8-hour shift. Two physiotherapists reported that they see five ICU patients per day and the rest see two or three patients per day. Two physiotherapists reported that they see 15 hospital patients per day and one reported seeing two patients per day.

Tables 4.12A and 4.12B show the results of the questions about the daily duration and frequency of mobilization of critically ill patients by physiotherapists. As noted in Table 4.9A, the most common duration of mobilization was less than 15 minutes regardless of the specifics of the patient's condition, followed by one third reporting 16-30 minutes for alert and cooperative patients. Around one third of participants reported that no mobilization was performed for deeply sedated patients (35%) or inattentive and uncooperative patients (27.5%). A similar pattern is noted in Table 4.9B regarding not doing mobilization for sedated patients (27.5%) and inattentive patients (20%). Otherwise, the most commonly reported frequency of mobilization was from less than once per week to twice per week (up to 22.5% for those

who are not alert and up to 25% for patients who are alert) or once daily (15% for the cognitively impaired and up to 27.5% for those who are alert).

Table 4.12A: Duration of mobilization of critically ill patients by physiotherapists

Condition: patient who is intubated, mechanically ventilated, plus	**None**	**< 15 min**	**16-30 min**	**31-45 min**	**46-60 min**	**>60 min**	**Unsure**
Deeply sedated and Unconscious	14 (35%)	26 (65%)	0.0	0.0	0.0	0.0	0.0
Inattentive and uncooperative	11 (27.5%)	29 (72.5%)	0.0	0.0	0.0	0.0	0.0
Alert, interactive, cooperative but can not ambulate yet	4 (10.0%)	20 (50.0%)	12 (30.0%)	2 (5%)	0.0	0.0	2 (5.0%)
Alert, interactive/cooperative and can ambulate	4 (10.0%)	17 (42.5%)	14 (35.0%)	3 (7.5%)	0.0	0.0	2 (5.0%)

Table 4.12 B. Frequency of mobilization of critically ill patients by physiotherapists

Condition: patient who is intubated, mechanically ventilated,	**None**	**< once per week**	**1-2 times per week**	**3-4 times per week**	**5-6 times per week**	**Once daily**	**≥ 2 times per day**	**unsure**
Deeply sedated and unconscious	11 (27.5%)	7 (17.0%)	7 (17.5%)	4 (10.0%)	2 (5.0%)	6 (15.0%)	0.0	3 (7.5%)
Inattentive and uncooperative	8 (20%)	8 (20.0%)	9 (22.5%)	4 (10.0%)	2 (5.0%)	6 (15.0%)	0.0	3 (7.5%)
alert, interactive cooperative, cannot ambulate	2 (5%)	1 (2.5%)	10 (25.0%)	11 (27.5%)	3 (7.5%)	8 (20.0%)	1 (2.5%)	4 (10.0%)
alert, cooperative and can ambulate	3 (7.5%)	0.0	9 (22.5%)	10 (25.0%)	2 (5.0%)	11 (27.5%)	1 (2.5%)	4 (10.0%)

Table 4.13 shows the results of the frequency of implementation of physiotherapy techniques for patients eligible for rehabilitation. Forty percent of participants reported that chest physiotherapy is routinely implemented and 36.8% that it was done frequently. Passive and active range of motion exercises were done frequently by 38.5% and 40% of the sample, respectively. Moreover, and the frequency

of moving patients in bed was reported to be routinely in 30% and frequently by 22.5%. Transfers were less often done as their reported frequency was mostly sometimes (43.6%) or infrequently (41%). Similarly, strengthening exercises were reported to be done either sometimes (30%) or never (25%). Finally, the following techniques were reported by over half the sample as never implemented: pre gait activities, gait training/ambulation, treadmill, neuromuscular electrical stimulation, cycle ergometer, and dynamic tilt table.

Table 4.13 Frequency of Implementation of Physiotherapy Techniques in Patients Eligible for Rehabilitation (N=49).

Type of physiotherapy	Never N (%)	Infrequently N (%)	Sometimes N (%)	Frequently N (%)	Routinely N (%)	Unsure N (%)
Chest physiotherapy	1 (2.6%)	0	6 (15.8%)	14 (36.8%)	15 (39.5%)	2 (5.3%)
Passive range of motion	0	0	9 (23.1%)	15 (38.5%)	14 (35.9%)	1 (2.6%)
Active range of motion	2 (5.0%)	5 (12.5%)	11 (27.5%)	16 (40.0%)	5 (12.5%)	1 (2.5%)
Strengthening exercises	10 (25.0%)	7 (17.5%)	12 (30.0%)	6 (15.0%)	3 (7.5%)	2 (5.0%)
Moving patient in bed	1 (2.5%)	5 (12.5%)	11 (27.5%)	9 (22.5%)	12 (30.0%)	2 (5.0%)
Transfers	0	16 (41.0%)	17 (43.6%)	5 (12.8%)	0	1 (2.6%)
Pre-gait activities	20 (52.6%)	5 (13.2%)	5 (13.2%)	2 (5.3%)	0	6 (15.8%)
Gait training/ambulation	20 (51.3%)	5 (12.8%)	6 (15.4%)	2 (5.1%)	0	6 (15.4%)
Treadmill	33 (86.8%)	2 (5.3%)	1 (2.6%)	0	0	2 (5.3%)
Neuromuscular electrical stimulation	32 (84.2%)	3 (7.9%)	1 (2.6%)	0	0	2 (5.3%)
Cycle ergometer	29 (78.4%)	4 (10.8%)	1 (2.7%)	0	0	3 (8.1%)
Dynamic tilt table	32 (84.2%)	3 (7.9%)	1 (2.6%)	0	0	2 (5.3%)

E. Predictors of Perceived Feasibility of Early Mobility

1. Health care providers' demographic factors associated with their perceived feasibility of early mobilization in critical care units

Regarding demographic factors, the association between the level of education and years of experience of clinicians with the perceived feasibility of implementing EM in critical care units were tested. An independent samples t-test was conducted to compare feasibility of EM by level of education using the dichotomous variable. There was no significant difference in the feasibility scores between those with bachelor degree (M= 2.04, SD= 0.84) and those with masters degree and above (M= 2.77, SD= 1.17); t= -2.0, p= 0.06). Given the small sample size, the analysis was repeated using the Mann Whitney U nonparametric test but the results remained non-significant (p = 0.074). This shows that the level of education of clinicians is not associated with their perceived feasibility of early mobility.

