The development of a clinical management algorithm for early physical activity and mobilization of critically ill patients: synthesis of evidence and expert opinion and its translation into practice

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Abstract

Objective: To facilitate knowledge synthesis and implementation of evidence supporting early physical activity and mobilization of adult patients in the intensive care unit and its translation into practice, we developed an evidence-based clinical management algorithm.

Methods: Twenty-eight draft algorithm statements extracted from the extant literature by the primary research team were verified and rated by scientist clinicians ($n = 7$) in an electronic three round Delphi process. Algorithm statements which reached *a priori* defined consensus – semi-interquartile range <0.5 – were collated into the algorithm.

Results: The draft algorithm statements were edited and six additional statements were formulated. The 34 statements related to assessment and treatment were grouped into three categories. Category A included statements for unconscious critically ill patients; Category B included statements for stable and cooperative critically ill patients, and Category C included statements related to stable patients with prolonged critical illness. While panellists reached consensus on the ratings of 94% (32/34) of the algorithm statements, only 50% (17/34) of the statements were rated essential.

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Conclusion: The evidence-based clinical management algorithm developed through an established Delphi process of consensus by an international inter-professional panel provides the clinician with a synthesis of current evidence and clinical expert opinion. This framework can be used to facilitate clinical decision making within the context of a given patient. The next step is to determine the clinical utility of this working algorithm.

Keywords

Physiotherapy, rehabilitation, ICU, Delphi, critical care

Introduction

The early mobilization of critically ill adult patients is a relatively new management approach advocated to address respiratory failure[1] and limit the disability associated with intensive care unit (ICU) acquired weakness.[2–4] This therapeutic approach has been reported in clinical studies[5–7] and has been recommended by the European Respiratory Society and European Society of Intensive Care Medicine Task Force on Physiotherapy for Critically Ill Patients.[8] While the detrimental physiological effects of recumbency and restricted mobility on organ systems in typically healthy subjects have been widely reported for many years,[9–13] issues related to the use of early mobilization of critically ill patients as a therapeutic option have only recently been a shared focus of interest to interprofessional teams practising in the ICU.[1,2,5,6,14].

The majority of physiotherapists surveyed in Australia,[15] South Africa[16] and the UK[17] offer some form of rehabilitation in the ICU, while physiotherapists in the USA[18] reported greater involvement during the recovery from critical illness. Apparently underutilized, only 10% of Australian responders reported that exercise therapy is indicated for all critically ill patients who are physiologically stable and have no contra-indications. A survey by Skinner and colleagues[15] reported that the decision to mobilize a patient in the ICU was predominately made by physiotherapists. However, large variations were noted in the safety criteria used to initiate and monitor exercise as well as in the dosage of therapy reported by physiotherapists.[15]

Clinical decisions about patient management incorporate a range of factors, although a necessary element should be the evidence available, albeit limited.[19] To address uncertainties among clinicians about early mobilization, we previously conducted a systematic review of the literature.[20] Although our findings illustrated that evidence to support the use of early mobilization in critically ill patients is emerging, the published reports lacked details about the clinical decision-making factors to be considered by clinicians when mobilizing a patient. This lack of practical information to inform clinical decision making may be a barrier to the use of early mobilization as a therapeutic option in this population. The inconsistent and variable implementation strategies which have been reported for early mobilization, support this reasoning.[2,15,21–24] Variations in practice may reflect a paucity of research and challenges in translating and implementing evidence into clinical practice.[19]

The formulation of evidence-based clinical guidelines and/or best practice recommendations has been proposed as a means of facilitating clinical decision making.[8,14,19,25–27] An algorithm developed by a group of recognized experts who appraise and contextualize evidence in the field constitutes one means of facilitating the translation of best practice recommendations into clinical practice potentially making the uptake of evidence by practitioners more compelling.[5,28] The reported cost-effectiveness of using practice guidelines in the ICU lends further support for developing an evidence-based clinical management algorithm with respect to mobilizing patients in the ICU, the most expensive care setting.[29,30]

The problem of limited evidence is not unique to the field of critical care. In recent years, Delphi expert panels have been used in medical fields to help develop best practice recommendations when only limited or equivocal evidence is available.[31–33] This approach is less commonly applied in critical care, but it could be a pragmatic method to support clinical decision making, particularly related to new advances in critical care interventions. Furthermore, the methodology provides the tools to incorporate clinical expertise in the clinical decision-making process, specifically in grey areas of clinical practice.[34] The importance of clinical expertise in evidence-based practice is widely recognised.[34,35]

This work forms part of a larger project in which a comprehensive evidence-based framework consisting of five clinical management algorithms for the physiotherapeutic management of patients in ICU was developed through a process of evidence synthesis and Delphi consensus. The aim of which was to facilitate evidence-based clinical decision making of physiotherapists in the ICU and determine the effect on patient outcome.[20,36] The purpose of this paper is to report on the development of an evidence-based clinical management algorithm to facilitate knowledge synthesis, translation and implementation with respect to early physical activity and mobilization of critically ill patients.

