Mobility Practices, Attitudes and Perceptions of Nurses, Doctors and Physiotherapists Regarding Early Mobilisation of Critically Ill Patients in Intensive Care Units in Namibia. A Retrospective Record Review and Cross-sectional Survey

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Declaration

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Abstract

Background: The main focus of care in intensive care units (ICU) has historically been on preventing mortality. With advancing knowledge and technology, more patients now survive their ICU stay. Therefore, critical care priorities have recently shifted to preventing critical illness related morbidities, including ICU-acquired weakness (ICUAW) and delirium, in order to optimise functional, psychosocial, cognitive, and quality of life outcomes for survivors of critical illness and their families. Early mobilisation and ICU-based rehabilitation are recommended interventions to achieve these clinical objectives. There are no published studies describing early mobilisation practice in Namibia.

Aims: This study aimed to describe the profile of patients admitted to two private intensive care units in Windhoek, Namibia, and to describe practices, attitudes and perceptions of nurses, doctors, and physiotherapists regarding early mobilisation of critically ill patients in those ICUs.

Methodology: A retrospective, descriptive record review was conducted to describe the ICU patient profile and documented mobility practice. Charts of 870 patients admitted between 01 January 2016 and 31 December 2016 to two private Windhoek ICUs were included in the record review.

A descriptive, cross-sectional, self-administered survey was used to assess knowledge of ICUAW and early mobilisation, reported mobility practice, personal views on early mobilisation, perceived contraindications/precautions to early mobility, the perceived barriers to the provision of early mobility, perceived permissible activity levels based on patient physiological status, and sedation practices. A total 39 nurses, doctors, and physiotherapists were included in the survey.

Results: *Record Review:* 538 (61.8%) patients were male. Mean age was 56 (SD 14.9, range 18-90) years. Most admissions were elective (n=577; 66.3%). Coronary angiogram (n=179; 20.6%), cardiac conditions (n=113; 13%) and cardiac surgery (n=90; 10.3%) were the main admission diagnoses. Most patients (n=697; 80.1%) did not receive mechanical ventilation; average length of stay in ICU was 3.41 (1-37) days, and duration of mechanical ventilation was 0.7 (0-20) days. The mortality rate was 5.2%. Three hundred and fifty-two (40.5%) patients received physiotherapy treatment, with the majority (n=271; 78.6%) being mobilised once daily. Most patients (n=253; 73.3%) who were mobilised were done so within 48 hours of ICU admission. Physiotherapy techniques used were manual chest physiotherapy, mobilisation to a chair, and active range of motion exercises. Five (1.4%) patients experienced adverse events during physiotherapy treatment (change in systolic blood pressure to <90mmHg or >200mmHg during treatment). Delirium was not assessed or monitored in any included patient.

Survey: The overall response rate was 24.1% (n=42). Clinician group response rates were physiotherapists 10.2% (n=13); nurses 65.6% (n=21); and doctors 55.6% (n=5). Most participants underestimated the incidence of ICUAW (n=17; 44.7%) and reported unfamiliarity with the literature on early mobilisation (n=19; 51.4%). Twenty-five (38.5%) of sixty-five total physiotherapist responses reported they would mobilise patients once daily, while thirty-one (47.7%) responses reported they would mobilise patients twice daily. Twenty-seven (41.5%) physiotherapist responses reported they spend 16-30 minutes mobilising a patient. The mobilisation team described consisted mainly of physiotherapists, nurses, and porters. Routinely used physiotherapy techniques included manual chest physiotherapy, bed mobility, pre-gait activities and strengthening exercises. Providers reported conservativism in permissible patient activity levels, especially in ventilated patients. The most commonly reported barriers to early mobilisation were requiring a doctor's referral for mobilisation, medical instability, excessive sedation, safety concerns, inadequate training, and lack of communication.

Conclusion: Patients were admitted electively, mainly post-cardiac surgery or for cardiac-related diagnoses. Delirium is not being standardly monitored in ICU. This could contribute significantly to poor patient outcomes. Quality improvement programmes to implement and optimise delirium monitoring and prevention in Namibian ICUs are recommended.

Physiotherapists routinely use manual chest techniques, bed mobility, pre-gait activity, and strengthening exercises in ICU. Survey participants underestimated the likely incidence of ICUAW and lacked sufficient knowledge and training on early mobilisation. Many barriers to early mobilisation were identified in this study, which should be addressed through implementing quality improvement programmes to direct and improve ICU mobility practice. Future point-prevalence studies are recommended with larger sample sizes from both the private and public sectors to increase the generalisability of results.

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My sweet son Dane: All you have known your entire life thus far is your mom constantly working. You have been so well-behaved and understanding, even in your young age. New and exciting things are coming your way soon.

List of Abbreviations

Abbreviation	Definition
6MWD	Six Minute Walking Distance
ABCDE	Awakening and Breathing Co-ordination, Delirium Monitoring/Management, and Early Mobility
ABCDEF	Assess, prevent, and manage pain, Both spontaneous awakening trials and spontaneous breathing trials, Choice of analgesia and sedation, Delirium, Early Mobility, and Family engagement
ABCDEFGH	Airway management, Breathing trials, Coordination of care and Communication, Delirium assessment, Early Mobility, Family involvement, Follow-up referrals and Functional reconciliation, Good handoff communication, and Handout materials on post intensive care syndrome (PICS) and post intensive care syndrome family (PICS-F)
ACIF	Acute Care Index of Function
ADL	Activities of Daily Living
AE	Adverse Event
AMSTAR	Assessment of Multiple Systematic Reviews
ANOVA	Analysis of Variance
APACHE II	Acute Physiology and Chronic Health Evaluation II
ARDS	Acute Respiratory Distress Syndrome
AROM	Active Range of Motion
ATP	Adenosine Triphosphate
BOOST	Better Outcomes by Optimising Safe Techniques
BPS	Behavioural Pain Scale
CABG	Coronary Artery Bypass Graft
CAM-ICU	Confusion Assessment Method-ICU
CICU	Cardiac Intensive Care Unit
CIM	Critical Illness Myopathy
CINM	Critical Illness Neuromyopathy
CIP	Critical Illness Polyneuropathy

CPAP	Continuous Positive Airway Pressure
CPD	Continuous Professional Development
CPOT	Critical Care Pain Observation Tool
CPP	Cerebral Perfusion Pressure
CSF	Cerebrospinal Fluid
CT	Cardiothoracic
CTICU	Cardiothoracic Intensive Care Unit
DEX	Dysexecutive Questionnaire
ECLS	Extra Corporeal Life Support
ECMO	Extra Corporeal Membrane Oxygenation
EM	Early Mobilisation/Mobility
EMG	Electromyogram
ETT	Endotracheal Tube
FiO_2	Fraction Index of Oxygen
GBS	Guillain Barre Syndrome
H_2O	Water
HCP	Health Care Practitioner
HPCNA	Health Professions Council of Namibia
HR	Heart Rate
HREC	Human Research Ethics Council
ICDSC	Intensive Care Delirium Screening Checklist
ICH	Intracranial Haemorrhage
ICP	Intracranial Pressure
ICU	Intensive Care Unit
ICUAW	Intensive Care Unit Acquired Weakness
INR	International Normalised Ratio
IPPB	Intermittent Positive Pressure Breathing
LOF	Level of Function
LOS	Length of Stay
MAP	Mean Arterial Blood Pressure

MD	Medical Doctor
MDT	Multidisciplinary Team
MoHSS	Ministry of Health and Social Services
MMSE	Mini Mental State Examination
MRC	Medical Research Council
MV	Mechanical Ventilation
MVA	Motor Vehicle Accident
MVV	Maximum Voluntary Ventilation
NAVA	Neurally Adjusted Ventilatory Assist
NICU	Neonatal Intensive Care Unit
NIV	Non-Invasive Ventilation
NMES	Neuromuscular Electrical Stimulation
NSP	Namibian Society of Physiotherapy
OT	Occupational Therapist
PAD	Pain Agitation Delirium
PDSA	Plan Do Study Act
PEEP	Positive End Expiratory Pressure
PF	Physical Function
PFIT	Physical Function ICU Test
PICS	Post Intensive Care Syndrome
PICS-F	Post Intensive Care Syndrome Family
PIP	Performance Improvement Project
PM	Passive Movement
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analyses
PROM	Passive Range of Motion
PT	Physical Therapist
PTSD	Post Traumatic Stress Disorder
QI	Quality Improvement
QIP	Quality Improvement Programme
QOL	Quality of Life

RASS	Richmond Agitation Sedation Scale
RCSQ	Richards-Campbell Sleep Questionnaire
RCT	Randomised Control Trial
RICU	Respiratory Intensive Care Unit
RNA	Ribonucleic Acid
ROM	Range of Motion
RR	Respiratory Rate
SAS	Sedation Agitation Scale
SAT	Spontaneous Awakening Trial
SBT	Spontaneous Breathing Trial
SD	Standard Deviation
SF-36 PF	Short Form-36 Physical Function
SICU	Surgical Intensive Care Unit
SIMV	Synchronised Intermittent Mandatory Ventilation
SMD	Standardised Mean Difference
SpO_2	Oxygen Saturation
SR	Systematic Review
SV	Stroke Volume
SVV	Stroke Volume Variation
UCSF	University of California San Francisco
UK	United Kingdom
US	United States
USA	United States of America

Glossary of Terms

ICUAW	Weakness that is acquired during the critical illness episode [1]
Post Intensive Care Syndrome	New or worsening impairments in physical, cognitive, or mental health status arising after critical illness and persisting beyond acute care hospitalization [2]
Mobility Champion	An individual who co-ordinates and implements early mobilisation through sharing expert knowledge on the benefits of early mobility to the clinicians, patients, and family, provides training, and develops the hands-on skills of ICU staff [3]
Mobilisation	Active or assisted patient mobility that may include bed mobility, sitting, standing, ambulation, or active exercises [1]
Early Mobilisation	Physiotherapist-directed rehabilitation started within 48 hours of admission to the ICU [1]
Progressive Mobility	A series of planned movements that is built up and intensified to more challenging activities that aim to return the patient to their previous level of function [4]
Delirium	Acute manifestation of brain dysfunction with behaviour disturbances in attention, awareness, and cognition [5]
Adverse Event	An unforeseen adverse incident that occurs in a patient related to a healthcare intervention, e.g. a drop in systolic blood pressure [6]

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Chapter 1 Introduction and Background

In the critical care environment, the main focus of care has historically been on preventing mortality [7]. With medical and technological advances over the last decade, intensive care unit (ICU) survival has improved [7]. There is now increased awareness and focus on ICU- related morbidities, such as ICU-acquired weakness (ICUAW), which can affect long-term functional outcomes and quality of life in survivors of critical illness [1, 8, 9]. Many other detrimental consequences arise from bedrest and immobility during critical illness, such as skeletal muscle and heart deconditioning, the development of pressure sores, and delirium, which also lead to poor physical and functional outcomes [10]. Post intensive care syndrome (PICS) is a collective term used to describe the multisystem sequelae of critical illness, affecting patient cognition and physical function, and psychosocial wellbeing and health-related quality of life in the patient and their families/caregivers well beyond the acute critical illness episode [11].

This introduction will focus on early mobilisation as a solution to mitigate the detrimental consequences of bedrest and reduced mobility, and ICUAW and delirium as potential factors predisposing to PICS, as it is important to understand the impact these critical care-related complications have on patient recovery and functional outcomes.

1.1 Early Mobilisation

There is no clear consensus on the definition of early mobilisation [12]. Some studies define early mobilisation variably as mobility initiated within 24 hours [13], 48 hours [1], or 72 hours of ICU admission [14], while others define it as mobilisation occurring within 2-5 days of ICU admission [15]. Early mobility has also been defined as mobility initiated within 72 hours of intubation/mechanical ventilation [16]. This thesis will define early mobilisation as physiotherapy and acute rehabilitation started within 48 hours of ICU admission (regardless of ventilation status).

Although consensus is still needed on the optimal dosage, frequency, and intensity of early mobilisation, this intervention strategy can help mitigate the detrimental effects of critical illness, bedrest, and immobility [14, 17, 18]. Early mobility is safe, feasible, and has been associated with reduced incidence and duration of delirium, reduced ICU and hospital LOS [19] and health-related costs, and improved functional and physical patient outcomes [8, 10, 14, 20-31]. Once ICUAW has developed, it becomes difficult to address, hence the importance of initiating early activity, which is the best strategy in preventing its development [32, 33].

Despite the known benefits and safety of early mobilisation in critical care, a multitude of barriers that affect its implementation have been described in different settings, including perceived or actual patient-, provider-, and institutional-related barriers [1, 20, 34]. These are discussed in detail in Chapter 2.

To date, no research on early mobilisation in critical care has been conducted in Namibia, a country situated on the South-Western coast of Africa.

1.2 Intensive Care Unit Acquired Weakness

ICU-acquired weakness (ICUAW) can be defined as weakness that is acquired during the critical illness episode [1]. As patients' survival rates in the intensive care unit (ICU) have improved over the years, the issue of ICUAW has become more evident and is now receiving more attention [9]. Clinicians have been shown to underestimate the incidence of ICUAW [1], the prevalence of which is estimated to exceed 50% of all patients admitted to ICU [35, 36]. ICU-acquired weakness may affect all muscle

groups, including limb, trunk, and respiratory muscles. Muscle tone and deep tendon reflexes are also reduced [32, 33, 35-37].

ICUAW impacts on the ability to successfully wean from mechanical ventilation (MV), owing to respiratory muscle weakness, increases risk of mortality, hospital length of stay (LOS) and out of hospital costs; and is associated with poor physical outcomes and quality of life in the longer term [37, 38].

Although the pathophysiology of ICUAW is still unclear [37, 38], it can be classified as critical illness polyneuropathy (CIP) or critical illness myopathy (CIM). Considering these impairments often co-exist and may be difficult to differentiate, the collective terms "critical illness neuromyopathy" or "critical illness polyneuromyopathy" are commonly used [32, 33, 37, 39].