As for the association of the clinicians' years of experience with their perceived feasibility, a one-way ANOVA test was conducted. The results showed that the perceived feasibility was not significantly different by years of experience, F (2, 37) = 0.55, p = 0.583. Non-significance was shown also when using the nonparametric test Kruskal Wallis (p = 0.431). This shows that there is no difference between novice or senior clinicians in their perceived feasibility of implementing EM in critical care units.

2. The predictors of the perceived feasibility of implementing early mobilization in the critical care units

Spearman's rho correlation analysis was conducted to test the association between perceived importance of EM, knowledge and training, beliefs about when to initiate EM, patient barriers, and the perceived feasibility of early mobilization in the ICU. Importance and feasibility were not significantly associated (Spearman Rho =

0.25, p = 0.111). None of the knowledge items was significantly correlated with the perceived feasibility of implementation of EM. However, perceived adequate training in mobilizing mechanically ventilated patients was significantly associated with perceived feasibility (Spearman Rho = 0.56, p <0.001). Believing that EM must be initiated as soon as possible following admission was positively associated with feasibility of its implementation (Spearman Rho = 0.38, p = 0.009).

None of the patient barriers was associated with the feasibility variable. In terms of provider barriers, feasibility was significantly associated with limited staffing, MD (Rho = -0.37, p = 0.012), limited staffing. RN (Rho = -0.39, p = 0.008), limited staffing RT (Rho = -0.62, p < 0.001), EM not seen as priority in care RN (Rho = -0.51, p < 0.001) and EM not supported by specific individuals RN (Rho = 0.40, p = 0.006). Moreover, lack of communication among clinician groups about EM during rounds by PT (Rho = -0.39, p = 0.008), RN (Rho = -0.37, p = 0.012), RT (Rho = -0.40, p = 0.007), and CS (Rho = -0.45, p = 0.002) were negatively correlated with feasibility, whereas presence of such communication was positively associated (Rho = 0.31, p = 0.036). Feasibility was also negatively associated with lack of communication about rehabilitation during shift reports by PT (Rho = -0.44, p = 0.002), RN (Rho = -0.36, p = 0.014), and CS (Rho = -0.39, p = 0.007), but positively associated with the presence of such communication (Rho = 0.48, p = 0.001). Feasibility was also negatively associated with lack of coordination among providers by MD (Rho = -0.40, p = 0.007), RN (Rho = -0.30, p = 0.045) and CS (Rho = -0.61, p < 0.001), and positively associated with the presence of such coordination (Rho = 0.8, p = 0.001). Feasibility was negatively associated with lack of decision making authority by PT (Rho = -0.32, p = 0.035), as well as safety concerns by RN (Rho = -0.43, p = 0.003), RT (Rho = -0.44, p = 0.003)

and CS (Rho = -0.38, p = 0.01). Finally, inadequate training contributed by all members of the health team except PT was negatively associated with feasibility (Rho between -0.46 and -0.55, p values between < 0.001 and 0.002), whereas adequate training was positively associated with feasibility (Rho = 0.50, p < 0.001).

The results of the correlation between perceived feasibility and institutional barriers are presented in Table 4.14. Perceived feasibility was significantly associated with routine bed rest orders at admission (p = .043), insufficient equipment (p = 0.002), no written guidelines (p = 0.001) and no physical space (p = 0.002). Routine bed rest orders was also moderately significantly associated with orders needed for EM (p = 0.002), and no written guidelines (p = 0.017). Lack of equipment was also strongly significantly associated with lack of written guidelines (p < .001), lack of space (p < 0.001), and lack of a champion for EM (p = 0.031), the latter two being significantly associated with lack of written guidelines; p = 0.001 and 0.02, respectively. Perceived expense of EM implementation was also significantly associated with the lack of space (p = 0.018). It is worth noting that the correlations were based on 46 participants due to missing data.

Table 4.14 Correlation of institutional barriers with perceived feasibility

Variable	1	2	3	4	5	6	7	8
1. Perceived feasibility	1							
2. Routine bed rest orders at admission	-0.299*	1						
3. Orders required for EM	-0.116	0.441**	1					
4. Insufficient equipment	-0.451**	0.253	0.208	1				
5. No written guidelines	-0.483**	0.350*	0.247	0.507**	1			
6. Lack of space	-0.452**	0.255	0.058	0.627**	0.487**	1		
7. No champion for EM	-0.129	0.091	0.124	0.318*	0.342*	0.437**	1	
8. Perceived expense	-0.278	0.128	0.166	0.260	0.234	0.349*	0.166	1

Based on the results of the bivariate analyses of feasibility and institutional barriers (research question 7), we entered the variables that were significantly associated with the feasibility variables (routine bed rest orders at admission, insufficient equipment, no written guidelines and lack of space) and included the years of experience as we thought it was relevant to the analysis. Although this model was significant ($p = 0.023$) and explained 22% of the variance, none of the predictors were significant. We noted collinearity between lack of equipment and lack of space. Thus, we conducted a backward hierarchical regression analysis with the same variables. The final model was significant at $p = 0.002$, and explained 26% of the variance in feasibility of implementing EM. The remaining predictors in the final model were insufficient equipment and lack of written guidelines, with the former significant and the latter approaching statistical significance. Thus, lack of sufficient equipment and

lack of written guidelines predict lower perceived feasibility of implementing early mobility in critical illness. Table 4.15 shows these results.