Methods

Ethical approval was provided by the ethics committee of Stellenbosch University and participants provided informed consent. The study entailed a three-round Delphi process to formulate and rate the importance of draft algorithm statements. A systematic review of the literature was conducted to answer the specific PICO (population; intervention; comparison; outcome) question: Is it safe and effective to mobilize/exercise intubated and ventilated adult patients in the ICU? (safe = no harmful outcomes, effective = improved function; functional capacity; length of stay; time on ventilator; muscle strength). The search was limited to English language papers reporting on the adult population. Grey literature was not consulted. Experimental and observational studies were considered. Six electronic databases were searched, including Pubmed, CINAHL, Web of Science, PEDRO, Cochrane, Science direct and TRIP. Manual searching through the contents of the *South African Journal of Critical Care* (SAJCC) and the *South African Journal of Physiotherapy* (SAJP) was also done. Two critical appraisal tools were used to appraise the methodology of the eligible papers. Systematic review methodology and findings are available at www0.sun.ac.za/Physiotherapy_ICU_algorithm.

Based on the systematic review findings the primary research team (SH;QL) drafted five best practice recommendations based on the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) formulation.[28,37] Based on data extracted from the identified studies, 28 draft algorithm statements were formulated and grouped into three categories. Category A included statements related to assessment and treatment of unconscious critically ill patients who are unable to initiate activity; Category B included statements on assessment and treatment of stable and cooperative critically ill patients, who are able to initiate activity; and Category C included statements related to stable patients with prolonged critical illness.

Selection of rehabilitation subgroup Delphi panellists

Potential panellists were identified during the systematic review process used in the development of a comprehensive evidence-based framework for the physiotherapeutic management of patients in ICU. Scientist clinicians were eligible to participate in the rehabilitation subpanel if 1) they had published predominately in the area of rehabilitation and if 2) the papers were indexed in Medline, CINAHL, Web of Science, PEDro, Science Direct, Cochrane, TRIP or published in the SAJP or SAJCC. Researchers were excluded if they were not electronically contactable or declined the invitation (Figure 1).

Instrumentation

An interactive website linked to a password-protected database was developed to distribute information and collate responses from the Delphi panel. The website contained the draft best practice recommendations, algorithm statements and evidence synthesis reports. The functionality of the database changed in relation to the specific round of the three-round Delphi process (Figure 2).

Delphi study procedure

Each round lasted two weeks. During this time, panellists had unlimited access to the database and an opportunity to add anonymous text comments. Following each round, a summary of responses not registered on the database was communicated electronically to individual panellists by the principal investigator (SH) to provide an opportunity to complete responses.

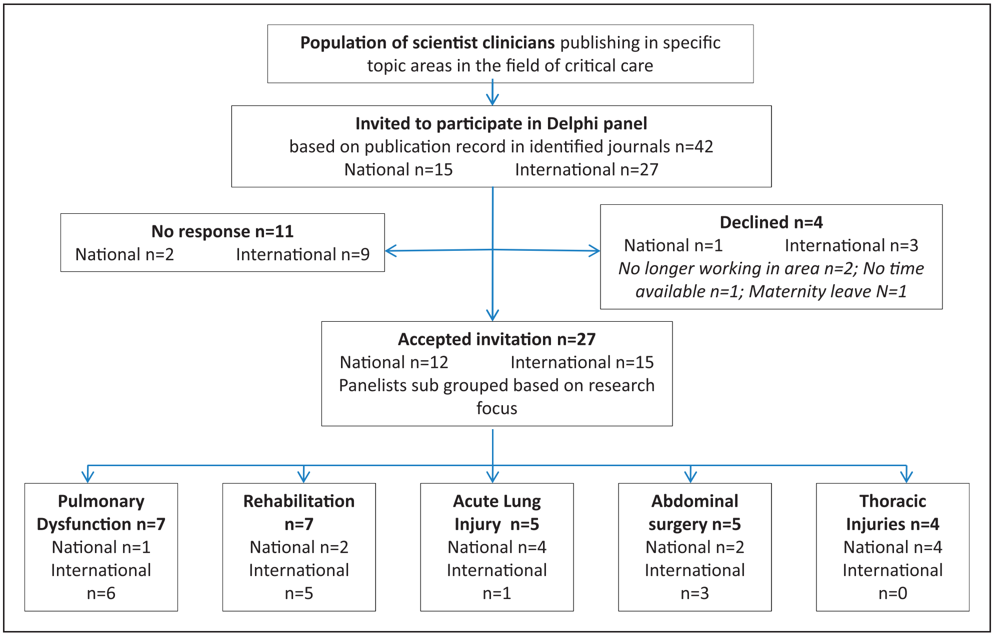

Figure 1. Flowchart of Delphi panel allocation.

This individual communication was concerned with logistical issues and not related to content.

Data analysis

The median rating and the semi-interquartile range (SIQR) were calculated for each algorithm statement. Consensus on the algorithm statements was defined *a priori* as a SIQR < 0.5.

Formulation of the final evidence-based clinical management algorithm

Statements which reached consensus were collated into an algorithm using descriptors based on the median rating. This resulted in a hierarchy of ratings. No statements were discarded based on importance.

Results

Ten of the 42 potential panellists identified during the systematic review process had published predominately in the area of rehabilitation and were thus invited to partake in the rehabilitation subgroup. Seven panellists accepted and were allocated to this sub-panel (Figure 1). The profiles of the panellists are summarized in Table 1.