1.2.1 Critical Illness Polyneuropathy

Peripheral nervous system failure is thought to be the primary mechanism behind CIP, related to multiple pathophysiological processes including decreased and impaired oxygen and adenosine triphosphate (ATP) usage and therefore decreased axonal nutrient delivery, resulting in axonal degeneration [32, 33, 39, 40]. This may occur as a consequence of microvascular dysfunction that occurs during severe sepsis, causing decreased cardiac output and stroke volume, and postural hypotension leading to fluid losses [32, 33, 39, 41].

Nerve conduction tests show a marked reduction in the amplitude and number of compound motor and sensory action potentials in limb muscles, with severe axonal degeneration [32, 33, 39, 40]. However, conduction speeds of sensory and motor impulses are unaffected. Cranial nerves/nerve roots may also be involved as well as the phrenic and intercostal nerves, resulting in diaphragmatic and intercostal muscle weakness that adversely affect respiratory system function and contribute to increasing duration of mechanical ventilation [32, 33, 39].

Other factors contributing to CIP include use of corticosteroids which may induce hyperglycaemia (high blood glucose); neuromuscular blockade drugs, resulting in muscle toxicity and chemical denervation; hyperglycaemia causing axonal damage through glucose cellular toxicity and/or increased oxidative stress; and multiple organ failure [39, 42].

1.2.2 Critical Illness Myopathy

Patients in critical care are prone to develop ICUAW and have poor functional outcomes because of underlying systemic illness, multiple organ failure, sepsis, hyperglycaemia, corticosteroids, use of neuromuscular blockades and duration of bedrest and/or immobility [7, 42].

The main pathophysiological processes underlying CIM are thought to be [32, 33, 39, 41, 42]:

- Notable muscle wasting that occurs at a rate of 3-4% each day.
- Decreased excitability of muscle membrane through inactivation of sodium channels and corticosteroid use.
- Reduced uptake and release of calcium in the sarcoplasmic reticulum leading to reduced muscle contractility.
- A decrease in muscle force generation.
- Mitochondrial dysfunction resulting in impaired use of oxygen and ATP production.
- Muscle toxicity related to the use of neuromuscular blockades, and structural changes occurring in muscle related to corticosteroid use. Neuromuscular blockades increase the susceptibility of muscle to corticosteroids.

1.2.3 Clinical Features

The weakness developing after the onset of critical illness is flaccid in nature, with sparing of facial grimacing, and is more pronounced distally (lower limbs more affected than upper limbs). Within the limbs, weakness is generally more marked distally than proximally [32, 33, 37]. Although gradual recovery occurs, weakness can persist for up to two years after ICU discharge [32].

ICU-acquired weakness can be diagnosed with electrophysiological examination (nerve conduction testing, electromyogram), muscle strength testing using the medical research council (MRC) muscle grading test, and muscle biopsy [32, 33, 38, 42].

1.2.4 Prevention and Management of ICUAW

Once ICUAW occurs, it is extremely difficult to treat. Therefore, reducing the risk factors for its development i.e., reduced mobility, systemic illness, multiple organ failure, sepsis, hyperglycaemia, corticosteroids, neuromuscular agents, through holistic management strategies targeting the disease processes as well as implementing early ICU-based rehabilitation and mobilisation are essential to prevent the development of ICUAW [37, 42]. Once ICUAW has already set in, it is still possible to address it through early physiotherapy and rehabilitation [43, 44]. This will be elaborated on in the literature review.

1.3 Delirium

Delirium is defined as an acute manifestation of brain dysfunction with behaviour disturbances in attention, awareness, and cognition [5]. It is a well-described complication of critical illness, associated with increased mortality, prolonged ICU and hospital LOS, poor physical and functional outcomes, and long-term cognitive impairment. It can be grouped into hyperactive, hypoactive, and mixed delirium. Patients with hypoactive delirium (who are seemingly calm and quiet) are often under recognised [5, 36, 45].

1.3.1 Risk Factors

Risk factors for the development of ICU related delirium include pre-existing dementia, coma, heavy sedation, mechanical ventilation, alcohol consumption, hypertension, and high patient acuity on admission [5]. It is therefore important to routinely screen for delirium in ICU patients [5]. The confusion assessment method (CAM-ICU) and the intensive care delirium screening checklist (ICDSC) are considered the best tools available to monitor delirium [5, 45].

1.3.2 Management and Treatment of Delirium

The incidence and duration of delirium can be reduced by introducing early mobilisation in the ICU and by appropriate sedation management avoiding the use of benzodiazepines [5]. Occupational therapy has an important role in ameliorating the cognitive impairments that may be caused by delirium [45]. Pain should first be appropriately managed through analgesics and thereafter minimal effective sedation applied, guided by using the Richmond Agitation Sedation Scale (RASS).

The PAD (Pain, Agitation, Delirium) guidelines help to reduce the risk for developing delirium by appropriate pain management (analgesia-first medication); monitoring of agitation using the RASS; delirium monitoring using the CAM-ICU and ICDSC tools; and promoting early physical activity [46-48].

Haloperidol is the preferred drug for the treatment of delirium. This drug blocks the D_2 dopamine receptors, thereby blocking the occurrence of hallucinations and disorganised thought processes [5]. However, the evidence for proving the efficacy of psychoactive drugs is lacking, and these drugs themselves are risk factors for delirium, and therefore should not be used routinely [5, 49]. Patients receiving Haloperidol or other psychoactive drugs should be monitored for any adverse effects i.e.,

hypotension (low blood pressure), dystonia, laryngeal spasm, hyperthermia, glucose and lipid dysregulation, constipation and urinary retention [5].

1.4 Post Intensive Care Syndrome

Post Intensive Care Syndrome is a collection of complications arising after the critical illness episode, which may extend well beyond hospital discharge [50]. Post ICU syndrome is characterised by either new or worsening physical, cognitive (impaired executive function controlled by the pre-frontal cortex, memory, attention span, language and visuo-spatial difficulties) and mental health (stress, anxiety, depression, post traumatic sleep diss) impairments or disabilities that decrease quality of life of both the patient and their family members and/or caregiver/s [11] [50].

Barely 10% of patients receiving mechanical ventilation for more than 4 days achieved functional independence and survived 1 year after discharge in an American study [50]. ICU-acquired weakness developed in 25-80% of those with sepsis or those requiring mechanical ventilation for more than 4 days [50]. Cognitive impairment developed in 30-80%, while depression and anxiety occurred in up to 57% and 48% of patients [50]. Between 10-50% of these patients developed post-traumatic stress disorder (PTSD) [50].

Critical illness also affects families and recognition for the psychological symptoms experienced by family members are included in the term PICS-Family (PICS-F). Up to 42% of family members of survivors of critical illness develop PTSD as a result of altered family dynamics, taking on a caregiving role, having to take off time from work that may affect their income, and up to 75% of family members develop anxiety (33% of them requiring medication) that can all persist for years after hospital discharge [50].

1.4.1 Risk Factors

Bedrest and immobility; increased duration of mechanical ventilation and LOS in ICU; delirium; sedative use (specifically the use of benzodiazepines); sepsis; development of acute respiratory distress syndrome (ARDS); hypoglycaemia; and hypoxia are all risk factors for the development of PICS [50]. The duration of delirium negatively affects cognitive function following ICU discharge, while the use of sedatives can contribute to the development of post-traumatic stress disorder (PTSD) following hospital discharge [5].

1.4.2 Prevention and Management of PICS

Firstly, the risk factors for the development of PICS must be minimised. Early psychological support for both the patient and family is essential. For example, keeping an ICU diary that describes the patient and family's experiences during the ICU stay may reduce their levels of anxiety, and may reduce the risk of development of PTSD, and depression. Creating an environment conducive to healing i.e., sleep promotion, noise reduction, appropriate lighting, family presence and involvement can also be used as strategies to decrease the prevalence of PICS. It is recommended that a checklist of patients' physical, cognitive, and mental status be recorded from pre-admission through to their recovery [50].

Other strategies to reduce the risk of developing PICS include optimal pain management, appropriate use of sedation with regular awakening and spontaneous breathing trials; preventing, monitoring, and managing delirium (associated with long-term cognitive impairment); encouraging patient and family engagement; and promoting early activity in patients [11, 46].

Early activity will help minimise the worsening of existing or development of new physical weakness that arise from bedrest and reduced mobility and can even work on improving skeletal muscle

strength and physical/functional outcomes once the weakness, referred to as ICUAW, has already set in [14, 15, 18, 43, 44].

Together these strategies have been grouped in the "ABCDEF" [47, 50] and PAD [46] bundles of care, which aim to optimise the functional and psychosocial outcomes of critically ill or injured patients and are discussed in more detail in Chapter 2.

Table 1.1: ABCDEF Bundle of Care

A	Assess, prevent, and manage pain
B	Both spontaneous awakening and breathing trials
C	Choice of medication management
D	Delirium
E	Early mobility and exercise
F	Family engagement and empowerment [51]

Post-ICU rehabilitation is necessary to address the long-term physical, cognitive impairment and mental health issues that may persist after hospital discharge. This must include education and family/caregiver involvement since they are also profoundly affected by PICS [11, 50].

1.5 Aims and Objectives of the Study

This study aims to describe the mobility practices, attitudes and perceptions of nurses, doctors, and physiotherapists regarding early mobilisation of critically ill patients in Namibian ICUs.

Objectives of this study are to describe:

- The profile of patients admitted to two private ICUs in Windhoek.
- The mobility practices of physiotherapists working in Windhoek ICUs.
- Nurse, doctor and physiotherapist attitudes, and perceived barriers to early mobilisation in Namibian ICUs.

1.6 Significance of this Study

This study is the first of its kind in Namibia. The results of this study will add to the body of knowledge in the field by describing the typical profile of patients admitted to private hospitals in Windhoek as well as describing mobility practices and clinician perceptions on early mobilisation in critical care.

Results of this study may be used to inform and direct quality improvement programmes aimed at mitigating the identified barriers to early mobilisation and promoting adherence to the ABCDEF bundle of care, in order to optimise functional ICU outcomes of patients admitted to private hospital ICUs in the region.

1.6.1 Description of the Healthcare Structure in Namibia

Healthcare services in Namibia are divided into private and public sectors. Of the 2.45 million population, only 18% have access to private medical care, while 82% utilise the public health system [52].

The Namibian public health system, run by the Ministry of Health and Social Services (MoHSS), consists of four-tiers i.e., primary health care; district hospitals; intermediate hospitals; and referral hospitals. In rural areas, there are 5780 people per primary healthcare clinic, and 58 825 people per district hospital [52]. Public hospitals are overcrowded, putting the public healthcare system under tremendous strain. These hospitals also suffer a severe shortage of staff, especially specialists, that include physiotherapists, and will be discussed in more detail below. As a result, those that can afford it seek medical attention elsewhere i.e., at private healthcare facilities, that are perceived to be of higher quality care [52].

The various private and public hospitals that exist in Windhoek are described here. The role of the Motor Vehicle Accident (MVA) Fund is also described in this section.

The MVA Fund

The Namibian motor vehicle accident (MVA) fund act was promulgated in 1990 (Appendix I). It provides compensation directly to the injured persons and/or their families and pays for any healthcare services related to a motor vehicle or motorcycle accident that has occurred on Namibian roads. The latest government gazette: MVA Fund Act 10 of 2007 (Appendix II) can be found on their website www.mvafund.com.na regarding their accident response:

The accident scene is attended to by paramedics as soon as possible. Patients requiring medical treatment are transported to the nearest hospital for the appropriate procedure/s. Once the patient's condition is stabilised, they are transferred to private facilities for further treatment and in-patient rehabilitation. After discharge from hospital or step-down facilities, the fund pays for further outpatient rehabilitation/medical consultation, as necessary.

1.6.2 Participating Institutions

Roman Catholic Hospital is a 123-bed private facility with a modern 10-bed general ICU. Each of these beds are in private rooms with glass doors that make for easy isolation of patients, when necessary, for infection control purposes. They also have a 7-bed High Care Unit that is used as an ICU when the general ICU exceeds its capacity. This hospital does not have a paediatric nor a maternity unit.

One physiotherapy practice is contracted to this hospital. This practice holds renewable accreditations as an intern facility (Appendix III) that offers supervision and guidance to newly qualified physiotherapists, and a continuous professional development (CPD) facility (Appendix IV) that offers in-house CPD activities, with the Health Professions Council of Namibia (HPCNA). The practice has written protocols in place for the appropriate rehabilitation of patients with various medical and surgical conditions, and after cardiac and orthopaedic surgery. The physiotherapists here do not automatically assess the patients in ICU for commencement of rehabilitation and mobilisation. Physiotherapy, rehabilitation and mobilisation is commenced upon written or verbal referrals from doctors. The physiotherapists do, however, conduct a pre-operative session on elective cardiac and orthopaedic surgery patients one day before the surgery. The cardiothoracic surgeon and the orthopaedic surgeons make a written request to commence rehabilitation and mobilisation one day after surgery. These patients are required to be seen twice daily in ICU as well as in the wards until hospital discharge. Medical and other surgical patients are only seen once daily, unless requested by the attending doctor for twice daily physiotherapy.

Motor Vehicle Accident (MVA) patients in the ICU and hospital are only seen upon referral by the attending doctor, once daily, as the MVA fund will not pay for rehabilitation services that are not requested in writing by a medical practitioner. Requests for twice daily physiotherapy for these patients are required by the MVA fund to be done by the attending doctor in writing. MVA patients are transferred to the public hospitals and private step-down facilities for continuation of in-patient rehabilitation as soon as their condition has stabilised.

Mediclinic Windhoek is a private facility with a 9-bed Intensive/High Care Unit, and a 5-cot Neonatal Intensive/High Care Unit. One physiotherapy practice is contracted to this hospital. Whether this hospital has mobilisation protocols are unknown. The ICU at this hospital also receives MVA patients who may only commence physiotherapy, performed once daily, upon written referral by a medical practitioner, as described above.

1.6.3 Non-Participating Institutions

Rhino Park Hospital is a 104-bed private facility with a 4-bed ICU, one double High Care room, and 14-cot Neonatal ICU. They too have one contracted physiotherapy practice that services their patients. Whether they have mobility protocols is unknown.