Table 4.15 Hierarchical Linear regression test of institutional barriers with perceived feasibility of implementation of early mobility

Model 1	**Unstandardized B**	**Standard error of B**	**95% confidence interval**	**Standardized Coefficient Beta**	**t**	**P value**
Constant	5.33	.811	3.67, 6.98		6.57	.000
Years of ex perience	-0.06	.22	-0.46, 0.35	-0.04	-0.28	0.785
Routine bedrest orders at admission	-0.28	0.31	-0.90, 0.35	-0.14	-0.91	0.371
Insufficient equipment	-0.74	0.50	-1.74, 0.273	-0.29	-1.49	0.147
No written guidelines or protocols	-0.54	0.39	-1.34, 0.26	-0.25	-1.37	0.179
Not enough physical space	-0.15	0.47	-1.10, 0.80	-0.07	-0.325	0.747
Model 2	**Unstandardized B**	**Standard error of B**	**95% confidence interval**	**Standardized Coefficient Beta**	**t**	**P value**
Constant	5.29	0.78	3.70, 6.86		6.78	0.000
Routine bedrest orders at admission	-0.29	0.30	-0.90, 0.33	-0.14	-0.95	0.351
Insufficient equipment	-0.75	0.49	-1.74, 0.25	-0.29	-1.53	0.14
No written guidelines or protocols	-0.54	0.39	-1.32, 0.25	-0.25	-1.39	0.173
Not enough physical space	-0.17	0.46	-1.10, 0.76	-0.07	-0.37	0.717
Model 3	**Unstandardized B**	**Standard error of B**	**95% confidence interval**	**Standardized Coefficient Beta**	**t**	**P value**
Constant	5.26	0.30	3.70, 6.81		6.86	0.000
Routine bedrest orders at admission	-.29	0.30	-0.89, 0.31	-0.15	-0.99	0.331
Insufficient equipment	-0.84	0.41	-1.67, -0.01	-0.33	-2.05	0.048
No written guidelines or protocols	-0.59	0.36	-1.31, 0.14	-0.27	-1.65	0.109
Model 4	**Unstandardized B**	**Standard error of B**	**95% confidence interval**	**Standardized Coefficient Beta**	**t**	**P value**

Constant	5.02	0.73	3.54, 6.50		6.91	0.000
Insufficient equipment	-.87	0.41	-1.70, 0.05	-0.34	-2.15	0.039
No written guidelines or protocols	-0.67	0.35	-1.37, 0.04	--0.30	-1.92	0.063

CHAPTER VI

DISCUSSION

This study examined the feasibility of implementing early mobility in ICUs from the perspective of health professionals. The response rate (40%) is limited; however, it is acceptable given that this is an online survey, and it compares to that of Anekwe et al. (2019). Moreover during the data collection period (March 8 through May 2nd, 2021), the medical center was still suffering from the effect of COVID-19 with an exodus of nurses and physicians. The sample may not represent the health care professionals at AUBMC since only two physicians have responded whereas there are twenty physicians, and only twenty nine nurses responded out of a total of 70 at the critical care units. The sample's distribution by years of experience reflects the actual distribution of health professionals in critical care at AUBMC.

Although the majority of participants acknowledged the importance of early mobilization in critical care, they were less certain about its feasibility, as evidenced by the weak association between the two variables. As expected, patient, provider and institutional barriers were identified. The sample also reported lack of enough knowledge and training in early mobility. At the practice level, delay in assessing patients for readiness to mobilization and relying on nurses in this regard were reported. Mobilization was mostly and more often done for patients who are alert. The most frequent physiotherapy techniques included chest physiotherapy, passive and active range of motion exercises, and moving patients in bed. The most commonly done techniques are those where no equipment needed such as active or passive range of motions, etc.. Chest physiotherapy was the most frequent technique since is mostly

done by nurses during their usual rounds on critically ill patients and does not actually require any physiotherapist consult.

The findings of this study show that the perceived feasibility to implement EM at the complex setting of ICU is associated with a number of variables: adequate training in EM, believing that EM must be started as soon as possible following admission, and a number of institutional barriers. Multivariate analysis showed that feasibility was predicted by the unavailability of equipment for mobilization and the absence of written guidelines and protocols.

A. Feasibility and Importance of Early Mobility

Almost half of the respondents in this study identified EM as very important and that it should be a top priority in patients' care, and one fifth considered it as crucial. About two thirds of participants believed it could be somewhat feasible at ICU but none believed it is extremely feasible. An earlier study by Anekwe et al. in 2019 also showed that EM was perceived as very important (39.1%) among health care professionals. Nurses constituted the majority of the respondents in this study and their judgment is likely to have influenced the results. The result showed that health care professionals are aware that early mobility is a significant factor in the care of patients. Another study by Koo et al. in 2016 reported that EM is perceived as crucial or very important (68.8%) and perceived importance was more significant in those with EM champion at their ICU. Despite empirical evidence that EM helps in improving functional mobility and independence, leading shorter length of stay and improving quality of life, the reviewed studies had one major limitation, which is the timing of initiation of EM as there was no clear or consistent definition regarding *'early'* mobilization and its timing. In the

current study, the majority of clinicians believed that EM should start as soon as the patient is conscious and can cooperate and as soon as the patient's cardio-respiratory status has stabilized, as reported by Anekwe et al. (2019) and as recommended in the study of Stiller et al. (2004). The percent of participants who considered that mobilization must be started 'as soon as possible' following admission (33.3%) was lower than what was reported by Koo et al. (2016) and Anekwe et al (2019), possibly because this item lacks a specific time frame and ICU patients come with different conditions, so 'as soon as possible' varies among patients. Previous studies have shown that the consequences of bed rest could start within few days of immobility and do not require a prolonged time to appear such as pulmonary atelectasis, which can occur within 48 hours of bed rest, and metabolic and vascular changes that could appear within five days of bed rest (Brower, 2009). Identifying a specific time frame to initiate early mobility is challenging taking into consideration the different patients' conditions; however, identifying a minimum time frame for example, within 48 hours of admission or stabilization if not contraindicated would be helpful in preventing consequences of bed rest. To note that, not all patients in critical care units are intubated or sedated. Some patients could be fully alert and cooperative and admitted for an acute phase of their illness, so this kind of patients could benefit from initiating mobilization at the soonest convenience instead of risking them into complications of immobility and prolonging their hospital stay and increasing their hospitalization expense.