The three rounds of the Delphi process were completed online between May and August 2008. A 100% response rate was achieved in rounds one and three. Due to technical difficulty, one panellist was unable to complete all responses in round two.

During the verification process used in round one, the 28 draft algorithm statements were edited,

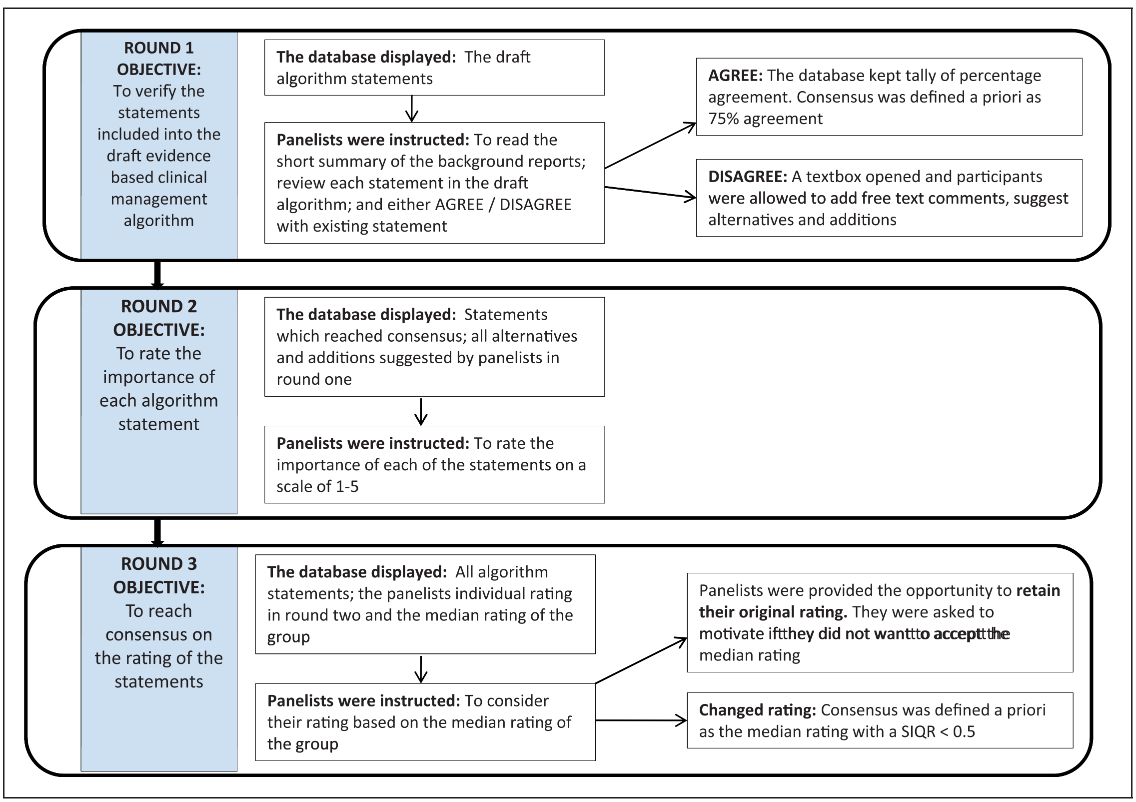

Figure 2. Verification and rating of the algorithm statements.

Table 1. Profiles of the panellists who participated in the rehabilitation Delphi sub-panel

Country	Qualification	Number of years of clinical experience	No. of publications in field *number of publications Indexed in medline *n*=
Australia	Physiotherapist (PhD)	25	10 *25
Belgium	Physiotherapist (PhD)	30	10 *74
Canada	Physiotherapist (PhD)	30	20 *19
Italy	Intensivist (PhD)	37	15 *171
USA	Registered nurse and psychologist (PhD)	20	3 *57
South Africa	Physiotherapist (PhD)	16	8 *1
South Africa	Physiotherapist (MSc)	12	3

removed or additional statements formulated, resulting in a total of 34 algorithm statements. None of the statements was rated as either unimportant or detrimental. The verification process was used to reformulate and add additional information as indicated (Electronic supplement E1).

In Category A (unconscious patients), three new statements were added and the original four statements were edited. Editing was confined to sentence structure, for example, the original statement 'Two hourly change of position supine – quarter turn' was changed to 'Regular change of position: with the aim of two hourly changes in position'. Two of the three additional statements addressed the themes of inter-professional consultation and individual patient assessment. The panellists reached consensus on the rating of all seven statements, rating the majority of the statements essential 43% (3/7) or very important 43% (3/7). While the assessment of cardiovascular reserve before initiating activity was rated essential, inter-professional team discussions regarding sedation and implementation strategies were rated very important by the panel. Semi-recumbent positioning and regular position change were rated essential activities to include in the management of this group of patients, while the inclusion of daily passive movements was rated very important. (Refer to Electronic supplement E2 for completed algorithm.)