Lady Pohamba Private Hospital is a 98-bed private facility with a 10-bed general ICU, 11-bed High Care Unit, 6-bed Neonatal ICU, 14-bed trauma unit, and a 7-bed gastro-intestinal unit. The structure of physiotherapy/rehabilitation services at this hospital is unknown, as are the existence of written mobility protocols. This hospital also receives MVA patients who may only commence physiotherapy upon written referral by a medical practitioner, as described above.

Windhoek Central Hospital is Namibia's largest public referral hospital with 855 beds. It has an 8-bed mixed ICU (adults and paediatrics). They have a spinal unit that receives patients (including MVA patients) from the private hospitals after having the necessary surgery/procedures and initial rehabilitation. The cardiac unit currently has two adult, and one cardiothoracic surgeon (that also perform surgeries at private facilities).

The hospital has a hydrotherapy pool that is used as a storage facility for wheelchairs by the occupational therapists (that are staffed at well over 10). Physiotherapy and rehabilitation services at this hospital are in dire straits, as they only had three physiotherapists servicing the hospital for the last 11 years. Two physiotherapists have subsequently resigned, with only one remaining. The Namibian Ministry of Health and Social Services (MoHSS) made a request to the Namibian Society of Physiotherapy (NSP) for physiotherapists in private practice to provide their services at this hospital. This request has been forwarded to all members of the NSP (Appendix V).

Katutura Intermediate Hospital is a public facility with 830 beds. This referral hospital, however, does not have an ICU. It is situated on the same premises as Windhoek Central Hospital, to where any patients requiring intensive care are transferred. This hospital once had a big group of medical practitioners, specialists, physiotherapists, and occupational therapists in the 1980s. Decades later, their medical and rehabilitation services severely declined as many practitioners moved into the private sector. They now have a small group of medical practitioners and specialists that also work in the private sector, and a group of occupational therapists to service their patients. There are no physiotherapy services currently.

Step-down Facilities

Two step-down facilities where patients receive long-term rehabilitation exist in Windhoek i.e., Paramount and West Care rehabilitation centres.

Paramount Healthcare Centre

www.paramounthcc.com

This is a privately funded facility. Services offered include physiotherapy (including hydrotherapy), occupational therapy, clinical psychology, and speech therapy. Motor vehicle accident (MVA) patients, and all other patients requiring long-term rehabilitation are referred here. Primary healthcare services, chronic disease management, and chemotherapy infusion are also offered. It is uncertain whether this facility has written rehabilitation/mobility protocols in place, and what the mobility practice of the physiotherapists are.

West Care Medical Centre

This is a newly established privately funded step-down facility that offers physiotherapy, occupational therapy, biokinetics, and dietetics. Motor vehicle accident patients (MVA) patients requiring long-term rehabilitation are also transferred/referred here. They also have day clinic that offers primary healthcare services, and a mobile clinic that provides wound care and chronic disease monitoring services to patients that are unable to travel to the facility. It is uncertain whether this facility has written rehabilitation/mobility protocols in place, and what the mobility practice of the physiotherapists are.

University of Namibia School of Medicine

www.unam.edu.na/school-of-medicine/undergraduate-qualifications

The University of Namibia School of Medicine, based in Windhoek, was opened in 2010. The first doctor graduates were produced in 2015. Occupational and physiotherapy schools were started with their first group of students in 2018 that are yet to graduate. The physiotherapy department, however, does not currently have adequate facilities and staff to provide all the necessary training to the students enrolled. In 2020, the physiotherapy school only had three lecturers that conducted all lectures, practical training, and clinical supervision. Moreover, due to the physiotherapy service crisis at the public facilities in Windhoek, clinical placements of these students are challenging. The head of the physiotherapy school is currently scouting for potential clinical placement venues and recruitment of lecturers and clinical supervisors. So far, two private facilities have been earmarked for these placements i.e., Roman Catholic Hospital and Dagbreek School (a school for special-needs children).

Chapter 2 Literature Review

2.1 Aims and Objectives

The aims of this literature review are to describe the global mobility practices, and the attitudes and perceptions of clinicians (nurses, doctors, and physiotherapists) on early mobilisation of critically ill patients.

The objectives are to describe:

- The international profiles of patients admitted to ICU, as described in studies of mobility practice
- The current mobility practices in ICUs worldwide
- The safety, feasibility, and benefits of early mobilisation in ICU
- The attitudes and perceived barriers to early mobilisation in ICU

2.2 Methods

2.2.1 Searching

The student researcher conducted this review using computerised databases, namely PubMed, CINAHL, Scielo, and Google Scholar from the date of inception to December 2020. A combination and variation of the following key search terms included: “ICU mobility culture” OR “ICU admissions” OR “patient demographics” OR “current early mobilisation practice in ICU” OR “mobility practices in ICU” OR “physiotherapy techniques in ICU” OR “cardiac surgery ICU admission practices” OR “timing of mobilisation in ICU” OR “benefits of early mobilisation in ICU” OR “clinician knowledge, attitudes and perceptions regarding early mobilisation of critically ill patients” OR “barriers to early mobilisation in ICU” OR “perceived barriers to early mobilisation in ICU” OR “staff barriers to early mobilisation in ICU”. Search term “Hanekom, S” was included on the Scielo database. More articles were sourced by direct searches of published titles referenced in the studies found through the above-mentioned searches.

2.2.2 Selection Criteria

All articles that reported on the profile of adult patients in ICU, ICU mobility practices, the safety, feasibility, and benefits of early mobilisation, attitudes and perceptions of barriers and facilitators to early mobilisation were eligible for inclusion, regardless of study design and including reports of quality improvement programmes. Pilot studies and articles not in English were excluded from this review.

The student researcher independently performed the literature search. Titles and abstracts of potentially relevant articles were screened, and full text review was conducted after the initial screening.

2.2.3 Search Results

Tables 2.1-2.5 present the articles selected for inclusion in this review chapter (total 117):

16 systematic reviews, 10 intervention studies, 45 observational studies, 11 quality improvement programmes, and 35 other (14 clinical reviews, 14 expert opinion, 3 case reports, 2 special features, 1 conference report, and 1 expert consensus) articles.

Table 2.1: Summary of Included Systematic Reviews

Author	Country	Total Studies Included	Population	Primary Objective	Main Outcome
Early Mobilisation Definition					
Clarissa et al 2019 [12]	USA Australia	76 qualitative and quantitative (RCTs, case-series, case-control, cohort) studies	10583 Critically ill adults	To explore the definitions of early mobilisation of mechanically ventilated patients in the literature	➢ Cohort studies were the predominant study design (n=33, 43%), followed by RCTs (n=18, 24%) and case control studies (n=11, 15%) ➢ Most of the studies originate from the USA (n=27, 36%) and Australia (n=9, 12%) **Four major themes** 1. Non-standardised definition 2. Contextual factors relating to early mobilisation activities 3. Negotiated process between patients and staff 4. Collaboration between patients and staff ➢ EM-MV full definitions were obtained from 15 studies (20%) and partial definitions were identified from 15 studies (20%) ➢ The other studies (n=46, 61%) did not provide a definition ➢ There is no consensus on the definition of early mobilisation in mechanically ventilated patients ➢ Early mobilisation activities in mechanically ventilated patients are varied, dependent on the patient's characteristics and the ICU settings
Barriers to Early Mobilisation					
Parry et al 2017 **[53]**	USA Australia UK	89 studies 77 quantitative (RCTs, pseudo-RCTs, cohort studies, case-	17547 Critically ill adults, 56 Caregivers, 4425 HCPs working in ICU	To investigate the factors influencing physical activity and rehabilitation for survivors of critical illness	➢ Most common countries were USA (n=54, 61%); Australia (n=13, 15%) and UK (n=10, 11%) ➢ Most of the papers (93%, n=83) focused on the ICU setting alone ➢ Most of the included quantitative studies were either case series with or without intervention or cross-sectional study (n=48/77, 62%)

		control studies, case series, cross-sectional studies) and 12 qualitative studies			➢ Qualitative studies scored poorly for lack of reporting of the interviewer's characteristics and relationship between interviewers and participants ➢ The median [interquartile] score for qualitative studies was 21 [11–22] ➢ Patient physical and psychological ability (sedation, delirium) to perform physical activity, safety concerns, lack of leadership, knowledge, MDT collaboration, staff/equipment, and mobility culture are the main barriers influencing rehabilitation. These barriers are multifaceted, and addressing these factors will help to increase physical activity in critically ill patients
Benefits of Early Mobilisation					
Calvo-Ayala et al 2013 **[54]**	Australia USA Belgium Denmark France UK	14 RCTs	7417 Critically ill adults	To identify effective interventions that improve long-term physical function of critically ill patients	➢ There were five multicentre studies (range, 2-12 centres per study) ➢ Study sizes ranged widely (16-4,640 subjects), with only three trials enrolling >300 patients ➢ Broad distribution of adult ICU patients evidenced by the variations in the mean APACHE (Acute Physiology and Chronic Health Evaluation) II score (range, 9-28) and mean age of studies' subjects (48-66 years) ➢ Lack of double blinding in studies ➢ Five of the studies did not report at least one measured key outcome ➢ The Short Form-36 PF questionnaire (SF-36 PF), Barthel Index, 6-minute walk test, and ability to perform activities of daily living were used to assess physical function ➢ Only early physical activity improves long-term physical function of critically ill patients, with potentially greater benefits if started sooner ➢ More research comparing different interventions and timing is needed in this field
Stiller K 2013 **[23]**	Australia	85 (55 clinical and 30 non-	Critically ill adults (not	To investigate the effectiveness of	➢ Early progressive mobilisation is safe and feasible, improves functional status and reduces ICU and hospital length of stay

		clinical studies): RCTs, randomised crossover trials, systematically allocated controlled trial, historical controlled trial, observational studies, systematic literature reviews	consistently mentioned for all studies)	physiotherapy for adult patients on mechanical ventilation in the ICU (An updated systematic review)	➢ Evidence from randomised controlled trials evaluating the effectiveness of routine multimodality respiratory physiotherapy is conflicting ➢ The studies included were of variable methodological quality ➢ Further research required to agree on dosage (intensity, duration, and frequency) of mobilisation
Connolly et al 2016 **[55]**	UK	5 systematic reviews (with 3 included meta-analysis; 24 RCTs)	Critically ill adults (number of patients not clearly specified)	To conduct an overview of systematic reviews that evaluate the effect of physical rehabilitation interventions in the continuum of recovery in critical illness	➢ Two reviews reported moderate-to-high quality evidence of the beneficial effects of physical therapy commencing during intensive care unit (ICU) admission in improving critical illness polyneuropathy/myopathy, quality of life, mortality, and healthcare utilisation ➢ Interventions from these two reviews included early mobilisation, cycle ergometry and electrical muscle stimulation ➢ Two reviews reported very low to low quality evidence of the beneficial effects of electrical muscle stimulation delivered in the ICU for improving muscle strength, muscle structure and critical illness polyneuropathy/myopathy ➢ One review reported that due to a lack of good quality randomised controlled trials and inconsistency in measuring outcomes, there was insufficient evidence to support beneficial

					effects from physical rehabilitation delivered post-ICU discharge ➢ Physical rehabilitation generates short-term benefits (improved quality of life, reduced mortality) ➢ There is insufficient evidence to support the long-term benefits of physical rehabilitation ➢ More robust RCTs and systematic reviews are needed to determine the impact of physical rehabilitation and electrical muscle stimulation on long-term outcomes
Ramos Dos Santos et al 2017 **[56]**	Brazil	9 RCTs	1419 Critically ill adults	To investigate the effects of early mobilisation in patients after cardiac surgery on hospital LOS, functional capacity, and postoperative complications	➢ Participants were mostly male ➢ Age range from 49 to 68 years ➢ Average hospital LOS ranged from 5.9 to 12.2 days ➢ Average ICU LOS ranged from 1.5 to 2.3 days ➢ Early mobilisation prevents post-operative complications, improves functional outcomes, and reduces hospital LOS after cardiac surgery ➢ There is still no consensus on timing, dosage, and frequency of mobilisation in critical care
Tipping et al 2017 **[57]**	New Zealand	14 RCTs, clinical controlled trials	1753 critically ill adults	To determine the effect of active mobilisation and rehabilitation in ICU on mortality, function, mobility, quality of life, ICU and hospital length of stay, duration of mechanical ventilation, and days alive and out of hospital to 6 months	➢ Active mobilisation and rehabilitation had no impact on mortality ($p > 0.05$) ➢ **Meta-analysis showed that active mobilisation and rehabilitation was associated with:** ➢ Greater muscle strength (body function) at ICU discharge as measured using the Medical Research Council Sum Score (mean difference 8.62 points, 95% confidence interval (CI) 1.39–15.86) ➢ Greater probability of walking without assistance (activity limitation) at hospital discharge (odds ratio 2.13, 95% CI 1.19–3.83) ➢ More days alive and out of hospital to day 180 (participation restriction) (mean difference 9.69, 95% CI 1.7–17.66) ➢ Need for robust RCT to determine the effect of active mobilisation and rehabilitation on long-term outcomes of

					patients, and more direction needed on dosage and progression of rehabilitation
Doiron et al 2018 (Cochrane Review) **[58]**	Australia	4 RCTs	690 critically ill adults	To determine the effects of early mobilisation or exercise in ICU on mechanically ventilated patients or not, compared to usual care or delayed exercise	➢ Three studies (a total of 454 participants) reported at least one measure of physical function. One study (104 participants) reported low-quality evidence of beneficial effects in the intervention group on return to independent functional status at hospital discharge (59% versus 35%, risk ratio (RR) 1.71, 95% confidence interval (CI) 1.11 to 2.64) ➢ Absolute effect is that 246 more people (95% CI 38 to 567) per 1000 would attain independent functional status when provided with early mobilisation ➢ The effects on physical functioning are uncertain for a range measures: Barthel Index scores (early mobilisation: median 75 control: versus 55, low quality evidence), number of ADLs achieved at ICU (median of 3 versus 0, low quality evidence) or at hospital discharge (median of 6 versus 4, low quality evidence) ➢ The effects of early mobilisation on physical function measured at ICU discharge are uncertain, as measured by the Acute Care Index of Function (ACIF) (early mobilisation mean: 61.1 versus control: 55, mean difference (MD) 6.10, 95% CI -11.85 to 24.05, low quality evidence) ➢ Physical Function ICU Test (PFIT) score (5.6 versus 5.4, MD 0.20, 95% CI -0.98 to 1.38, low quality evidence) ➢ Low quality evidence that early mobilisation may have little or no effect on physical function measured by the Short Physical Performance Battery score at ICU discharge from one study of 184 participants (mean 1.6 in the intervention group versus 1.9 in usual care, MD -0.30, 95% CI -1.10 to 0.50), or at hospital discharge (MD 0, 95% CI -1.00 to 0.90). The fourth study, which examined postoperative cardiac surgery patients did not measure physical function as an outcome