B. Barriers to Early Mobility

Among patient barriers, medical instability, endotracheal intubation and risk of dislodgment of lines were the most frequently cited. These findings are similar to those

of Koo et al (2016) and those of Anekwe et al. (2019). Koo et al (2016) also reported excessive sedation frequently as a patient barrier, which was mostly reported by the physicians in the current study. This explains the more frequent activities being done mostly for alert and cooperative patients as opposed to those sedated. Nurses less often endorsed excessive sedation as being the most frequent barrier since there are protocols implemented at AUBMC that allow nurses to titrate sedation according to Richmond Agitation Sedation Scale (RASS) to prevent excessive sedation on patients and avoid its adverse consequences. Safety concerns and limited staffing, especially by nurses, were also frequently reported provider barriers, similar to the findings by Koo et a. (2016) and Anekwe (2019). This result is explained by the important role that nurses play in mobilizing patients, as 79% reported that nurses participate in mobilization of patients; the same applies to physiotherapists.

The findings related to physical therapists suggest their limited availability, especially that most work part time, and are not available after hours or over the weekend and holidays. The findings suggest that physiotherapists are not necessarily designated exclusively to the ICU, which could explain the short duration and limited frequency of mobility they perform on critically ill patients. Findings from this study showed that physical therapists (PTs) not only spend short period of time during their session, but also treat patients the same despite their medical condition. For example, the findings showed that PTs spend less than 15 minutes in their session for both, patients who are mechanically ventilated and deeply sedated and unconscious patients as well as patients who are intubated but alert, interactive and can ambulate.

Studies on the benefits of early mobility done by Burtin et al. (2009), Adler & Malone (2012), Kayambu et al. (2013) and Seo et al. (2019) showed that physiotherapy

sessions were done for at least 20 minutes per session for a minimum of five days per week. The findings of this study suggest that mobility sessions are not enough to prevent consequences of inactivity and improve functional independence. The findings also showed that patients are not automatically assessed by PTs who see around five patients per day compared to the actual number of patients at ICUs (around 30). Joelly et al. (2014) surveyed PTs and 41% agreed that EM at critical care units increases the overall work stress and 16% reported prolongation of their work day and delay in usual care. The limitation in timing and frequency in the current study could be due to shortage of PTs and the absence of designated PT for critical care unit. These findings suggest the need to hire more physical therapists if early mobility is to be implemented, in order to achieve the positive outcomes for patients.

The main patient related concerns also varied with the clinician's occupation similar to what was shown by Koo et al. (2016). Nurses were significantly concerned about cognitive impairment in addition to safety and training in EM, whereas physicians mainly reported obesity, physical restraints and excessive sedation. This supports the belief that multidisciplinary teams are needed to overcome the barriers of EM in the complex setting of ICU and standardize the practice. Receiving adequate training for all health care professionals will prevent misconceptions and myths regarding EM, especially for mechanically ventilated patients, and will allow more collaboration in identifying patients eligible for EM and standardize the prescribed activities. In fact, lack of coordination among health team members was negatively associated with feasibility of EM in this study.

In terms of provider barriers, inadequate training in mobilizing patients at ICU, especially those of mechanically ventilated patients, can be a significant barrier to EM.

The findings showed that 60% of the clinicians did not feel sufficiently trained or informed about mobilizing patients on mechanical ventilation, similar to the study of Anekwe et al. (2019) where only 42% of clinicians felt well trained in mobilizing patients. Those who reported being well trained mainly are physiotherapists who would feel more competent than other providers in mobilizing patients given their training.

Safety concern was reported by nurses as being the most frequent provider barrier to EM in this study despite reliable evidence that mobilizing patients in critical care units including those mechanically ventilated is safe. This concern could lead to the late beginning of mobilization since most health care providers in this study agreed that the registered nurse is the first to identify the readiness of patients for mobilization. Nurses usually spend most of their time at the bedside; thus their judgment is significant in identifying any changes in patients' conditions or readiness to mobilize. The study by Stiller et al., in 2004, which involved implementing an early mobility program after comprehensive screening of the suitability of patients to EM, showed that although there was a mild change in the hemodynamic and respiratory status of patients during mobilization, it was not significant and did not require any or required only mild intervention. This shows that mobilizing patients could be safe and should not be a concern to health care providers if appropriate screening of patients is done before mobilizing them. Again, these findings in the current study, along with the reported deficient perceived knowledge, suggest the need for training.

The limited number RTs was also perceived as a significant provider-level barrier. RTs play significant role during mobilization, especially for mechanically ventilated patients where they can handle the invasive tube and decrease the risk of dislodgment incidents, which would lessen apprehension and encourage mobilization.

Adequate staffing was previously mentioned as being one of the important factors that is highly needed to ensure safe mobilization and prevent any adverse events and delay in care. In study by Joelly et al. in 2014, nurses were surveyed and reported that mobilizing patient takes 16 to 45 minutes, taking into consideration the shortage of staffing and increased workload. Thus, having more RTs can not only increase safety of EM, but reduce the time needed for the mobility session.

Other significant provider barriers have to do with lack of communication about rehabilitation and lack of coordination, mostly contributed by nurses and physicians, and conflicting perceptions about EM contributed by nurses, as in the studies of Koo et al. (2016) and Anekwe et al. (2019). These barriers can be improved when guidelines or protocols are developed and clinicians trained accordingly, and these are still not available at AUBMC. A study by Barber et al. in 2015 showed that communication was a significant barrier as all groups (physicians, nurses and PTs) reported finding difficulties in communicating among staff and contacting the right people to permit mobility. The authors suggested that the multidisciplinary team is important, need to develop daily goals and combine functional activities, in addition to involving families that would be encouraging and rewarding to increase the level of mobilization. Moreover, guidelines and protocols could clarify who are eligible for EM and what type of physiotherapy is needed, for example, those requiring active or passive ROM and those who could be ambulated freely. Protocols clarify also who participates in mobilization as well as the frequency and timing of sessions. The practice would be standardized and even providers who are not familiar with EM could refer to it to.