In Category B (physiologically stable patients), six new statements were added and six draft statements were edited. The draft statements were revised based on editorial comments to improve the sentence structure. For example, the original statement 'During all activities, ensure $SpO_2 > 90\%$' was revised to 'Maintain sufficient oxygenation ($SpO_2 > 94\%$) during all activity (can increase FiO_2)'. Three of the six added statements referred to the importance of an individual patient-centered programme. The panellists reached consensus on the rating of 17/19 statements after the third round. The majority of the statements (79 % (15/19)) was rated either essential (53% (10/19)) or very important (26% (5/19)). Panellists agreed that it was essential that there be congruency between the following four aspects when deciding to initiate early activity for Category B patients. This included 1) physiological stability (cardiovascular and pulmonary reserve) 2) practical considerations, e.g. the identification of existing precautions which could restrict mobility e.g. fractures, patient size, 3) inter-professional team discussions, and 4) clearly documented functional goals determined in consultation with the patient. Panellists were unable to agree on the ratings of two statements. This included the evaluation of arrhythmias and a patient's physical appearance during activities. (Refer to Electronic supplement E3 for completed algorithm.)

In Category C (deconditioned patients), no statements were added but six statements were revised based on editorial comments pertaining to the structure of the statements. The panellists reached consensus on the rating of all eight statements after the third round, with the majority of the statements (75%) being rated as essential (50% (4/8)) or very important (25% (2/8)). Panellists agreed that it was essential for patients to reach medical stability (controlled sepsis, haemorrhage and arrhythmias) before the implementation of an exercise programme. This exercise programme should target the trunk and extremities and focus on strengthening and endurance. The panel agreed that it was essential to offer this programme daily. (Refer to Electronic supplement E4 for completed algorithm.)

Discussion

This paper reports on the development of the first evidence-based clinical management algorithm for the mobilization of adult patients in the ICU. The statements rated essential by the panel highlighted the importance of including a mobilization plan for every patient admitted to an ICU. In addition the importance of individual patient assessment, clinician's judgement and inter-professional consultation in the decision-making process was emphasized. Through the consensus rating of the remaining statements ranging from desirable to very important, the panellists strived to provide a rating hierarchy of issues for clinicians to consider when making this judgement. This validated framework could be useful in clinical practice to identify patients' readiness for being mobilized, thereby implementing patient- or physiotherapist-initiated activities in a timely fashion. This could in turn systemize pathways to guide clinical decision making.[8]

Some panellists questioned the applicability of the reductionist model of analysis for the management of patients with complex conditions such as in the ICU. Patients in the ICU who are typically managed by physiotherapists present with complex co-morbidities which may directly or indirectly threaten or impair oxygen transport. Because of the potential for such heterogeneity in presentation, patients require a range of medications and medical support. Thus, patients in the ICU require detailed comprehensive organ system assessment and ongoing evaluation in order to develop patient prescriptive parameters. While recognizing this reality, panellists acknowledged that by providing physiotherapists with criteria for mobilizing ICU patients, the barriers to mobilization may be removed, thereby facilitating the exploitation of this powerful intervention.[1] Evident from the consensus reached, these view points were reconciled. The panellists concurred that while individual clinical judgement is essential, there is a role for a framework to guide such decision making. However, the progression of the patient needs to be response dependent versus protocol dependent.

The importance given to the development of a mobilization plan for each patient admitted to an ICU could prioritize the use of mobilization and physical activity as a therapeutic option.[15,21,23] This plan would ensure a daily screening of all patients and allow for the early identification of patients who are sufficiently haemodynamically stable to warrant being mobilized.[1,5,38] This has the potential for physiotherapists to include early mobilization for all patients in the ICU[1,2,38] rather than reserve this therapeutic option as an additional management option for specific patients.[15,17] Panellists agreed that after the initial medical stabilization of the patient, the goal in the management of all patients in the ICU is the timely progression to active mobilization and eventual participation within a patient's state of rouse ability.[2] Therefore, discussion between the physiotherapist and inter-professional team members was encouraged with respect to a range of issues including the effect of medication on a patient's ability to respond to verbal commands and the need for reduced but effective sedation.[2] While the initiation of mobilization could be experienced as an uncomfortable procedure, early rehabilitation has been linked to improved emotional wellbeing following the ICU stay.[39] Thus, balancing the prescription of mobilization and analgesia needs to be examined further. Auto-sedation and relaxation could have a major role in minimizing anxiety and physical discomfort for patients in the ICU. This could be a novel area of physiotherapy research.

Despite the scarcity of studies, the panellists agreed on the rating of core activities included for Category A (unconscious) patients. This includes the use of semi-recumbent positioning with the goal of 45° head off the bed up and higher[8,40,41]; regular position changes beyond the standard every two-hour turning regimen;[42] daily passive movement of all joints,[1–3,43] (passive) bed cycling[3] and electrical stimulation as indicated.[44,45] The additive and multiplicative effects of these interventions need to be evaluated further. The panellists agreed that it is safe to mobilize patients in Category B (physiological stable) if screened beforehand.[1,5,38,46,47] Patients mobilized in the ICU based on specific criteria have been reported to remain haemodynamically stable with few instances of adverse events.[5,38,46] None of these adverse events has been reported to result in increased mortality, length of stay, or additional cost.[5,38,46] The addition of targeted exercise to an ambulation programme for patients in Category C (deconditioned) has been reported to increase muscle strength,[48] functional activity[49] and exercise tolerance.[50] The panellists concurred that for patients who were unable to be actively mobilized within five days of admission to the ICU, a targeted strengthening programme should be added to a standardised ambulation program. The frequency and length of these exercise sessions should be informed by the best possible conditioning effect within the margins of the patient's tolerance for exercise and safety. Despite the recommendation, panellists were not convinced that these additional exercise sessions, over and above mobilization alone, constitute a cost-effective strategy for all patients admitted to an ICU. The added value of these interventions to patient outcome warrants investigation. The identification of which patients would benefit most from additional interventions is also warranted.