					➢ Evidence on the effect of early mobilisation in critical care on physical function, performance, adverse events, muscle strength and health related quality of life is currently insufficient ➢ Low-quality evidence: small sample sizes, lack of blinding of participants and staff, variation in interventions and outcomes ➢ Inadequate descriptions of interventions ➢ Four other studies were still awaiting classification and three others were still in progress
Herling et al 2018 (Cochrane Review) [49]	Denmark	12 RCTs	3885 Critically ill adults	To determine the effect of interventions on delirium, ICU mortality, number of delirium-free and ventilator free days, ICU LOS, and cognitive impairment	➢ Usual care compared with the following interventions: commonly used drugs (four studies); sedation regimens (four studies); physical therapy or cognitive therapy, or both (one study); environmental interventions (two studies); and preventive nursing care (one study) ➢ Participants were 48 to 70 years old ➢ 48% to 74% participants were male ➢ Mean acute physiology and chronic health evaluation (APACHE II) score was 14 to 28 (range 0 to 71; higher scores correspond to more severe disease and a higher risk of death) ➢ No difference in event rate ICU delirium was identified between groups, (risk ratio (RR) 1.01, 95% confidence interval (CI) 0.87 to 1.17) (moderate-quality evidence) No difference between Haloperidol and placebo for: ➢ **Preventing ICU delirium and coma-free days** (mean difference (MD) -0.60, 95% CI -1.37 to 0.17; 2 studies, 1580 participants (moderate-quality of evidence)) ➢ **Reducing or increasing in-hospital mortality,** (RR 0.98, 95% CI 0.80 to 1.22; 2 studies; 1580 participants (moderate-quality evidence) ➢ **Number of ventilator-free days** (mean 23.8 (MD -0.30, 95% CI -0.93 to 0.33) 1 study; 1439 participants, (high-quality evidence))

					➢ **Length of ICU stay,** (MD 0.18, 95% CI 0.60 to 0.97); 2 studies, 1580 participants; high-quality evidence ➢ The study did not measure the event rate of ICU delirium **Physical and cognitive therapy intervention versus standard care neither reduced nor increased:** ➢ **In-hospital mortality,** (RR 0.94, 95% CI 0.40 to 2.20, $I^2 = 0$; 1 study, 65 participants; very low-quality evidence) ➢ **Number of delirium- and coma-free days,** (MD -2.8, 95% CI -10.1 to 4.6, $I^2 = 0$; 1 study, 65 participants; very low-quality evidence ➢ **Number of ventilator-free days** (within the first 28/30 days) was median 27.4 (IQR 0 to 29.2) and 25 (IQR 0 to 28.9); 1 study, 65 participants; very low-quality evidence ➢ **Length of ICU stay,** (MD 1.23, 95% CI -0.68 to 3.14, I2 = 0; 1 study, 65 participants; very low-quality evidence) ➢ **Cognitive impairment** measured by the MMSE: Mini-Mental State Examination with higher scores indicating better function, (MD 0.97, 95% CI -0.19 to 2.13, $I^2 = 0$; 1 study, 30 participants; very low-quality evidence); or measured by the Dysexecutive questionnaire (DEX) with lower scores indicating better function (MD -8.76, 95% CI -19.06 to 1.54, $I^2 = 0$; 1 study, 30 participants; very low-quality evidence ➢ Insufficient evidence on the effects of physical and cognitive intervention on delirium. Further research is needed ➢ Effects of pharmacological interventions on delirium are unclear. Further robust RCTs needed ➢ Five studies awaiting classification and fifteen ongoing studies ➢ Low quality evidence of studies: small sample sizes, lack of blinding
Anekwe et al 2019 **[59]**	Canada	9 RCTs Meta-analysis included	841 critically ill adults (419	To determine how much early rehabilitation intervention reduces the	➢ **Early rehabilitation is associated with a decreased risk of developing ICUAW**: odds ratio of 0.63 (95% CI: 0.43 to 0.92) in

		(Robust Review)	intervention and 422 usual care)	incidence of ICUAW in critically ill patients versus usual care	the screened population, and 0.71 (95% CI: 0.53 to 0.95) in the randomised population ➢ The interventions varied across studies: EM in five trials, NMES in three trials, EM and NMES in one trial ➢ ICUAW was measured with MRC sum score instead of electrophysiological studies. Results may have underestimated the incidence of ICUAW ➢ No difference in the pooled OR for acute mortality in ICU and hospital (OR 1.19; 95% CI: 0.79 to 1.80) ➢ The wide confidence intervals suggest that well-conducted trials are needed to validate the findings
Higgins et al 2019 **[60]**	Canada (USA, China, Norway, Italy)	9 RCTs, prospective cohorts, retrospective cohorts, prospective observational, bidirectional case-control. Retrospective control arm and prospective experimental arm study Meta-analysis	3372 Trauma patients	To determine the effect of early mobilisation on mortality, LOS and mechanical ventilation of trauma patients admitted to the ICU (The first study of its kind)	➢ Sample sizes ranged from 15 to 1132 patients: median 63 ➢ Early mobilisation in trauma patients reduces number of ventilator days, but similar mortality and LOS than those receiving usual care ➢ Most studies used a progressive mobility protocol as the intervention ➢ Meta-analysis showed no difference in mortality between patients mobilised early and those receiving usual care ➢ Meta-analysis showed duration of mechanical ventilation was significantly lower with EM (mean difference -1.18 days, 95% CI, -2.17 – -0.19) ➢ More robust RCTs are needed to confirm the benefits of EM on trauma ICU patient outcomes
Zhang et al 2019 **[61]**	China (Canada, France, United Kingdom,	23 RCTs Meta-analysis included	2308 critically ill patients	To assess the evidence available on the effect of early mobilisation on critically ill patients in the ICU	Early mobilisation: ➢ Decreased the incidence of ICUAW at hospital discharge (3 studies, 190 patients, relative risk (RR): 0.60, 95% confidence interval (CI) [0.40, 0.90]; p = 0.013, I^2 = 0.0%) ➢ Increased the number of patients able to stand (one study, 50 patients, 90% vs. 62%, p = 0.02)

	and China)				➢ Increased number of ventilator-free days (six studies, 745 patients, standardised mean difference (SMD): 0.17, 95% CI [0.02, 0.31]; p = 0.023, I^2 = 35.5%) ➢ Increased distance of unassisted walking at hospital discharge (one study, 104 patients, 33.4 (0–91.4) meters vs. 0 (0–30.4) meters, p = 0.004) ➢ Increased discharged-to-home rate (seven studies, 793 patients, RR: 1.16, 95% CI [1.00, 1.34]; p = 0.046) ➢ Had no significant effect on adverse event and mortality rates Huge variation amongst studies, with low-quality evidence: ➢ Different definitions of early mobilisation ➢ Interventions in studies were not the same ➢ Outcome measures not the same ➢ Randomisation and blinding in many studies not sufficient
Safety and Feasibility of Early Mobilisation					
Li et al 2013 **[22]**	China (Belgium, USA, Taiwan, Turkey, Australia, France)	17 (7 RCTs, 1 quasi-RCT, 1 prospective cohort studies, 1 history-controlled study, and 7 case-series)	1614 Critically ill adults	To investigate the safety and effectiveness of active mobilisation on physical function and outcomes in mechanically ventilated patients	➢ Sample sizes ranged from 17 to 510 participants ➢ Lack of blinding of therapists ➢ Early active mobilisation in the ICU is safe and has positive effects on physical function and hospital outcomes (6 MWD improved at hospital discharge, improved functional status, shorter duration of MV, more ventilator-free days, shorter ICU and hospital LOS) ➢ Only 1 study reported that active mobilisation reduced the 1-year mortality rate ➢ More robust evidence is needed to support the safety and effectiveness of early active mobilisation as the current studies are hugely varied and of low methodologic quality (methodologic limitations, study designs, small sample sizes)
Laurent et al 2016 **[21]**	France	22 (19 RCTs, 1 quasi-randomised controlled	1821 Critically ill adults (total after many patients lost	To perform a systematic review on how to deliver early mobilisation to achieve what goals in the ICU	➢ Sample sizes were small and varied with huge loss to follow-up rates ➢ Only 14% of studies assessed long-term outcomes, i.e., 1-year mortality, functional status during the follow-up year and/or 1year cost

		studies, 2 case series)	to follow-up; one study did not mention the number of patients in the control group)	(The first qualitative systematic review)	➢ Early exercise is safe and feasible in critical care ➢ Culture change in terms of exercise in ICU is necessary ➢ Further studies on the effect of early exercise on mortality, morbidity and quality of life are needed
Ferreira et al 2019 **[62]**	Brazil	20 (retrospective cohort, case-series, case-study, prospective cohort)	317 Critically ill adults (259 patients treated with PT and 58 patients not treated with PT during ECMO support)	To determine the safety of physical therapy in adult patients on ECMO support	➢ Respiratory therapy and early progressive rehabilitation are both safe and feasible for patients on ECMO support ➢ One study showed a significant decrease in mortality in patients who underwent PT (intervention group) compared to those who did not (control group) (odds ratio, 0.19; 95% confidence interval, 0.04 - 0.98) ➢ The length of MV before the indication of ECMO was reported in six studies and ranged from 0.77 to 151 days ➢ Most of the studies had low methodological quality ➢ More studies to confirm the benefits of physical therapy in terms of LOS, MV, lung function and muscle strength are needed
Mortality					
Okada et al 2019 [63]	Japan	11 RCTs with meta-analysis	1322 critically ill patients	To investigate the efficacy of early mobilisation on mortality and health-related quality of life among critically ill adult patients	➢ Pooled relative risk for in-hospital mortality comparing early mobilisation to usual care (control) was 1.12 (95% CI [confidence interval]: 0.80 to 1.58, I2 = 0%) ➢ Pooled mean differences for duration of ICU and hospital stay were -1.54 (95% CI: -3.33 to 0.25, I^2 = 90%) and -2.86 (95% CI: -5.51 to -0.21, I^2 = 85%), respectively ➢ Pooled mean differences at 6 months post-discharge, as measured by the Short Form 36-Item Health Survey and Euro-QOL EQ-5D, were 4.65 (95% CI: -16.13 to 25.43, I^2 = 86%) for

					physical functioning and 0.29 (95% CI: -11.19 to 11.78, I^2 = 66%) for the visual analog scale ➢ Early mobilisation has no impact on in-hospital mortality and health-related quality of life

Table 2.2: Abbreviation List for Systematic Reviews

6-MWD	6 Minute Walk Distance
ACIF	Acute Care Index of Function
APACHE	Acute Physiology and Chronic health Evaluation
CI	Confidence Interval
DEX	Dysexecutive Questionnaire
ECMO	Extra Corporeal Membrane Oxygenation
EM	Early Mobilisation
EQ-5D	Euro Quality of Life 5 Dimension
ICU	Intensive Care Unit
ICUAW	Intensive Care Unit Acquired Weakness
IQR	Interquartile Range
LOS	Length of Stay
MD	Mean Difference
MDT	Multidisciplinary Team
MMSE	Mini Mental State Examination
MRC	Medical Research Council
MV	Mechanical Ventilation
NMES	Neuromuscular Electrical Stimulation
OR	Odds Ratio
PFIT	Physical Function ICU Test
PT	Physical Therapist
QOL	Quality of Life
RCT	Randomised Control Trial
RR	Risk Ratio
SF-36 PF	Short Form-36 Physical Function