In this study, only 7.7% reported the availability of protocols on EM, which draws the attention that either there is no protocol or there is an existing one that is not

being used. Alternatively, it may be that those who reported the availability of protocols are physiotherapists who have some existing protocols in their department. Previous studies also have identified the unavailability of written guidelines as a significant barrier to EM, whereas its existence can act as a facilitator. In Joelly et al. (2014), physicians were surveyed and 80% suggested that EM should occur automatically via nursing and PT protocols unless physicians specify a bed rest order. Physicians also agreed that EM should be done with patients on mechanical ventilation but few agreed to perform EM in case of vasoactive drugs. However, findings of this current study showed that patients who are mechanically ventilated and deeply sedated, none of physiotherapy techniques was initiated for them, not even passive range of motion. This lack of EM may be explained by limited staffing limited and/or safety concerns, as suggested by the correlation findings between feasibility of EM and these provider barriers.

In terms of institutional barriers, the most frequently cited were lack of equipment, lack of guidelines, lack of space, followed by the need for a physician order for EM and lack of an EM champion. These findings are similar to those of Koo et al. (2016) and Anekwe et al. (2019). The lack of equipment explains the almost nonexistent provision of physical therapy activities that require equipment like a cyclometer or treadmill, among others. The lack of guidelines, on the other hand, could explain the slow recognition of the need for EM, especially by nurses, who were reported to be the first to note the patient's readiness for EM.

Regarding the maximum level prescribed for patients reported by clinicians, some of the findings were reasonable, however there was some inconsistency. Bed rest was mainly prescribed for patients who are severely injured or very critical such as

those with spine injury, head trauma with increased ICP, and those who are hemodynamically and respiratory unstable and require vasopressors infusion and advanced mode of ventilation, which is expected. The inconsistency was in the activity level for obese patients as reported by clinicians that could range from passive range of motion to ambulation; if these patients are alert and cooperative their weight should not impede their mobilization out of bed if sufficient staff participated to ensure their safety. Moreover, patients with a Foley catheter, the responses were divided into transfer to chair and ambulation, taking into consideration that these patients could also stand, the presence of the Foley catheter should not prevent their ambulation. Contradiction was also seen in patients with chest tube that ranged from passive range of motion to transfer to chair; handling tubes properly by the staff could ensure safe transfer of these patients out of bed. The discrepancy in prescribing the maximum activity for patients with different medical conditions could be due to the fact that no training is done to the staff to teach them about proper techniques of mobilization and remove the safety apprehensions regarding dislodgment of devices and lines, fall and injuries, etc..

C. Predictors of Feasibility of Early Mobility in Critical Care

Bivariate analyses showed that feasibility is not associated with the level of education of clinicians ($p = 0.06$), but the association was in the positive direction. The lack of significance may be accounted for by the small sample size. The lack of a significant association with the years of experience ($p = 0.58$) could be accounted for by the fact that the majority of the sample (53.6%) had less than 10 years of experience; however, the lack of such association held when the variable was entered in the multivariate analysis.

It is expected that EM application is basically affected by the knowledge and training of ICU clinicians on EM, the priority they set for EM in the care provided, and the barriers and facilitators they come across while mobilizing patients. Adequate training and a positive attitude towards early mobility, as evidenced by believing that mobility ought to be started as soon as possible following admission, were significantly associated with feasibility. This suggests that training in and information about the benefits of early mobility could enhance its implementation in critical care units. The study further highlights that there is a gap between the perceived importance of EM, knowledge of benefits of EM and its actual practice at ICU, as noted by the brief and infrequent mobilization of patients.

The findings about associations between provider barriers and feasibility of implementation of early mobility suggest that promoting acknowledgment of the importance of EM, communication about mobility and rehabilitation among health care providers and coordination, and the provision of adequate staffing and training in patient mobilization can promote the feasibility of implementing EM in critical care. The institutional barriers that were associated significantly with feasibility of implementing EM in this study provide the practice and material aspects that must be attended to when planning an early mobility program in ICU. For instance, establishing guidelines and protocols for EM, securing the equipment needed and rearranging the setting of the ICU to ensure more space can all be facilitators of the implementation of EM. These findings were supported by the results of the multivariate analysis.

Clinicians at AUBMC agreed that EM is very important and should be considered as top priority in the care provided; however, their practice still lags behind. Early mobility was addressed earlier in the The Society of Critical Care Medicine meeting

that was held in 2010 and tackled the recommendations to prevent post intensive care syndrome. Examples of these recommendations were the awakening and spontaneous breathing trials, screening of delirium, ICU pain and agitation bundles, along with early mobility. In the critical care units of AUBMC, most of these recommendations are already set in practice. For example, pain and sedation protocols are available that specify the drugs to be used, target RASS scale and instructions that allow nurses to titrate drugs accordingly to prevent over or under sedation. Interruption of sedation is done routinely in the ICUs mainly at morning to assess the level of consciousness and patients' readiness for weaning from ventilator. In addition, delirium assessment is done every shift using the Confusion Assessment Method tool to identify acute fluctuations in level of consciousness and plan care accordingly. However, early mobility is still not addressed. Mobility is different from other recommendations since pain and sedation protocols for example do not require preparations such as adequate staffing, equipment, enough space, etc.. but only need workshops to train and inform clinicians. However, implementing such program as mobility needs many arrangements and could be expensive to the institution. To note that, once patients get admitted to the ICU their admission order set specifies the activity prescribed; however, clinicians order bed rest by default as part of the management. The routine bedrest order at admission was negatively associated with feasibility of EM in this study. Realizing that specific patient could be moved out of bed takes several days, and so early mobilization rarely happens.

The findings of this study would help in setting the ground for the development of an early mobility program at AUBMC critical care units. Surveying health care professionals have identified the barriers the clinicians might encounter while mobilizing patients. At first, clinicians at AUBMC believe that early mobility is

important and should be in top priority in the care provided but they believe that implementing such program is only somewhat feasible. It is significant to address their perceptions on the benefits and worth of such program because they are the ones handling the program. The basic constituents of the program are reflected by the identified barriers on all levels.