Studies in the literature use a variety of terms to describe physical activity and exercise related to the critically ill patient population including activity, mobility, movement, mobilization and exercise. Although the terminology used in this paper is defined within the context of each statement, there is a need to define terms within the context of critical care. With advances in developing principles of practice for mobilizing critically ill patients, we recommend the formation of an international taskforce to standardize terms and language.

Limitations in the process of algorithm development need to be considered. First, decisions made regarding the compilation of this Delphi panel could limit the external validity of the algorithm.[51] The decision to limit the panel to scientist clinicians in this field, however, was deliberate because it was expected that these scientist clinicians would be well informed about the clinical decision-making factors pertaining to early mobilization.[52,53] We recognize that this decision necessarily implies the potential of a vested discipline specific interest in the use of mobilization in the ICU. Early mobilization in the ICU is a new focus of research in critical care, with a limited number of scientist clinicians publishing in this field. This could explain the small number of scientist clinicians who qualified for participation on this Delphi panel. Finally, the sample was limited to scientist clinicians with a track record in the specific subject area. New scientist clinicians in this specific area of interest were therefore not included. These decisions are in line with current recommendations for Delphi panel composition.[51,52] Despite these concerns, the results of this Delphi process are supported by recent data from randomized controlled trials unavailable at the time of this study.[1,2]

Conclusion

Based on a synthesis of the extant literature contextualized to clinical practice, the international panel who participated in this Delphi study concluded that an individual mobilization plan must be developed for each patient admitted to an ICU. Given the unequivocal strength of the physiologic knowledge base supporting being upright and moving, and progressive exercise to achieve optimal functional capacity and life participation, we make a case for these being foundation pillars of physiotherapy management in the ICU. The important questions that need to be addressed and refined are how we can better titrate these interventions safely and therapeutically to achieve the optimal outcomes for a given patient. A working algorithm provides a basis for translating knowledge into the practice of mobilizing patients in the ICU. This tool has the potential to reduce practice variability; maximize safety and treatment outcome; provide a benchmark and baseline for further refinement of the practice of early activity and mobilizing patients over time; and inform future studies in the field.

The evidence-based clinical management algorithm developed through an established Delphi process of consensus by an international inter-professional panel is the first of its kind. It provides the clinician with a synthesis of current evidence and clinical expert opinion, and a framework to augment clinical decision making in the context of a given patient. The next step is to determine the clinical utility of this working algorithm.

Clinical messages

- A patient-specific mobilization plan must be developed for each patient admitted to an ICU. The goal of this plan is the timely implementation of early patient-initiated activity.
- This plan must be developed in consultation with inter-professional team members, the patient and/or family, and include clear objectives and measurable outcomes.

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Competing interests

None.

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Appendix E1. Process of reaching consensus on the algorithm statements for three patient categories (unconscious, and conscious conditioned or deconditioned)

CATEGORY A: Unconscious patients unable to initiate activity			
ROUND 1 **DRAFT ALGORITHM STATEMENTS**	**ROUND 2** **REVISED STATEMENTS AFTER VERIFICATION IN ROUND 1**	**RATING ROUND 2** MEDIAN (SIQR) *n*=6	**RATING ROUND 3** MEDIAN (SIQR) *n*=7
1. Use the following criteria to determine that the patient has sufficient cardiovascular reserve before positioning, changing position or performing passive movements: • Mean arterial pressure (MAP) > 60 mm Hg • No new cardiac arrhythmias visible on electrocardiogram (ECG) • Heart rate (HR) < 75% age predicted maximum • Low dose inotropic support: Dopamine <10mcg/kg/min;[41,46] Nor/adrenaline<01mcg/kg/min {{281 Stiller, K. 2004; 61 Thomas,P.J. 2006}}	1. Use the following criteria to determine that the patient has sufficient cardiovascular reserve before including any of Category A activities: • less than 20% variability in blood pressure (BP) • no new cardiac arrhythmias visible on ECG • HR < 75% age predicted maximum (APM) at rest • patient is on low dose inotrope support: Dopamine < 10 mcg/kg/min; Nor/adrenaline < 01 mcg/kg/min • sufficient oxygenation (SaO_2 > 90%) can be maintained	1 (0.38) *	1 (0.00) *
2. Nurse the patient in 30-45^{o} head up position (supine)[40]	2. Semi-recumbent positioning of at least 30 degrees head up with the goal of reaching a 45 degree head up position	1 (1.25)	1 (0.25) *
3. Two hourly change of position supine – quarter turn[41,42,54]	3. Regular change of position: with the aim of two hourly changes in position.	1 (1.25)	1 (0.0) *
4. Passive movement of upper and lower extremities once daily through full range	4. Passive movements of the upper and lower extremity joints. Five repetitions of all physiological movements completed once daily	2 (0.88)	2 (0.0) *
	5. Initiate discussions with inter professional team members with regard to medication affecting patient consciousness (including sedation) with the goal of ensuring patient is alert and awake as soon as possible	2 (0.5)	2 (0.0)*
	6. Discuss the potential benefits of implementing the core elements (positioning, regular position change and passive movements) compared to the possible compromise of the cardiovascular, renal, neurological and pulmonary systems with the inter-professional team and document patient specific parameters.	2 (0.38) *	2 (0.00) *
	7. If the equipment is available include neuromuscular electrical stimulation to target the muscles	3 (0.38) *	3 (0.25) *
CATEGORY B: Physiologically stable patients able to initiate activity			
Factors to consider before initiation of active mobilization Neurological contra indications?; Orthopaedic contra indications?;	8. Before evaluating a patient's respiratory, haemodynamic or cardiovascular reserve to initiate early activity consider the	1 (0.0) *	1 (0.0) *
Recent split skin graft ?	presence of any surgical intervention (e.g. recent split skin graft; neurological or orthopaedic condition that could restrict activity		
Environmental factors to consider: Patient size and help available; Length and placement of lines/attachments; Patient consent.	9. Before evaluating a patient's respiratory, hemodynamic or cardiovascular reserve to initiate early activity consider and address the following environmental factors: Patient size and help available; length and placement of lines/attachments and patient consent.	1 (0.0) *	1 (0.0) *
During all activities ensure SpO_2 > 90%	10. Maintain sufficient oxygenation (SpO_2 > 94%) during all activity (can increase FiO_2)	1 (0.00)*	1 (0.0) *