SMD	Standardised Mean Difference
UK	United Kingdom
USA	United States of America

Table 2.3: Summary of Included Intervention Studies

Author	Country	Study Type	Sample Size	Intervention	Control	Primary Outcomes	Main Findings
Benefits of Early Mobilisation							
Girard et al 2008 **[64]**	USA	RCT	336 mechanically ventilated patients	Daily spontaneous awakening trial followed by a spontaneous breathing trial (n=168)	Sedation per usual care plus a spontaneous breathing trial (n=168)	➢ Time breathing without assistance	➢ Patients in the intervention group spent more days breathing unassisted during the 28-day study period than those in the control group (14.7 days vs 11.6 days; mean difference 3.1 days, 95% CI 0.7 to 5.6; p = 0.02) ➢ Patients in the intervention group were discharged from ICU (median time in ICU 9.1 days vs 12.9 days; p = 0.01) and the hospital earlier than those in the control group (median time in the hospital 14.9 days vs 19.2 days; p = 0.04)
Thomson et al 2008 **[65]**	USA	Pre-post cohort	104 respiratory	Prospective early activity protocol to all consecutive	No control group mentioned	➢ Increase in ambulation of patients once	➢ Probability of ambulation (p < .0001)

			failure patients	respiratory failure patients admitted to RICU		transferred to the RICU	significantly increased after transfer to RICU Probability of ambulation also increased by: ➢ Female sex (p = .019), no sedatives (p = .009), and lower APACHE II scores (p = .017)
Burtin et al 2009 **[66]**	Belgium	RCT (single centre)	90 adult patients	Respiratory therapy, daily standardised active/passive motion for 20mins/day on a bedside cycle ergometer	Respiratory therapy and daily standardised active or passive motion	➢ Functional status ➢ Functional exercise capacity ➢ Quadriceps force	SF-36 PF score: ➢ 6-min walking distance, isometric quadriceps force, and the subjective feeling of functional well-being were all significantly higher in the intervention group (21 points [18-23 points] than control group (15 points [14-23 points] (p < .05)
Schweickert et al 2009 **[67]**	USA	RCT (double centre)	104 adult patients	Early exercise and mobilisation during periods of daily interruption of sedation (intervention; n=49	Daily sedation interruption-with standard care (control; n=55)	➢ Number of patients returning to independent functional status at hospital discharge	➢ Return to independent functional status at hospital discharge: Intervention:29 (59%) Control: 19 (35%) (p = 0.02; odds ratio 2.7 [95% CI 1.2–6.1]) ➢ Intervention group had shorter duration of delirium (median 2.0 days, IQR 0.0–6.0 vs 4.0

							days, 2.0–8.0; p=0.02), and more ventilator-free days (23.5 days, 7.4–25.6 vs 21.1 days, 0.0–23.8; p = 0.05) during 28-day follow up than control group
Thelandersson et al 2016 **[68]**	Sweden	Prospective experimental	20 adult patients	20-min cycle with bedside ergometer performed soon after NICU admission and after approval from the attending neurosurgeon	No control group mentioned	➢ Intracranial pressure (ICP) ➢ Cerebral perfusion pressure (CPP) ➢ Mean arterial blood pressure (MAP) ➢ Heart rate (HR) ➢ Peripheral oxygen saturation (SpO_2) ➢ Cardiac output (CO) ➢ Stroke volume (SV) ➢ Stroke volume variation (SVV)	➢ Early exercise with a bedside cycle did not affect ICP but caused minor increases in SV (p = 0.003) and MAP (p = 0.029) ➢ CPP is improved
Hickmann et al 2018 **[43]**	Belgium	RCT	21 adult patients	Twice daily manual mobilisation plus 30 minutes active/passive cycling	Once daily manual mobilisation	➢ Regulation of protein degradation/synthesis ➢ Preservation of muscle fibre cross-sectional area ➢ Exercise-induced muscle inflammation ➢ Restoration of neuromuscular function ➢ Safety of the intervention	➢ Early physical therapy during the first week of septic shock is safe and preserves muscle fibre cross-sectional area (μm^2) (–25.8% ± 21.6% in control vs 12.4% ± 22.5% in intervention group; p = 0.005)

Veldema et al 2019 **[44]**	Germany	RCT	39 adult patients	➢ Ergometer training group ➢ Resistance training group	Standard care (57 therapy hours over 4 weeks)	➢ Walking ability ➢ Muscle strength ➢ Cardiovascular endurance ➢ Muscular endurance of lower limbs ➢ Quality of life	➢ Ergometer and resistance training improved lower limb muscle strength, walking ability, and cardiovascular endurance ➢ 10-metre walk test improved more with resistance training than ergometer training between two and four weeks of intervention (p = 0.022). Ergometer training (p = 0.012 and 0.005, respectively) and resistance training (p = 0.025 and 0.007, respectively) caused significant improvements of the 10-metre walk test from baseline to two and four weeks of intervention. ➢ Maximum muscle force improved more with ergometer training, when compared to standard care, from baseline to four weeks of intervention (p = 0.009)

							➢ **Performance** increased between baseline and two weeks of intervention in the ergometer training (p = 0.001) and resistance training groups (p = 0.043), but not in the control group ➢ **Heart rate** after one-minute cool-down decreased stronger between baseline and two and four weeks in the ergometer training group, compared to both, the control (p = 0.001 and 0.048, respectively) and resistance training groups (p = 0.023 and 0.035, respectively)
Wollersheim et al 2019 **[69]**	Germany	Exploratory randomised interventional trial	50 adult patients	Neuromuscular electrical stimulation or whole-body vibration in addition to early protocol-based physiotherapy	Early protocol-based physiotherapy only	➢ Muscle strength and function	Neuromuscular electrical stimulation did not improve muscle strength nor function at: ➢ **First awakening** (MRC median [IQR]: CPP 3.3 [3.0–4.3]; control 3.0 [2.7–3.4]; intervention 3.0 [2.1– 3.8]; p > 0.05 for all)

							➢ **ICU discharge** (MRC median [IQR]: CPP 3.8 [3.4–4.4]; control 3.9 [3.3–4.0]; intervention 3.6 [2.8–4.0]; p > 0.05 for all) ➢ **12-month follow-up** (MRC median [IQR]: control 5.0 [4.3–5.0]; intervention 4.8 [4.3–5.0]; p = 0.342 for all), but prevented muscle atrophy
Yayla and Ozer 2019 **[30]**	Turkey	Quasi-experimental with control group	102 adult patients	Early mobilisation protocol (51 patients)	Routine, non-standard mobilisation (51 patients)	➢ Richards-Campbell Sleep Questionnaire (RCSQ) ➢ Hospital LOS Development of post-operative late complications	➢ Patients in the experimental group had better improvement in: **RCSQ scores** ➢ Statistically significant difference observed on post-operative day 5 between the two groups (p < .05) ➢ **Shorter hospital LOS** (mean 9.14, SD 2.51 compared to the control group: mean 11.18, SD 3.08) ➢ **Fewer late complications** after surgery (23.5% of the patients compared to 43.1% of patients in the control group); p < .05

							➢ Early mobilisation is feasible in patients after cardiac surgery
Schujmann et al 2020 **[70]**	Brazil	RCT	99 adult patients	Early and progressive mobility program with five levels of activity (50 patients)	Conventional treatment. No pre-established routine (49 patients)	➢ Functional status ➢ Level of activity ➢ Respiratory status ➢ Muscle strength ➢ Mobility at ICU discharge	➢ Better functional status and more functionally independent patients in the intervention group compared with those in the control group (96% vs 44%; $p < 0.001$)

Table 2.4: Abbreviation List for Intervention Studies

APACHE II	Acute Physiology and Chronic health Evaluation
CI	Confidence Interval
CO	Cardiac Output
CPP	Cerebral Perfusion Pressure
HR	Heart Rate
ICP	Intracranial Pressure
ICU	Intensive Care Unit
IQR	Interquartile Range
LOS	Length of Stay
MAP	Mean Arterial Blood Pressure
MRC	Medical Research Council
NICU	Neurological Intensive Care Unit
RCSQ	Richards-Campbell Sleep Questionnaire
RCT	Randomised Control Trial
RICU	Respiratory Intensive Care Unit
SD	Standard Deviation
SF-36 PF	Short Form-36 Physical Function

SV	Stroke Volume
SVV	Stroke Volume Variation
USA	United States of America

Table 2.5: Summary of Included Observational Studies

Author	Country	Study Types	No. of Participants	Primary Outcome Measures	Primary Objectives	Main Findings
Patient Profiles						
Size et al 2005 **[71]**	Malawi	Retrospective Audit	339 critically ill patients	Not mentioned	To describe the profile of patients admitted to Queen Elizabeth Central Hospital ICU	➢ 81% of admissions were surgical patients ➢ 45% of admissions were ventilated ➢ 38% overall mortality rate
Hanekom et al 2006 **[72]**	South Africa	Prospective cohort observational study	159 patients	➢ Demographic information ➢ Admission diagnosis ➢ Surgery classification (elective or emergency) and co-morbidities ➢ APACHE II score ➢ ICU length of stay (LOS) ➢ Mortality	To describe the baseline data of patients admitted to the surgical intensive care unit in a tertiary hospital in the Western Cape, and their outcome at discharge from the ICU	➢ Mean age was 49 ± 19.95 years ➢ Mean APACHE II score was 12.3 ± 7.19 ➢ 12.3% mortality ➢ ICU LOS was 5.94 ± 6.55 days ➢ Hypertension was the most frequent co-morbidity (42%) ➢ Age, sex, and co-morbidities had no significant association with mortality or ICU LOS ($p > 0.01$) ➢ Significant correlation between APACHE II scores, mortality, and ICU LOS ($p < 0.001$)
De Freitas 2010 **[73]**	Brazil	Observational prospective study (single centre)	146 critically ill patients	➢ Demographic characteristics ➢ Origin of admission ➢ Mortality rate	To understand the profile and severity of patients receiving physiotherapy	➢ 58.9% male, mean age 60.5 ± 19.2 years, from emergency service for non-surgical treatment ➢ Mean age of 60.5 ± 19.2 years

					after admission to the ICU using the APACHE II index	➢ Mean APACHE II score was 20 ± 7.3 (severe illness) ➢ 58.2% mortality ➢ Mean hospital LOS was 27.8 ± 25.2 days ➢ Mean ICU LOS was 23.2 ± 23.7
Chalya et al 2014 **[74]**	Tanzania	Descriptive prospective study (Single centre study)	312 patients	Not mentioned	To describe the characteristics and treatment outcome of major trauma patients admitted to ICU and to identify predictors of outcome	➢ Median age of 27 years ➢ Male; female ratio 5.5:1 ➢ Admissions mostly emergencies (95.2%) ➢ Road accidents most common cause of injuries (70.8%) ➢ 169 (54.2%) patients were intubated and ventilated for a median 7 days (range 1-32 days) ➢ Median ICU LOS was 8 days ➢ 32.7% mortality rate
Sawe et al 2014 **[75]**	Tanzania	Retrospective analysis (Multicentre study)	5627 critically ill patients	Not mentioned	To describe the disease patterns and clinical outcomes of patients admitted in Tanzanian tertiary ICUs	➢ Trauma (22.2%) was the main disease category ➢ Intracranial injury (12.5%) was the leading diagnosis ➢ Male: female patient ratio=1.4:1 ➢ Median age was 34 years, (IQR 21–53) years ➢ In-ICU mortality rate was 41.4% ➢ No mention of ventilation status ➢ Tanzanian tertiary ICUs lack infrastructure, staff and resources that influence the level of care provided that may affect the high mortality rate ➢ No intensive care specialist or nutritionist at any of the ICUs ➢ No arterial blood gas analyser at any of the ICUs

						➢ One of the ICUs had one ventilator for four ICU beds
Tadyanemhandu et al 2015 **[76]**	Zimbabwe	Cross-sectional study (multi-centre prospective record review)	137 critically ill patients	➢ Demographics ➢ Admission diagnoses ➢ Surgery classification ➢ Method and time of mechanical ventilation ➢ Physiotherapy techniques and frequency ➢ Length of stay	To describe the profile of patients and physiotherapy patterns in public sector Zimbabwean ICUs	➢ Mean age of patients was 36.0 ± 16.6 years ➢ 61 (45 %) patients had emergency surgery ➢ 72 (52.6 %) of patients were on mechanical ventilation on admission ➢ Mean duration on mechanical ventilation was 4.0 ± 2.7 days ➢ ICU LOS was 4.5 ± 3.0 days ➢ Most common used physiotherapy techniques: active-assisted exercises (66.4 %), deep breathing exercises (65.0 %) and forced expiratory techniques (65.0 %)
El-Fakhouri et al 2016 **[77]**	Brazil	Retrospective, descriptive study (single centre)	1936 critically ill patients	Sex, age, education, religion, race, origin, admission diagnosis, mortality rates, deaths and causes of death, average occupancy rate, length of stay	To describe the epidemiological profile of patients in a Brazilian ICU	➢ Mean age was 56.64 ± 19.18 years ➢ Patient population mostly males (57.91%) ➢ 19.83% mortality rate for ICU LOS >24 hours ➢ Mean ICU LOS was 12.77 ± 17.07 days ➢ Admissions were mostly for circulatory system diseases (25.5%) and trauma (23.03%)
Mobilisation Practices						
Skinner et al 2008 **[78]**	Australia	Postal questionnaire	111 intensive care physiotherapists	Not mentioned	To identify rehabilitation and exercise prescription practices in Australian	➢ Rehabilitation practice varies widely throughout Australia ➢ Almost all (94%, 104/111) physiotherapists prescribed exercise routinely for ICU patients: active and active-assisted exercise techniques with

					intensive care units To determine the outcome measures used for the evaluation of exercise intervention	mobilisation the most common activities used ➢ 71% (79/111) of respondents prescribed modified exercise routinely for mechanically ventilated patients ➢ Only (34%, 38/111) of physiotherapists used outcome measures routinely in ICU exercise prescription and included: SpO_2, respiratory rate and distance (metres) walked ➢ In 62/111 (59%) ICUs, physiotherapists were responsible for deciding whether the patient should exercise ➢ Further research required to enable adequate evaluation of exercise prescription and rehabilitation in ICUs
Garzon-Serrano et al 2011 [79]	USA	Prospective observational study (single unit)	63 adult critically ill patients	➢ Mobilisation level measured on the SICU optimal mobilisation scale	To evaluate whether the level of mobilisation achieved, and the barriers thereof differ between nurses and physical therapists	➢ Physical therapists mobilise their critically ill patients to higher levels compared to nurses (2.3 ± 1.2 mean ± SD versus 1.2 ± 1.2, respectively $p < .0001$) ➢ Different barriers to mobilisation identified: ➢ Haemodynamic instability (26% versus 12%, $p = .03$) and renal replacement therapy (12% versus 1%, $p = .03$) were barriers rated higher by nurses ➢ Neurologic impairment rated higher by physical therapists (18% versus 38%, $p = .002$)
Berney et al 2013 [80]	Australia New Zealand	Prospective observational point	514 critically ill patients	➢ Demographic information ➢ Admission diagnosis	To describe mobilisation practices for	➢ Mean age was 59.2 ± 16.7 years ➢ 5 % adverse event rate

		prevalence study (multicentre)		➢ Mobilisation practices	critically ill patients, especially those requiring >48 hours mechanical ventilation	➢ No patient on mechanical ventilation sat out of bed or walked ➢ Further research needed to confirm results
Chawla et al 2014 **[81]**	India	Web-based survey	659 physicians (11.1% response rate)	➢ Demographics ➢ Delirium assessment ➢ Sedation practices ➢ Pain management	To study current practice patterns related to mobilisation, analgesia, relaxants, and sedation and help standardise best practices in the ICU	➢ Midazolam (94.99%) and Fentanyl (47.04%) were the most common sedative and analgesic agents used respectively ➢ Ramsay's Sedation Scale (56.1%) and Visual Analogue Scale (48.07%) were the preferred sedation and pain scales respectively ➢ CAM (Confusion Assessment Method)-ICU was the most preferred method of delirium assessment, although 65.6% of participants reported not assessing delirium in ICU ➢ Despite awareness of the benefits of early mobilisation, the implementation thereof is low ➢ Benzodiazepines (Haloperidol) are still the predominant ICU sedative used ➢ Giving analgesia before sedation is not practiced ➢ Pain, sedation, and delirium are not monitored
Doherty-King et al 2014 **[82]**	USA	Time and motion design (qualitative)	15 registered nurses	➢ Frequency and duration of mobility events	To evaluate the frequency and duration of nursing care activity related to	➢ Nurses rarely initiated mobility for hospitalised older patients and most often engaged them in low-level activity ➢ 15 of 47 (31.9%) patients had no mobility events during their observation