D. Role of the Clinical Nurse Specialist

The critical care clinical nurse specialist (CNS) has a key role in promoting early mobility in critical care units. The clinicians reported that there is no advocate or clinical champion to promote EM nor a protocol to guide practice. In addition, lack of communication and coordination among clinicians with regard to mobility were associated with lower feasibility of its implementation. Thus, a multi-disciplinary team is needed to set the fundamentals of the program. A task force for EM could be formed including health care professionals from different disciplines. A champion may be assigned for EM, and defined and clear comprehensive protocols, guidelines and screening tools should be developed in order to standardize the practice and make mobility as part of routine care, identifying who initiates EM and participate in mobilizing patients. The CNS can be in the best position to serve as the champion for early mobility in the ICU, working closely with physiotherapists and coordinating the activities of the team so this aspect of care is given priority. In parallel, the CNS can consult with engineering regarding the setup of the rooms in ICU to evaluate the needs for physical space and check with companies for the equipment needed for mobilizing patients at ICU, including walkers, ceiling lifts, chairs, etc... Moreover, adequate staffing of nurses, PTs, RTs, physicians and health care aids is needed. A

comprehensive proposal can then be submitted to the administration addressing all these aspects, so that early mobility can be set as a priority. After the needed equipment is ready, a training workshop can be done so that clinicians feel competent and safe in mobilizing patients.

E. Limitations

There are multiple limitations of the current study. This study was carried out using a survey design methodology and although the clinicians provided their responses regarding barriers and mobility practices at ICU, they were not observed during their work, which would provide more valid data. Nevertheless, to our knowledge early mobilization is not practiced at AUBMC, so using a self-administered survey was appropriate as a first step to explore the issue, despite the risk of socially desirable answers. Moreover, early mobilization was defined in this study as a mean of rehabilitation to be started as soon as possible after admission to ICU; it can be initiated once patients are hemodynamically stable, for example having a resting heart rate of less than 50% of age predicted maximal rate, blood pressure of less than 20% variability recently, normal EKG, SpO2 more than 90% (Stiller et al., 2004). Identifying a standard time frame was challenging given the different types of patients and individual differences in their comorbidities and baseline functional status.

The current study was at AUBMC; hence, it was restricted to clinicians who work at this hospital only and the findings cannot be generalizable to all hospitals in Lebanon. The sample was small in size and the number of nurses included in this study was much higher than that of the physicians and therapists in the ICU, although it reflects the actual distribution of the number of providers at ICU. This limitation was addressed in the statistical analysis. Finally, the questionnaire was rather long and some

parts of it were difficult, as was noted in the pilot study, taking into consideration the shortage in staffing and increasing workload that have influenced the response rate.

F. Conclusion

Bed rest, if continued long after the patient's condition stabilizes, is harmful to patients at ICUs. Early mobilization has gained significant attention due to its benefits in reducing the negative consequences of bed rest post intensive care discharge and in improving the quality of life of ICU survivors. This study provided baseline data for setting the ground for implementing the program of early mobilization in critical care units at AUBMC. A positive attitude of clinicians towards EM was noted despite hesitancy to implementation suggested by the lower perceived feasibility. As the findings revealed the main barriers of the program, these should be resolved before its implementation, so it will be applied successfully and in return positively impact ICU survivors.

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APPENDIX

MODIFIED CANADIAN SURVEY OF MOBILIZATION OF ICU PATIENTS: CURRENT KNOWLEDGE, PERSPECTIVES, AND PRACTICES

Dear practitioner,

Please complete the following questions. All responses will be held in confidence.

Below is a list of definitions of terms and abbreviations used throughout this survey

Glossary of Terms

- ICU: Intensive Care Unit

- NCU: Neurosurgery Intensive Care Unit

- RCU: Respiratory Care Unit.

- Mobilization: physical therapy that involves active or assisted patient mobility. This may include bed mobility, sitting, standing, ambulation or active exercise training. This does not include passive range of motion.

- Early Mobilization (EM): physical therapy and acute rehabilitation measures initiated as soon as possible following admission to the critical care units. Patients who receive EM will be progressively rehabilitated through a series of exercises that may begin while they are still receiving life support (i.e. mechanical ventilation).

- **Non-Mobility Physiotherapy:**
  - Cardio-respiratory/Chest physiotherapy: physical therapies to improve ventilation-perfusion matching and respiratory mechanics including deep breathing exercises, airway secretion clearance, and percussion techniques.
  - Passive Range of Motion: passive movement facilitated by providers.

- **Mobility Physiotherapy:**
  - Active Range of Motion: unassisted patient movement.
  - Strengthening exercises: muscle strengthening (can include bedside cycle ergometer), neurodevelopmental play (i.e., play activities to facilitate fine and gross motor development) for infants and developmentally delayed children.
  - Bed mobility: activities done while recumbent (e.g., active or partially assisted repositioning in bed or rolling from side to side).
  - Transfers: trunk control, unsupported sitting, sitting on edge of bed, sit to stand, from bed to chair or commode.
  - Pre-Gait: weight shifting, stepping in place and sideways.
  - Ambulation: walking/gait training with or without walking aid or assistance.

PERCEPTIONS

1.0 Personal view of Early Mobilization in the ICU\ NCU\ RCU.

1. Please select ONE option below that best describes your view of early mobilization:
    a. Crucial, should be top priority in the care of patients.
    b. Very important, should be a priority in the care of patients.
    c. Important, should be a priority in the care of patients.
    d. Somewhat important, should be considered in the care of patients.
    e. Not of great importance, but clinicians should bear it in mind.
    f. Of minimal importance to the care of patients.
    g. Of no importance to the care of patients.

2. How feasible do you think implementation of early mobility in intensive care units at AUBMC is?
    a. Not at all feasible.
    b. Somewhat feasible.
    c. Unsure.
    d. Very feasible.
    e. Extremely feasible.

1.1 **Barriers to Early Mobilization**.

3. a) What is (are) the most important institutional barrier(s) to early mobilization in YOUR unit? By institutional barriers we mean customs and behavior patterns in your work environment. Please check ALL that apply or "no institutional barriers" if there are none.

    a. Routine bed rest orders upon admission.
    b. Physician orders required prior to mobilization.
    c. Insufficient equipment for early mobilization (e.g. ceiling lifts, chairs, walkers etc).
    d. No written guidelines or protocols for early mobilization.
    e. Not enough physical space.
    f. No clinician champion/advocate to promote early mobilization at critical care units.
    g. Perceived to be an expensive intervention by administrators or unit leaders.
    h. No institutional barriers.
    i. Other institutional barrier(s), please specify.