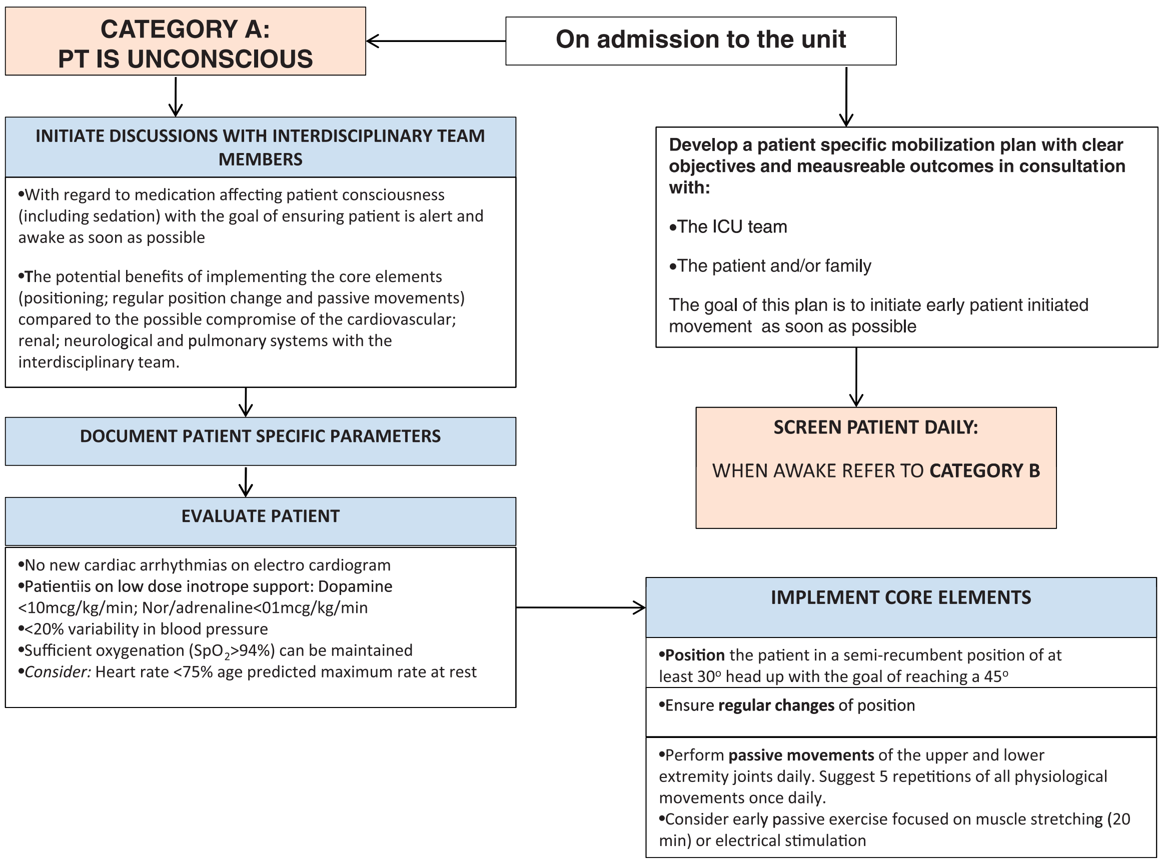
During all activities monitor heart rate to maximum of 75% of age predicted maximum	11. Ensure an appropriate incremental increase in HR during all activities	2 (0.38) *	2 (0.25) *
During all activities monitor the presence of arrhythmias on ECG	12. Monitor for the presence of increasing ectopic beats; arrhythmias during activities	3 (1.13)	3 (1)
Monitor the patient's physical appearance: conscious state, respiratory pattern, pallor, flushing, sweating, clamminess, cyanosis, visible or patient reported signs of pain, discomfort or fatigue during all activities	13. Monitor the patient's physical appearance: conscious state, respiratory pattern, pallor, flushing, sweating, clamminess, cyanosis, visible or patient reported signs of pain, discomfort or fatigue during all activities	3 (1.25)	3 (0.5)
Before initiating early mobilization ensure that: Haemoglobin (Hgb) >7gm/dl Platelet count 20,000 cells/m^3 White cell count 4300–10800 cells/m^3 Temperature <38°C >36°C Blood glucose 3.5–20 mmol/L	14. Before initiating early mobilization ensure that: Hgb >8.5 gm/dl Platelet count >30,000 cells/m^3 White cell count 4300–10800 cells/m^3 Temperature < 38.5 > 36°C Blood glucose 3.5–20 mmol/L	2 (0.5)	2 (0.0) *
Before initiating early mobilization determine cardiovascular reserve: Resting HR < 50% age predicted maximum BP less than 20% variability ECG normal (no arrhythmias) Major cardiac pathologies excluded[46] Absence of orthostatic hypotension and catecholamine drips	15. Before initiating early mobilization determine cardiovascular reserve: Resting HR < 50% age predicted maximum BP less than 20% variability ECG normal (no arrhythmias) Major cardiac pathologies excluded Absence of orthostatic hypotension and catecholamine drips	2 (0.5)	2 (0.0) *
Before initiating early mobilization determine pulmonary reserve: PaO_2 :FiO_2 > 300 SpO_2 >90% variations less than 4% Satisfactory respiratory pattern Able to maintain adequate respiratory support [9] FiO_2 < 0.6 PEEP < 10 cm H_2O	16. Before initiating early mobilization determine pulmonary reserve: PaO_2 :FiO_2 > 300 SpO_2 > 90 variations less than 4% Satisfactory respiratory pattern Able to maintain adequate respiratory support FiO_2 < 0.6 PEEP < 10 cmH_2O	1 (0.0) *	1 (0.25) *
Mobilization activities include moving from: lying to sitting on the edge of the bed	17. Mobilization activities include progressing from: lying to sitting on the edge of the bed	1 (0.0) *	1 (0.0) *
sitting to standing a standing transfer from the edge of the bed to a chair walking with assistance walking independently[5,46]	sitting to standing a standing transfer from the edge of the bed to a chair walking with assistance walking independently climbing stairs		
Progress the activities with goal of walking 100 m before discharge[5]	18. Progression of early activity should be guided by patient's tolerance, but with the goal of walking at least 100 m on discharge from the unit	3 (0.5)	3 (0.0) *
If patient is unable to mobilize out of bed the inclusion of arm exercises (both strengthening and endurance) into a mobility regime is safe and could potentially facilitate weaning[55,56]	19. If patient is unable to mobilize out of bed include arm exercises (both strengthening and endurance) into early activity	3 (0.63)	3 (0.0) *
Temporarily adjust FiO_2 if patient desaturates[5,46]	20. Maintain sufficient oxygenation (SpO_2 > 94%) during all activity (can increase FiO_2)	1 (0.00)*	1 (0.0) *