					mobility in acute care settings and determining who initiates the mobility	period, most of which were initiated by patients ➢ Highest mean duration of mobility events was with walking and standing, (1.8 and 1.5 min, respectively) ➢ For dependent patients (n = 16), 5 (31.3%) had no mobility events during their observation period ➢ Transferring was the most frequently observed mobility event, with a mean of 0.8 events per patient per observation period
Malone et al 2015 **[83]**	USA	Cross-sectional survey (national)	667 physical therapists	➢ Practitioner demographics ➢ ICU staff patterns ➢ Methods of ICU training ➢ Barriers to rehabilitation ➢ Patient factors that influence physiotherapists' clinical decision-making	To determine current physical therapist ICU practice	➢ Low response rate: 29% (667/2,320) ➢ Number of physical therapists per 100 beds were: ➢ 2.4 (1.7-3.3) for the hospital and 6.3 (4.0-10.0) for the ICU ($p < .001$) ➢ Academic hospitals had lower ICU staffing than community hospitals (academic:5.4[3.6-9.2]; community: 6.7 [4.4-10.0]; $p = .005$) ➢ Participants had an average, 13 (5.5-22) years of experience, 10 (5-17) years of experience working in the acute care hospital setting, and 7.8 (3-15) years of experience working in the ICU ➢ Physical therapists at academic hospitals had greater acute care experience (academic: 13.2 years [11.9-14.4]; community: 11.0 years [10.1-12.0]; $p = .009$) and greater ICU experience (academic: 10.9 years [9.7-

						12.2]; community: 9.3 years [8.-10.2]; p = .03) ➢ Only 31.8% of the physical therapists had received formal ICU training ➢ Barriers to ICU rehabilitation exist: Limited staff and training, departmental prioritising policies
Pires-Neto et al 2015 **[25]**	Brazil	Retrospective medical record review (single centre)	275 critically ill patients	Secondary aims ➢ Record adverse events ➢ Verify and compare the provision of mobilisation therapy in patients with long and short ICU LOS ➢ Investigate if there is a relationship between the activity level performed in the ICU and ICU mortality rate, mortality 1 year after hospital discharge, discharge destination, and number of hospital readmissions	To investigate early mobilisation practice in a Brazilian ICU and to investigate the relationship between physical activity level and clinical outcomes	➢ Mostly male patients (52%) ➢ Most patients were medical and admitted from emergency n=62; 52%) ➢ Mean age was 49 ± 18 years ➢ Mobilisation in ICU was safe and feasible with in-bed exercises being the most common used activity ➢ A small number of mechanically ventilated patients mobilised out of bed ➢ Median duration of mechanical ventilation =3 (4) days ➢ Median ICU LOS=8 (10) days
Skinner et al 2015 **[84]**	Australia	Observational cohort study (single centre)	100 critically ill patients	➢ Total number of physiotherapy, exercise physiology, or allied health assistant entries ➢ Details of respiratory therapy and mobility/rehabilitation activities performed	To investigate usual care physiotherapy during acute hospitalisation	➢ Mostly male with a median (interquartile range) age of 61 (49-3) ➢ Median ICU LOS of 4.3 (3-7) days ➢ 3.5% adverse event rate ➢ 86% of Australian ICUs have blanket referral system: physiotherapists routinely assess all ICU patients daily for mobilisation

						➢ Patients received a higher frequency of physiotherapy in the ICU than in the wards ➢ Positioning, ventilator lung hyperinflation, and suctioning were the most frequently performed respiratory care activities in the ICU ➢ Ambulation from the bed with a physiotherapist was a median 5 (3-8) days after ICU admission Consensus needed on consistency of data collection in order to compare outcomes internationally
The TEAM Study Investigators 2015 **[35]**	Australia New Zealand	Prospective cohort study (multicentre)	192 critically ill patients	➢ Mobilisation during invasive ventilation ➢ Sedation depth ➢ Duration of mechanical ventilation ➢ ICU-acquired weakness (ICUAW) at ICU discharge ➢ 90-day mortality ➢ 6-month functional recovery	To investigate ICU environment and practices, and to evaluate organizational characteristics that influence EM practice	➢ International ICU structure and practice is heterogeneous ➢ Several factors influence mobility practice i.e., MDT rounds; presence of a dedicated physiotherapist, country; setting daily goals for patients; nurse/patient ratios ➢ 192 patients studied (mean age 58.1 ± 15.8 years ➢ Mean Acute Physiology and Chronic Health Evaluation (APACHE) (IQR) II score was 18.0 (14 to 24)) ➢ 90-day mortality was 26.6% (51/192) ➢ Patients who died by day 90 had a mean MRC score of 28.9 ± 13.2 compared with 44.9 ± 11.4 for day-90 survivors ($p < 0.0001$) ➢ 52% of patients whose strength was assessed had ICU-acquired weakness (Medical Research Council Manual

						Muscle Test Sum Score (MRC-SS) score < 48/60) at ICU discharge ➢ MRC-SS score was higher in those patients who mobilised while mechanically ventilated (50.0 ± 11.2 versus 42.0 ± 10.8, p = 0.003)
Bakhru et al 2016 **[85]**	International	International survey	951 ICU leaders (nurses and physiotherapists; 64% response rate)	**Rationale:** EM improves outcomes for mechanically ventilated patients Structural and organizational variation may affect implementation of EM practices	To evaluate organisational characteristics that enable EM practice	➢ 64% response rate (951 ICUs) ➢ EM practices present in 40% of French ICUs, 59% of German ICUs,52% of UK ICUs, and 45% of US ICUs EM practice was associated with: ➢ MDT rounds (odds ratio [OR], 1.77; p = 0.001) ➢ Setting daily goals for patients (OR, 1.62; p = 0.02) ➢ Presence of a dedicated physiotherapist (OR, 2.48; p < 0.001) ➢ ICUs being in Germany (reference, United States; OR, 2.84; p < 0.001) ➢ EM practice was also associated with higher nurse staffing levels (1:1 nurse/patient ratio as a reference; 1:2 nurse/patient ratio OR, 0.59; p = 0.05; 1:3 nurse/patient ratio OR, 0.33; p = 0.005; 1:4 or less nurse/patient ratio OR, 0.37; p = 0.005) ➢ Walking mechanically ventilated patients, use of a bedside cycle, or neuromuscular electrical stimulation as part of EM practice was rarely mentioned by participants

						➢ Physical therapy initiation, barriers to EM, and equipment were highly variable among participants
Lottering and van Aswegen 2016 **[86]**	South Africa	Questionnaire	108 physiotherapists	Not mentioned	To describe the current practice of physiotherapists in South African ICUs, and whether it is evidence-based and to determine if physiotherapists' practice in ICUs had changed since a previous report	➢ 33.9% response rate ➢ ICU chart assessment (n=90, 83.3%), chest auscultation (n=94, 81.8%) and cough effort (n=81, 75%) performed "very often" ➢ Manual chest clearance (n=101, 93.5%), in-bed mobilisation and positioning (n=91, 84.3%; n=91, 84.3%, respectively), airway suctioning (n=89, 82.4%), out-of-bed mobilisation (n=84, 77.8%), deep breathing exercises (n=83, 76.9%) and peripheral muscle-strengthening exercises (n=72, 73.1%) performed "very often" ➢ More participants used intermittent positive pressure breathing (57 v. 28%, p = 0.00), used adjustment of mechanical ventilation (MV) settings (30 vs. 15%, p = 0.01), were involved with weaning patients from MV (42 v. 19%, p = 0.00) and used incentive spirometry (76 v. 46%, p = 0.00) than reported previously ➢ More participants performed suctioning (99 vs. 70%, p = 0.00), extubation (60 vs. 25%, p = 0.00) and adjustment of MV settings (30 vs. 12%, p = 0.02) than reported internationally ➢ Physiotherapy practice in ICUs is evidence based

						➢ Mobilisation, exercise therapy and respiratory therapy are the main areas of focus ➢ More research needed on physiotherapy weaning from MV, and use of functional outcome measures
Johnson et al 2017 **[87]**	USA	Retrospective chart review	2568 patients	➢ Timing and amount of physical therapy in the cardiothoracic (CT) ICU	To determine existing mobilisation practices in the cardiothoracic ICU in patients with cardiac and respiratory problems requiring intervention	➢ Time to first physical therapy evaluation in the ICU and hospital, and mean days of physical therapy treatment associated with hospital length of stay ➢ Patients post CABG and Valve surgery had fewer mean days of physical therapy than all other subgroups (3.6 ± 2.6 and 4.1 ± 3.2 days respectively) ➢ Patients post CABG and valve surgery had the shortest days to first physical therapy in ICU (1.5 ± 1.1 and 1.5 ± 1.0 days respectively) ➢ Patients post CABG and valve surgery also had the shortest ICU (4.0 ± 2.6; 4.1 ± 2.9 respectively) and hospital LOS (10.4 ± 6.9; 17.2 ± 16.9 respectively) ➢ Patients in the CT ICU experience shorter time to first PT evaluation and treatment compared to that of those in the wards
Jolley et al 2017 **[88]**	USA	2-day Multicentre point prevalence study	Adult patients not younger than 18 years with acute respiratory failure needing	Not mentioned	To determine the prevalence and character of mobility for intensive care unit (ICU) patients with acute	➢ Mobility activities provided by physical therapists and occupational therapists were infrequent: Prevalence 32% (247/770 patient days) ➢ More non-ventilated patients received PT/OT (48% vs. 26%, p = < 0.001)

			mechanical ventilation		respiratory failure in US ICU	➢ Non-mechanically ventilated patients were significantly more likely than mechanically ventilated patients to achieve out of bed mobility (56% vs. 16%, p < 0.001) ➢ PT/OT involvement strongly associated with progression to out of bed mobility (adjusted OR 138.4, 95% CI 29.8-643.5, p < 0.001) ➢ MV via an ETT or tracheostomy tube negatively associated with achieving out of bed mobility [endotracheal tube adjusted OR 0.10, 95% CI 0.05-0.20, tracheostomy tube adjusted OR 0.20, 95% CI 0.09-0.47, p < 0.001] ➢ Delirium also associated negatively with achieving out of bed mobility (adjusted OR 0.41, 95% CI 0.18-0.93, p = 0.003)
Nickels et al 2019 **[89]**	Australia	Cohort study (single centre)	3222 critically ill patients	➢ Time from stability to patients' first completed sitting and upright activities	To describe time to initiation of exercise after ICU admission and achieving stability Examine factors associated with whether sitting and upright activities occurred in ICU Examine factors associated with time taken to commence these	➢ 57% of patients completed exercise interventions ➢ Exercise started a median (IQR) 2.3 (1.3-4.4) days after stability for upright activities and 2.7 (1.5-5.7) days for sitting ➢ Exercise interventions are delayed in critically ill patients ➢ Patients were mostly male (67%) ➢ Mean (SD) age of 54 (18) years ➢ Admission mostly for medical reasons (65%) ➢ ICU LOS a median (IQR) of 4.9 (3.0-9.5) days

					activities after stability had been achieved	
Sibilla et al 2020 **[90]**	Switzerland	Point prevalence study (multi-centre)	161 mechanically ventilated patients 37 clinicians	➢ Level of mobilisation ➢ Safety events ➢ Mobilisation barriers	To evaluate the current mobilisation practices across Switzerland	➢ Mobilisation during mechanical ventilation occurred infrequently ➢ Of the 161 MV patients, 33% (n=53) had active mobilisation ➢ Only 2% (n=4) of MV patients walked ➢ Greater organ failure associated with lower mobilisation (respiratory Sequential Organ Failure Assessment score: $p = .037$, cardiac: $p = .008$, neurology: $p < .001$) ➢ Mostly male (n=113, 70%) ➢ Safety events related to mobilisation were (20%, n=33) ➢ Most common barriers were medical contraindications (14%, n=22), cardiovascular instability (11%, n=17), and deep sedation (13%, n=8)
Timenetsky et al 2020 **[91]**	Brazil	Point prevalence study (multi-centre)	358 patients	➢ Demographics ➢ ICU characteristics ➢ Prevalence of mobilisation activities ➢ Level of mobilisation ➢ Reasons for not mobilizing patients	To evaluate the mobility practice in Brazilian ICUs of critically ill patients	➢ Mean age was 65 (53-76) years ➢ Mostly males (n=190; 53%) ➢ Admitted mostly for respiratory conditions (n=120; 33.5%) ➢ Most patients on MV (n=158; 44.1%) ➢ Almost no active mobilisation in mechanically ventilated patients ➢ Mobilisation activities in critically ill patients was highly prevalent ➢ The presence of an institutional early mobility protocol was associated with a higher chance of mobilisation
Knowledge and Barriers to Early Mobilisation						