3. b) What is (are) the most important patient level barrier(s) to early mobilization in YOUR unit? Please check ALL that apply or "no patient barriers" if there are none.

    a. Medical instability.
    b. Endotracheal intubation.
    c. Physical restraints.
    d. Risk of dislodgement of devices or lines.

e. Cognitive impairment/cognitive age.
f. Excessive sedation.
g. Inadequate analgesia.
h. Obesity.
i. Frailty.
j. Inadequate nutritional status.
k. No patient barriers.
l. Other patient barrier(s), please specify.

4. Providers are critical care physicians (MD), physiotherapists (PT), registered nurses (RN), respiratory therapists (RT), and referring consultants/primary surgeons (CS). What is (are) the most important provider level barrier(s) to early mobilization (EM) in YOUR unit? If you believe that the listed barrier is important, please select ALL provider(s) who contribute to the existence of that barrier. Alternatively, if you believe the listed barrier is NOT an important barrier, select "None".

Potential Provider Barrier	**MD**	**PT**	**RN**	**RT**	**CS**	**None**
a) Limited staffing to routinely mobilize patients.						
b) EM is generally supported but it is not perceived as a priority in the care plan of a critically ill patient.						
c) EM is generally perceived as important, but it is not supported by some specific individuals.						
d) Lack of communication among clinician groups to facilitate EM during bedside rounds.						
e) Lack of communication about rehabilitation during handover at shift change.						
f) Lack of coordination among providers to facilitate EM.						
g) Slow to recognize when patients should begin EM.						
h) Lack of specific decision-making authority to initiate EM.						
i) Conflicting perceptions about suitability of EM in some patients.						
j) Safety concerns about EM						
k) Inadequate training to facilitate EM						

1.2 When to Initiate Mobilization in critical care units:

5. Generally speaking, when do YOU think mobilization should be initiated in the critical care units? Please select ALL that apply.

a. As soon as possible following admission.
b. As soon as the patient's cardio-respiratory status has stabilized (i.e. no escalation in hemodynamic or ventilatory support).
c. As soon as the patient is extubated.
d. As soon as the patient is off all vasoactive infusions.
e. As soon as the patient is conscious and can cooperate.
f. As soon as all sedative infusions are discontinued.
g. As soon as the patient is ready to be transferred out.
h. Other, please specify.

1.3 Level of Activity

6. For each of the following scenarios, assume that the patients are previously ambulatory and are now physiologically stable on mechanical ventilation, no inotropes and on minimal sedation infusion. These patients have purposeful motor response and can obey verbal commands (unless otherwise stated). In YOUR opinion, what would you consider as the ***greatest permissible level of activity*** for a patient with the following diagnosis, condition, device or drug? Please select ONE response for each diagnostic group.

Diagnosis, Condition, Device or Drug	**bed rest**	**passive range of motion**	**active range of motion**	**standing**	**transfers to chair**	**ambulation**	**not sure**
Diagnosis/Conditions: a) Head trauma without increased intracranial pressure.							
b) Head trauma with increased intracranial pressure.							
c) Cervical spinal injury.							
d) Thoraco-lumbar spinal injury.							
e) Within 24 hours of treated myocardial infarction (cardiac enzymes persistently elevated).							
f) Within 24 hours of treated myocardial infarction (cardiac enzymes decreasing).							
g) Coagulopathy (INR > 3).							
h) Thrombocytopenia platelet count < 20 x109/L).							
i) Delirium (fluctuating level of consciousness at times inattentive or agitated).							
j) Within 24 hours of uncomplicated coronary bypass surgery.							
k) Deep vein thrombosis (receiving therapeutic anti-coagulation).							

l) Obesity							
m) Frailty.							
Devices n) Pulmonary artery catheter,							
o) Intra-aortic balloon pump.							
p) Femoral central venous catheter.							
q) Radial arterial catheter.							
r) Dialysis line inserted at the subclavian site (during non-dialysis periods).							
s) Dialysis line inserted at the femoral site (during non-dialysis periods).							
t) Continuous renal replacement therapy (during dialysis such as PRISMA).							
u) Extra corporeal membrane oxygenation.							
v) Mechanical ventilation with high frequency oscillation.							
w) Conventional mechanical ventilation with an endotracheal tube.							
x) Conventional mechanical ventilation with a tracheostomy.							
y) Non-invasive positive pressure ventilation (e.g. BiPAP).							
z) Chest tube							
aa) Foley catheter							
Drugs bb) Full anti-coagulation (iv heparin infusion, warfarin)							

7. Consider a patient admitted to your unit who is intubated and mechanically ventilated (unless otherwise stated). What ***maximum level of activity*** would you prescribe for this patient under each of the following independent circumstances? Please select ONE response for each condition.

Physiological Status	**bed rest**	**passive range of motion**	**active range of motion**	**standing**	**transfers to chair**	**ambulation**	**not sure**
Cardiovascular: a) Three or more vasopressors or inotropic infusions.							
b) Two vasopressors or inotropic infusions.							
c) One high dose vasopressor or inotropic infusion.							
d) One medium dose vasopressor or inotropic infusion.							
e) One low dose vasopressor or inotropic infusion.							
f) No vasopressors or inotropes.							
Respiratory g) Minimal pressure support on conventional mode of mechanical ventilation.							
h) Moderate pressure support on conventional mode of mechanical ventilation (e.g., FiO_2 0.5, PEEP 10).							
i) Advanced mode of mechanical ventilation (e.g., high frequency oscillation).							
Neurologic j) Unresponsive to verbal and motor stimulation.							
k) Purposeful motor response, not obeying verbal commands.							
l) Purposeful motor response, obeys verbal commands.							