(continued)

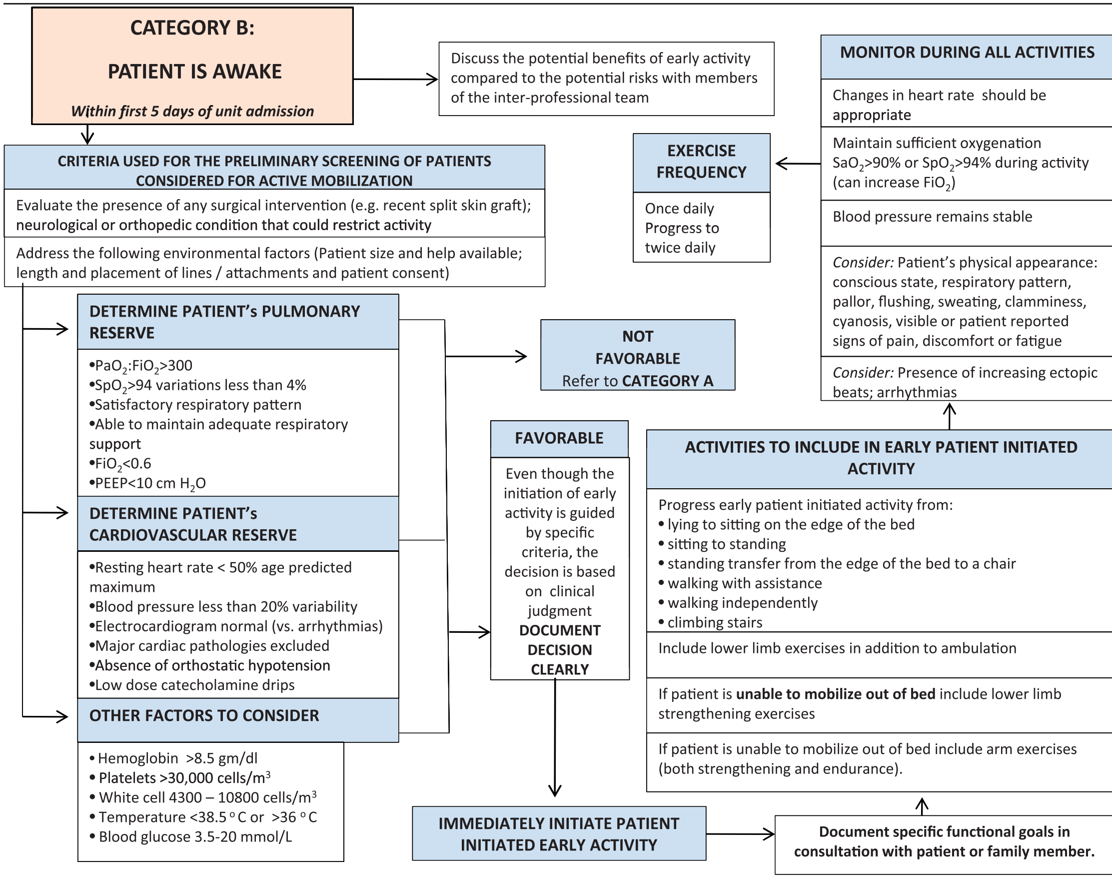
Appendix E1. Continued.