Winkelman and Peerebom 2010 **[92]**	USA	Descriptive, 2-centre study (qualitative, semi-structed interviews)	33 nurses	➢ Barriers to and facilitators of progressive mobility	Nurses' perceptions of the barriers to and facilitators of progressive mobility	**Barriers** ➢ Patient instability ➢ Sedation ➢ Respiratory status ➢ Safety concerns for the patient	**Facilitators** ➢ Compliant patient ➢ Good oxygen reserve ➢ Physician orders ➢ Specialized beds that assist with mobility
Leditschke et al 2012 **[24]**	Australia	Prospective audit (single centre)	106 critically ill patients	➢ Number of patient days mobilised ➢ Type of mobilisation ➢ Adverse events ➢ Reasons for inability to mobilise	To identify barriers to early mobilisation in ICU	➢ Critically ill patients can be safely mobilised in ICU ➢ 70 (66%) patients were male ➢ Mean age was 60±20 years ➢ Surgical postoperative admissions in 47 patients (44%) ➢ Trauma admissions in 14 patients (13%) ➢ Median ICU LOS was 1 (1-198) day ➢ Patients were mobilised on 176 (54%) of 327 patient days ➢ Adverse events occurred in 2 of 176 mobilisation episodes (1.1%) ➢ Vascular access devices sited in the femoral region, timing of procedures and agitation or reduced level of consciousness were barriers to mobilisation	
Balas et al 2013 **[93]**	USA	Prospective, before-after, mixed methods study (single-centre)	MDT ICU team	➢ Facilitators and barriers to ABCDE bundle adoption	To identify facilitators and barriers to the ABCDE bundle, and to evaluate the effectiveness	**Facilitators** ➢ Daily MDT rounds ➢ Engagement of implementation leaders ➢ Education	**Barriers** ➢ Safety concerns ➢ Communication and co-ordination of care challenges

					of its implementation	➢ ABCDE bundle quality	➢ Limited knowledge ➢ Workload concerns
Nydahl et al 2014 **[94]**	Germany	Point prevalence study (web-based survey)	105 clinicians 783 critically ill patients	➢ Hospital and ICU characteristic ➢ Level of patient mobilisation ➢ Associated barriers ➢ Adverse events during mobilisation	To build on the existing knowledge regarding early mobilisation in routine ICU practice	➢ Only 24% (n=185) of all mechanically ventilated patients and only 8%, 39%, and 53% of patients with an endotracheal tube, tracheostomy, and non-invasive ventilation respectively were mobilised out of bed ($p < 0.001$) ➢ The most common perceived barriers to mobilising patients out of bed were cardiovascular instability (17%) and deep sedation (15%) ➢ Deep sedation was more commonly reported as a barrier for mechanically ventilated patients with ETT versus tracheostomy versus NIV (17% vs 6% vs 0%; $p < 0.001$) ➢ Mobilisation out of bed was not associated with a higher frequency of complications	
Barber et al 2015 **[95]**	Australia	Qualitative descriptive study (focus groups)	25 ICU clinicians (medical n=12; nursing n=6; physiotherapy n=7)	Barriers and facilitators to EM	To determine the barriers and facilitators of EM in the ICU	**Facilitators** ➢ Organisational change ➢ Improved communication ➢ Improved resources	**Barriers** ➢ Communication ➢ Lack of resources ➢ Unit culture ➢ Leadership
Holdsworth et al 2015 **[96]**	Australia	Cross-sectional survey	22 MDT staff (18% response rate)	Not mentioned	To explore the barriers and enablers toward the mobilisation	**Enablers** ➢ Better respiratory function	**Barriers** ➢ Perception that EM is time consuming

					of ventilated patients To inform development of targeted implementation interventions	➢ Improved function ➢ Reduced muscle wasting/weakness ➢ Increased staff availability ➢ Teamwork	➢ Risk of dislodgement of lines ➢ Unstable patient ➢ Negative workplace culture
Koo et al 2016 **[1]**	Canada	Cross-sectional survey	311 clinicians (physicians n=194; physiotherapists n=114)	➢ Knowledge ➢ Perceptions ➢ Mobility practice	To assess current knowledge, perceptions and practices of Canadian physicians and physiotherapists regarding acquired weakness and early mobilisation in adults in the ICU	➢ 71.3% response rate ➢ 214 participants (68.8%) underestimated the incidence of ICU-acquired weakness in ICU ➢ 186 (59.8%) had insufficient knowledge or skills to mobilise patients receiving mechanical ventilation ➢ Excessive sedation, medical instability, limited staffing, safety concerns, insufficient guidelines sufficient equipment were common perceived barriers to early mobilisation	
Anekwe et al 2019 **[97]**	Canada	Cross-sectional survey (multi-centre)	138 ICU clinicians (nurses, physicians, respiratory therapists, physiotherapists)	➢ Perceived barriers, facilitators, knowledge, and practice patterns of early mobilisation	To assess the knowledge and practice patterns of ICU clinicians, and the barriers and facilitators to early mobilisation	➢ 50% response rate ➢ EM not perceived as top priority in 49% of participants ➢ Clinicians not fully aware of the benefits of early mobilisation according to current literature ➢ Although 65.2% of participants reported knowledge of literature and clinical studies on EM, only 40.6% correctly answered the incidence of ICUAW (p = .050)	

						➢ More than half of participants (58%) did not feel well trained and informed to mobilise mechanically ventilated patients ➢ 73.2% reported that the initial physiotherapy assessment in their ICU requires a doctor's referral ➢ Chest physiotherapy, range of motion (ROM) exercises, in and out of bed activities, and transfers are frequently used by physiotherapists ➢ Neuromuscular electrical stimulation, tilt table, gait training, treadmill walking, and cycle ergometry are never or infrequently used ➢ High level of disagreement on the maximal allowed level of activity in critically ill patients ➢ 6.5% of participants reported that patients are referred for outpatient rehabilitation after hospital discharge ➢ 78.6% of doctor participants reported to routinely use standardised sedation scales or a protocol to adjust sedation to waken patients to promote activity
Berney et al 2019 **[98]**	Australia	Prospective 3-part study: (survey on influential factors on EM; development of an EM	507 clinicians (ICU medical, nursing and physiotherapy staff)	➢ Description of patient and clinician samples ➢ Adverse events associated with out-of-bed rehabilitation ➢ Factors prioritised by ICU clinicians	To develop a guide that objectively identifies the most discriminative variables involved in providing out-	➢ Presence of an ETT still a major barrier to the provision of rehabilitation for critically ill patients ➢ Even though rehabilitation improves muscle strength, the presence of ICUAW did not influence clinicians' decisions regarding mobilisation

		guide; assessment of clinician decision making regarding mobilisation			of-bed rehabilitation, measure the effect of this decision and to identify the factors ICU clinicians think most influential in that decision	
Chaplin and McLuskey 2019 [99]	UK	Semi-structured interviews Qualitative study (single centre)	12 critical care nurses	➢ Prioritising mobilisation ➢ Team roles and responsibilities related to mobilisation ➢ Influences on decision-making	To explore how nurses decide on mobilising critically ill patients and the factors that influence their decisions	➢ Knowledge gaps on early mobilisation exist ➢ Mobilisation is given low priority ➢ Decisions to mobilise or not were influenced by time constraints, staffing levels, and unit demands ➢ Lack of communication, no MDT collaboration and role uncertainty are prevalent ➢ Education and MDT training needed
Lin et al 2020 [100]	Australia	Prospective questionnaire (single centre)	82 nurses, physicians, and physiotherapists	Knowledge, attitudes, behaviour, and perceived facilitators and barriers	To assess clinician perceptions, knowledge, attitudes, and behaviours, and perceived barriers and facilitators towards mobilising critically ill ventilated patients in the ICU	➢ Response rate: 56.6% (82 of 145) ➢ Early mobilisation not perceived as a top priority by 40.2% of participants ➢ Clinicians have various levels of knowledge on early mobilisation ➢ Mean overall knowledge score of all participants was 4.1 ➢ SD = 1.4 out of 6 ➢ **Barriers:** medical instability, delirium, sedation, and limited staffing ➢ **Facilitator:** most participants viewed EM as important

						➢ Opinions vary on timing and suitability for EM
Wang et al 2020 **[101]**	China	Cross-sectional survey	227 ICU nurses	➢ Knowledge regarding early mobilisation ➢ Attitudes towards early mobilisation ➢ Main aspects of early mobilisation that ICU nurses feel confused and/or negative about ➢ Perceived barriers towards early mobilisation	To investigate the knowledge, attitudes, and perceived barriers of ICU nurses regarding early mobilisation of ICU patients	➢ 100% response rate ➢ Most ICU nurses have good knowledge (> 96.5%) of and good attitudes towards EM ➢ ICU nurses who perceived fewer barriers had higher knowledge scores and more positive attitudes than those with more barriers ($p < .01$) ➢ **Main barriers:** heavy workload (76.8%) and work risks (42.3%); lack of staff (41.4%), equipment (50.2%) and training (47.1%), written protocols or guidelines (50.2%)
Safety and Feasibility of Early Mobilisation						
Kho et al 2015 **[27]**	USA	Prospective study (single centre)	688 critically ill patients 181 patients received in-bed cycling	Safety and feasibility of in-bed cycling	To evaluate the feasibility and safety of in-bed cycle ergometry as part of routine physiotherapy in ICU	➢ In-bed cycling as part of routine physiotherapy in ICU is safe and feasible ➢ Median (IQR) time from medical ICU admission to first PT intervention and first cycling session: 2 (1-4) and 4 (2-6) days, respectively ➢ Median (IQR) cycling session duration: 25 (18-30) minutes ➢ Only one adverse event (0.2%) occurred ➢ Further studies on benefits of in-bed cycling are needed
Hickmann et al 2016 **[13]**	Belgium	Observational study (single centre)	171 critically ill patients	**Secondary Objectives:** ➢ Safety of EM ➢ EM rate in MV related to hypoxaemia and severity and patients' perception	To demonstrate that early mobilisation within the first 24hrs of ICU admission is	➢ Mobilisation within the first 24 hours of ICU admissions is feasible and well-tolerated, even in patients receiving mechanical ventilation, vasopressors, or renal replacement therapy

					feasible and well tolerated in most critically ill patients	➢ Barriers to early mobilisation: lack of staff, diagnostic or surgical procedures, patients' refusal, severe haemodynamic instability ➢ Median time from ICU admission to first early mobilisation activity was 19 hours (IQR = 15-23)
Kumble et al 2017 **[31]**	USA	Retrospective case study	A 55-year-old patient	Haemodynamic and intracranial pressure changes during progressive mobility	To report on haemodynamic and ICP responses during progressive mobility interventions in a critically ill patient with intracerebral haemorrhage (ICH) requiring two EVDs (extraventricular drainage devices)	➢ Progressive, device-assisted early mobilisation was feasible and safe in this critically ill patient with haemorrhagic stroke ➢ ICP remained within normal range (9-14 mmHg) during verticalization (ANOVA p = 0.39) ➢ No device dislodgment or any other safety concern was noted during any mobility intervention ➢ Further research needed on haemodynamic and neurophysiological responses associated with early mobility in acute stroke
Lai et al 2017 **[16]**	Taiwan	Retrospective observational study	63 patients in the before-protocol group and 90 in the after-protocol group	➢ MV duration ➢ Rate of successful weaning ➢ ICU and hospital LOS	To evaluate the effects of a quality improvement program to introduce EM on the outcomes of patients receiving MV in the ICU	➢ EM for patients in the after-protocol group receiving ventilatory support in ICU shortened MV duration (4.7 days vs 7.5 days; $p < .001$) and ICU LOS (6.9 days vs 9.9 days; $p = .001$) ➢ Early mobilisation was negatively associated with the duration of MV ($\beta = .269$; $p < .002$; 95% confidence interval [CI], -4.767 to -1.072)

Nickels et al 2020 **[26]**	Australia	Observational process evaluation (as part of a two-arm parallel phase II RCT)	36 critically ill patients	➢ Acceptability ➢ Safety and feasibility	To examine the acceptability, safety, and feasibility of in-bed cycling with critically ill patients	➢ In-bed cycling was regarded as an acceptable intervention to patients, family, and clinicians ➢ In-bed cycling was safe and feasible ➢ Adverse event rate: 0.7%
Delirium						
Mo et al 2016 **[102]**	USA	Online survey	635 physician, pharmacist, nurse, and mid-level practitioner members of the Society of Critical Care Medicine	➢ Delirium practice in ICU ➢ Awareness and adoption of the 2013 PAD guidelines	To determine current delirium practices in the ICU and evaluate awareness and adoption of the 2013 PAD guidelines	➢ 90% of participants used the Confusion Assessment Method for the ICU (CAM-ICU) to screen for delirium ➢ Most respondents (97%) use pharmacological agents to treat hyperactive delirium ➢ EM used in most ICUs (83%) for prevention of delirium ➢ Awareness and use of PAD guidelines assessed (90% awareness) and have adjusted accordingly
Oxenboll et al 2016 **[48]**	Denmark	Qualitative focus group study	34 nurses (n=20) and physicians (n=14)	➢ Professional role issues ➢ Instrument reliability ➢ Clinical consequence	To identify nurses' and physicians' perceived barriers to using the CAM-ICU in Danish ICUs	➢ CAM-ICU gold standard for delirium detection ➢ ICU nurses and physicians raised concerns regarding the use of the CAM-ICU for delirium detection ➢ Reliability of the CAM-ICU assessment tool in non-sedated patients and multi-organ failure patients influenced by sedatives/opioids has received concern from nurses ➢ After CAM-ICU assessment, physicians lacked evidence-based treatment options

						➢ Recommended that nurses and physicians receive more training in the use of the CAM-ICU tool
Mortality						
Goldhill et al 2004 **[19]**	UK	Prospective observational study (multi-centre)	7190 critically ill patients	➢ Mortality	To explore the relationship between hospital mortality and LOS in the wards before admission to the ICU	➢ The longer patients were in hospital before ICU admission, the higher their mortality ➢ Hospital mortality increased significantly ($p < 0.0001$) in relation to time on hospital wards before ICU: ➢ 47.1% (standardised mortality ratio 1.09) for patients in hospital 0-3 days before ICU admission up to 67.2% (standardised mortality ratio 1.39) for patients on the wards for more than 15 days before ICU ➢ LOS before ICU admission an independent predictor of hospital mortality (odds ratio per day 1.019; 95% confidence interval 1.014-1.024)
Lee et al 2015 **[103]**	South Korea	Retrospective study (single centre)	1190 critically ill patients	➢ Post ICU mortality ➢ ICU readmission	To evaluate the efficacy of the discharge Acute Physiology and Chronic Health Evaluation (APACHE) II score in predicting post-intensive care unit (ICU) mortality and ICU readmission	➢ Discharge APACHE II score may be useful in predicting post-ICU mortality and ICU readmission ➢ Discharge APACHE II score (odds ratio [OR] 1.1, 95% CI 1.01 to 1.22, p = 0.024), unplanned ICU readmission (OR 20.0, 95% CI 7.6 to 53.1, p = 0.001), eosinopenia at ICU discharge (OR 6.0, 95% CI 1.34 to 26.9, p = 0.019), and hospital length-of-stay before ICU admission (OR 1.02, 95% CI 1.01 to 1.03, p = 0.021) were significant

						independent factors in predicting post-ICU mortality
Sauro et al 2020 [104]	Canada	Retrospective cohort study (multi-centre)	49447 patients	➢ Documented AEs	To investigate the frequency and type of adverse events (AEs) among critically ill patients in ICU	➢ Mostly males (63.8%) ➢ Median age was 62 (51-72) ➢ Elective, non-surgical admissions (70.8%) ➢ Most common AEs were respiratory complications (10%) and hospital-acquired infections (9%) ➢ AEs were associated with having ≥ 2 co-morbidities; being admitted to ICU from theatre or wards; and readmission to ICU during hospital stay ➢ Documented AEs are associated with longer stays and increased mortality