KNOWLEDGE

2.1 Current Literature

8. Are YOU familiar with any clinical trials or literature evaluating early mobilization of critically ill patients?

a. YES
b. NO

9. What do the clinical studies about early mobilization of critically ill patients (i.e., general medical surgical ICU population) show? Select ALL TRUE responses only.

a. I am not sufficiently familiar with the current literature/clinical studies on early mobilization in the ICU.
b. Early mobilization of critically ill patients can improve their functional independence (i.e., activities of daily living) at hospital discharge.
c. Early mobilization of critically ill patients is associated with reduced mortality at hospital discharge.
d. Early mobilization of critically ill patients is associated with a reduced incidence of delirium.
e. Early mobilization of critically ill patients reduces the incidence of deep vein thrombosis.
f. Early mobilization of critically ill patients reduces their time requiring mechanical ventilation.

2.3 Practical and Technical Skills

10. How well trained and informed do you feel to mobilize mechanically ventilated patients? Please select ONE response only.

a. I feel well trained and informed to mobilize mechanically ventilated patients.
b. I feel somewhat trained and informed to mobilize mechanically ventilated patients.
c. I do not feel sufficiently trained or informed to mobilize mechanically ventilated patients.

PRACTICE

3.1 Assessment for Need of Rehabilitation

11. Are all patients automatically assessed for appropriateness to begin mobilization by the physiotherapist in YOUR unit without prompting or requests by other clinician groups?

a. YES
b. NO
c. UNSURE

12. Who is generally the first health care provider to identify if a patient is ready for mobilization? Please select ONE response only.

a. Registered nurse.
b. Physician.
c. Physiotherapist.
d. occupational therapist.
e. Respiratory therapist.
f. Other, please specify.

13. Does the initial physiotherapist assessment on each patient require a written medical order by a physician?

a. Technically, YES
b. NO
c. UNSURE.

14. Does YOUR unit have written protocols or policies that provide guidelines on when a patient should begin mobilization?

a. YES
b. NO.
c. UNSURE

3.2 Intensity & Frequency of Mobilization

15. On average, what is the daily duration of mobilization performed by physiotherapists in YOUR unit on the following types of critically ill patients?

Condition	**none**	**<15 min**	**16-30 min**	**31-45 min**	**46-60 min**	**>60 min**	**unsure**
a) A patient who is intubated, mechanically ventilated, deeply sedated and unconscious.							
b) A patient who is intubated, mechanically ventilated, inattentive and uncooperative.							
c) A patient who is intubated, mechanically ventilated, alert, interactive and cooperative but cannot ambulate yet.							
d) A patient who is intubated, mechanically ventilated, alert, interactive/cooperative and can ambulate.							

16. How frequently is mobilization performed by a physiotherapist in YOUR unit on the following types of critically ill patients?

Condition	**none**	**<1/wk**	**1-2/wk**	**3-4/wk**	**5-6/wk**	**once daily**	**twice daily**	**>twice daily**	**Unsure**
a) A patient who is intubated, mechanically ventilated, deeply									

sedated and unconscious.									
b) A patient who is intubated, mechanically ventilated, inattentive and uncooperative.									
c) A patient who is intubated, mechanically ventilated, alert, interactive and co-operative but cannot ambulate yet.									
d) A patient who is intubated, mechanically ventilated, alert, interactive/cooperative and can ambulate.									

Staffing in the ICU/PCCU

17. Who participates in the mobilization of patients in YOUR unit? Please select ALL that apply.

a. Registered nurse.
b. Physician.
c. Physiotherapist.
d. Occupational therapist.
e. Respiratory therapist.
f. Health care aide (i.e. physical therapy assistant, nurse aide etc).
g. Family member or home caregiver.
h. Other, please specify.

18. Is there a designated physiotherapist working in YOUR unit during the following times?

Time	**Available for full assessments & mobilization**	**Available for limited assessments & mobilization**	**Available only for cardiorespiratory/ chest physiotherapy**	**Not available**	**Unsure**
Regular weekday hours (Monday - Friday)					
Weekday evenings (after 17:00, Monday to Friday)					
Weekends (Saturday,					

Sunday) & holidays					

3.4 Types of Physiotherapy Techniques Performed

19. In general, how often are these physiotherapy techniques used in patients who are eligible/suitable for rehabilitation? Please select only ONE answer for each type of treatment

.

Type of physiotherapy	**Never**	**Infrequently**	**Sometimes**	**Frequently**	**Routinely**	**Unsure**
a) Chest physiotherapy						
b) Passive range of motion						
c) Active range of motion						
d) Strengthening exercises						
e) Bed mobility						
f) Transferring patients from bed to chair						
g) Pre-gait activities						
h) Gait training/ambulation						
i) Treadmill						
j) Neuromuscular electrical stimulation						
k) Cycle ergometer						
l) Dynamic tilt table						

3.5 Workload of the Physiotherapist (Only for Physiotherapist)

20. Please answer the following questions about YOUR workload in the ICU:

a) On average, how many ICU patients do you see each per day? _____

b) On average, how many hospital patients (including ICU) do you see per day? _____

c) Do you work full time or part time in the ICU? □ full time □ part time

d) What is the duration of your shift? _____ hours.

3.6 Sedation Practices

21. Are daily interruption of sedation or sedation protocols used in YOUR ICU/PCCU?

□ Routinely □ Frequently □ Sometimes □ Infrequently □ Never □ Unsure.

22. Do YOU use standardized sedation scales to titrate sedation, according to patient activity level?

□ Routinely □ Frequently □ Sometimes □ Infrequently □ Never □ Unsure.

5.1 Clinician Demographics

23. What type of clinician are you?

a. Physiotherapist.
b. Physician.
c. Registered Nurse.
d. Respiratory Therapist.
e. Clinical Nurse Specialist.
f. Nurse Manager.
g. Clinical Educator.
h. Nursing Leader.

24. What is your primary area of practice?

a. Intensive Care Unit.
b. Neurosurgery Intensive Care Unit.
c. Respiratory Care Unit.

25. What is the level of education you have completed?

a. Bachelor's degree
b. Master's degree
c. Professional degree
d. Doctorate degree

26. How many years of experience?

a. 1-5 years
b. 6-10 years
c. 11-15 years
d. 16-20 years
e. 21 and above years

Thank You for Taking The Time To Participate In This Survey