Ensure a dyspnea rating of 13 on modified borg scale	*Remove from algorithm because it is too specific*		
Allocate patients to groups before developing mobility plans GROUP 1: Is not intubated or has been intubated less than 14 days[5,46]	*Formulate as recommendation 3: remove from algorithm*		
Group patients before developing mobility plans GROUP 2: Has been intubated more than 14 days [48-50,55,56]	*Formulate as recommendation 3: remove from algorithm*		
	21. Discuss the potential benefits of early activity compared to the potential risks of any of the criteria with members of the interprofessional team	1 (0.38) *	1 (0.0) *
	22. Even though the initiation of early activity is guided by specific criteria the decision is based on the clinical judgment of the therapist. This decision should be sufficiently documented	1 (0.0) *	1 (0.0) *
	23. Document specific functional goals with regards to mobility in consultation with each patient	1 (0.0) *	1 (0.0) *
	24. If a patient is unable to mobilize out of bed include lower limb strengthening exercises	2 (0.38) *	2 (0.38) *
	25. Include lower limb exercises in addition to ambulation	2 (0.0) *	2 (0.0) *
	26. Monitor that blood pressure remains stable during all activities	1 (0.00) *	1 (0.0) *
CATEGORY C: Physiologically stable patients; deconditioned due to a prolonged period of inactivity			
Duration of exercise session at least 30 min progress to 45 min daily[49,50]	27. Exercise frequency should be at least daily; progressing to two sessions per day	2 (0.5)	2 (0.0) *
to daily mobilization program initiate specific exercise programme[4,13,48]	28. In patients deconditioned due to a prolonged period of immobility caused by physiological instability, initiate a targeted exercise program in addition to ambulation	1 (0.0) *	1 (0.0) *
Incorporate trunk and arms (pectoralis major)[49,50,57]	29. Target the muscles of the trunk, upper and lower limb for strengthening and endurance training	1 (0.5)	1 (0.0) *
Program should include both strengthening and endurance component[44,55,56]	30. Muscle training should include low resistance multiple repetitions (3 sets of 8–10 repetitions at 50–70% of 1 repetition maximum)	3 (0.5)	3 (0.0) *
Exercise at intensity of at least 11 on Borg scale progressing to 13 by week 6[49,50]	31. Exercise intensity should be between 11 and 13 on the Borg Rating of Perceived Exertion scale	3 (1.0)	3 (0.0) *
Temporarily adjust FiO_2 if patient desaturates[5,46]	32. Maintain sufficient oxygenation (SpO_2 > 94%) during all activity (can increase FiO_2)	1 (0.00)*	1 (0.0) *
Before initiating exercise program determine medical stability Sepsis controlled No uncontrolled haemorrhage No uncontrolled arrhythmias, heart failure, or unstable angina Secure parenteral line	33. Before initiating exercise program determine the medical stability Sepsis controlled No uncontrolled haemorrhage No uncontrolled arrhythmias, heart failure or unstable angina Secure parenteral line	1 (0.0) *	1 (0.0) *
Before initiating exercise program determine pulmonary stability Airway: Tracheostomy for invasive ventilation. Minimal aspiration Secretions: manageable with infrequent suctioning Oxygen: adequate oxygenation with $FiO_2 < 0.5$, PEEP < 5 cm H_2 O, SpO_2 > 92% Ventilator settings: stable, no sophisticated modes Patient assessment: comfortable, no increased WOB or dyspnoea	34. Before initiating exercise program determine pulmonary stability Stable and secure airway Minimal aspiration Secretions: manageable with infrequent suctioning Oxygen: adequate oxygenation with $FiO_2 < 0.5$, PEEP ≤ 5 cm H_2 O, SpO_2 > 90% Ventilator settings: stable, no sophisticated modes Patient assessment: comfortable, no increased work of breathing or dyspnoea	2 (0.0) *	2 (0.25) *
LEGEND: * Priori defined consensus Underlined text: Edited statements			

Appendix E2. Clinical management algorithm for Category A (unconscious patients)



Appendix E3. Clinical management algorithm for Category B (physiologically stable patients)



Appendix E4. Clinical management algorithm for Category C (deconditioned patients)