Table 2.6: Abbreviation List for Observational Studies

ABCDE	Awakening and Breathing Co-ordination, Delirium Monitoring/Management, and Early Mobility
APACHE II	Acute Physiology and Chronic health Evaluation
ANOVA	Analysis of Variance
CT ICU	Cardiothoracic
CI	Confidence Interval
CAM-ICU	Confusion Assessment Method-Intensive Care Unit
CABG	Coronary Artery Bypass Graft
EM	Early Mobilisation
ETT	Endotracheal Tube
ICU	Intensive Care Unit
ICUAW	Intensive Care Unit Acquired Weakness
IQR	Interquartile Range

ICH	Intracranial Haemorrhage
ICP	Intracranial Pressure
LOS	Length of Stay
MV	Mechanical Ventilation
MRC	Medical Research Council
MRC-SS	Medical Research Council Manual Muscle Test Sum Score
MDT	Multidisciplinary Team
NIV	Non-Invasive Ventilation
OT	Occupational Therapy
OR	Odds Ratio
PAD	Pain Agitation Delirium
PT	Physical Therapy
RCT	Randomised Control Trial
ROM	Range of Motion
SD	Standard Deviation
SICU	Surgical Intensive Care Unit
UK	United Kingdom
US	United States
USA	United States of America

Table 2.7: Summary of Included Quality Improvement Programmes

Author	Country	Title/Objective	Main Points
Hopkins et al 2007 **[105]**	USA	Transforming ICU Culture to Facilitate Early Mobility	**Respiratory Failure Care Process Model Developed at One Hospital:** 1. A care manager with extensive clinical experience assigned to coordinate care activities for the entire hospital stay. 2. An MDT standard care process designed by practicing clinicians used to guide care in all patients 3. Outcomes-oriented data collected 4. Interdisciplinary documentation used 5. Tools to manage the care process were developed 6. Longitudinal outcome data collected ➢ Early activity programme included (reduced mean ICU and hospital LOS) ➢ MDT collaboration important to implement this care model ➢ Barriers to EM/care identified and addressed, sedation addressed
Bassett et al 2012 **[106]**	USA	Integrating a multidisciplinary mobility programme into intensive care practice To create a progressive mobility initiative that will help ICU teams to address key cultural, process and resource opportunities in order to integrate early mobility into daily care practices	➢ Multicentre initiative (13 units across 8 hospitals) ➢ Mobility culture improved and an expectation of early mobility was born ➢ MDT collaboration invaluable ➢ Initiative spanned 14 months ➢ No significant differences demonstrated in any of the mobility intervention group measurement however, a reduction in ventilator days (3.0 days pre vs. 2.1 days post) approached significance (p = 0.06) 1. **Design of a progressive mobility tool** Step-by-step progressive mobility guide, taking safety into consideration; Agitation and sedation (RASS) also assessed 2. **Workshop/Education** Key practice elements addressed; Toolkit to help identify barriers to mobilisation; Discussion of challenges and clinical

			strategies to transform mobility culture; MDT collaboration with a mobility champion 3. **Support with adopting new practices** Tools, resources, discussion forum to enable culture transformation; Incentives for adopting and maintaining mobility culture 4. **Qualitative evaluation of the processes and outcomes** Mobility integrated into daily care; buy-in of EM maintained; mobility tool welcomed: retrospective chart review RCTs needed to determine the impact of progressive mobility protocols
Engel et al 2013 **[107]**	USA	ICU Early Mobilisation: From Recommendation to Implementation at Three Medical Centres To compare and contrast the process used to implement an early mobility program in ICUs at three different medical centres and to assess their impact on clinical outcomes in critically-ill patients	➢ Multicentre Study ➢ Used the **Plan-Do-Study-Act** Approach ➢ MDT team: mobility champion led ➢ Barriers to EM identified and addressed ➢ EM quality improvement programme decreased delirium, ICU, and hospital LOS, need for sedation at all three institutions
Knoblauch et al 2013 **[108]**	USA	Financial Implications of Starting a Mobility Protocol in a Surgical Intensive Care Unit	➢ Single centre study ➢ More staff hired to deliver mobility ➢ Education of staff regarding mobility ➢ No consensus on dose of mobility ➢ Cost savings in terms of ICU and hospital LOS could not be demonstrated (influx of ARDS patients during study period)
Harris and Shahid 2014 **[109]**	USA	Physical therapy–driven quality improvement to promote early mobility in the intensive care unit	➢ Single centre study ➢ After starting this programme, more patients received physiotherapy (from 364 in 2011-2012 to 542 in 2012-2013)

			➢ MDT collaboration important, education, awareness of current referral process highlighted and changed, barriers to EM identified and addressed ➢ PT advocated for EM in ICU ward rounds ➢ A physical therapist–led initiative can help establish an ICU culture that supports early mobilisation
Castro et al 2015 **[110]**	USA	Early Mobilisation: Changing the Mindset To assess and improve the mindset of SICU staff toward early mobilisation of patients receiving mechanical ventilation before, 6 months after, and 1 year after implementation of early mobilisation	➢ Single centre study ➢ Progressive early mobility protocol by Morris and Herridge [111] was adopted ➢ **Plan-Do-Study-Act** (Identify improvement areas; test interventions; review results; implement reinterventions) ➢ MDT collaboration, education, institutional changes to overcome barriers to EM ➢ EM protocol integrated into daily care ➢ Mindset change occurred
Dafoe et al 2015 **[34]**	Australia	Overcoming barriers to the mobilisation of patients in an intensive care unit (To increase frequency of ICU mobilisation)	➢ Single centre study **Four-part Quality Improvement project:** 1. Audit on baseline mobilisation frequency 2. Survey on perceived barriers (medical instability and sedation common) to mobilisation 3. Identified barriers that could be changed and designed strategies to address (education, discussion of mobility in ward rounds, clarification of staff roles in mobilisation, mobility champion) 4. Follow-up audit on mobilisation frequency to determine effectiveness ➢ Even though this ICU was very pro- mobilisation, the baseline and follow-up audits yielded similar results. This unit needs to also address other factors that influence patients' ability to mobilise i.e., sedation levels
Van Willigen et al 2016 **[112]**	UK	The delivery of true early mobilisation in an intensive care unit	➢ Single centre study ➢ 112 patients included in QIP

			➢ **The Four Es model** was used: Engage, Educate, Execute, Evaluate ➢ Two mobility champions (nursing and physiotherapy) ➢ MDT involvement (meetings, ward rounds) ➢ Education of staff ➢ Barriers to EM identified and addressed ➢ Patients received additional daily mobility sessions, with minimal sedation ➢ Patients started mobility earlier (from 16.3 days in 2012, to 4.3 days at the end of improvement cycle 2) ➢ Decreased ICU LOS (from 20.8 days in 2012, to 11.2 days at the end of improvement cycle 2)
Corcoran et al 2017 **[29]**	USA	Early Rehabilitation in the Medical and Surgical Intensive Care Units for Patients with and without Mechanical Ventilation To assess the efficacy of early mobilisation of patients with and without mechanical ventilation in the ICU on length of stay (LOS) and patient outcomes and to determine the financial viability of the program	➢ Single centre study ➢ 123 patients in pre-PIP group; 160 patients in the PIP ➢ Early rehabilitation is feasible with improved patient outcomes, reduced costs, ICU, and hospital LOS (from 4.6 days (pre-PIP) to 3.7 days (PIP) (p = .05) ➢ MDT collaboration ➢ Education and mobility guidelines developed ➢ Interdisciplinary communication, ward rounds Rehabilitation increased by 60 minutes per patient daily
Johnson et al 2019 **[113]**	USA	Mobility bridges a gap in care: Findings from an early mobilisation quality improvement project in acute care	➢ Single centre study ➢ **Project BOOST** (Better Outcomes by Optimizing Safe Techniques) used: best practices for hospital discharge transitions (patient education methods and team communication to improve discharge planning) ➢ Qualitative evaluation of the QIP ➢ MDT collaboration; mobility champion ➢ Mobility activities became an expectation of daily care by patients ➢ EM improved mobility levels and patients' functional outcomes

			➢ EM QIPs can transform clinical practice and improve patient care
McWilliams et al 2019 **[114]**	UK	Introducing early and structured rehabilitation in critical care To assess the potential impact of introducing an already established and effective programme of rehabilitation within a critical care unit in a different organisation	➢ Single centre (tested an already successful QIP on a different institution) ➢ The Four Es Model was used ➢ 209 patients admitted to critical care for ≥4 days included ➢ Implementing an existing QIP at another institution was feasible and reproducible ➢ Barriers to mobility identified and addressed via MDT approach Education and training of staff ➢ Higher mobility levels in patients ➢ Patients mobilised earlier: significant reduction in time to 1st mobilisation (2 vs 3.5 days, $p < 0.001$) ➢ More patients mobilised (92% vs 73%, $p = 0.003$) compared to before QIP ➢ All patients assessed within 24 hours of ICU admission ➢ Mobilisation initiated and led by physiotherapists ➢ No consensus on exact details of mobility ➢ Research needed on long term outcomes of QIP and EM

Table 2.8: Abbreviation List for Quality Improvement Programmes

ARDS	Acute Respiratory Distress Syndrome
BOOST	Better Outcomes by Optimising Safe Techniques
EM	Early Mobilisation
ICU	Intensive Care Unit
LOS	Length of Stay
MDT	Multidisciplinary Team
PIP	Performance Improvement Project
PT	Physical Therapist
QIP	Quality Improvement Programme

RASS	Richmond Agitation Sedation Scale
SICU	Surgical Intensive Care Unit
UK	United Kingdom
USA	United States of America

Table 2.9: Summary of Included Clinical Reviews, Expert Opinion, Case and Conference Reports, Special Features, and Expert Consensus

Author	Country	Type of Article	Topic/Title	Main Points
ICU-Acquired Weakness				
Bolton et al 1984 **[32]**	Canada	Case Report	Polyneuropathy in critically ill patients Documenting the characteristics of, possible causes, and management approaches to polyneuropathy	➢ Electrophysiological examination can confirm the diagnosis of polyneuropathy ➢ Underlying major systemic illness and respiratory failure ➢ Spontaneous limb movements weaken ➢ Muscle tone becomes flaccid ➢ Normal response to pain absent (only facial grimaces) ➢ Disappearance of deep tendon reflexes ➢ Difficult ventilator weaning ➢ Unremarkable cerebrospinal fluid ➢ Cranial nerves and nerve roots may be involved ➢ Gradual recovery, but still evidence of polyneuropathy up to 2 years later ➢ Normal motor and sensory impulse conduction ➢ Severe reduction in amplitude of compound motor and sensory action potentials ➢ Huge reduction in numbers of motor unit potentials in limb muscles ➢ Severe denervation of diaphragm and intercostal muscles ➢ Severe axonal degeneration that can recover ➢ Polyneuropathy most severe distally

				➢ Cause of polyneuropathy could not be confirmed, although nutritional deficits and neurotoxic substances i.e., antibiotics may be involved	
Bolton et al 1986 **[33]**	Canada	Case Report	Electrophysical studies and differentiation between polyneuropathy (CIP) and Guillain-Barre Syndrome	➢ Polyneuropathy associated with sepsis and illness ➢ Reduced amplitudes on compound motor and sensory nerve action potentials ➢ Denervation of limb muscles ➢ Difficulty weaning from ventilator ➢ Recovery possible over several months if critical illness is survived ➢ Decreased deep tendon reflexes ➢ Spontaneous limb movements weaken, most marked in lower limbs ➢ Acute skeletal muscle denervation ➢ Electrophysiological examination confirms polyneuropathy ➢ Similar severity between CIP and GBS	
				CIP ➢ Illnesses occur before onset ➢ Purely axonal degeneration (normal impulse conduction speed) ➢ No conduction block ➢ CSF unremarkable ➢ Poorer prognosis in CIP	GBS ➢ Complications and illnesses occur after onset ➢ Demyelination (Slow impulse conduction speed) with some axonal degeneration ➢ Conduction block ➢ CSF elevations ➢ Better prognosis
Hermans et al 2008 **[37]**	Belgium France	Clinical Review	Critical illness polyneuropathy (CIP) and myopathy (CIM)	➢ CIP and CIM are serious complications of critical illness ➢ Difficulty weaning from mechanical ventilation. Rehabilitation prolonged	

				➢ Associated with increased ICU and hospital LOS, and mortality ➢ Axonal degeneration ➢ Flaccid weakness, absent deep tendon reflexes, phrenic nerve, and diaphragm involvement ➢ Medical Research Council (MRC) sum score used to screen for CIP/CIM ➢ EMG and nerve conduction studies can also be used to test for CIP/CIM ➢ CIP/CIM occurs in up to 100% of patients in ICU ➢ Pathophysiology still unclear ➢ Preventative measures (rehabilitation, decrease risk factors) and management of sepsis to manage this problem
Needham 2008 **[41]**	USA	Case Presentation	Mobilizing Patients in the Intensive Care Unit Improving Neuromuscular Weakness and Physical Function	➢ Deep sedation and bedrest have been the standard of care for a long time which are now being addressed ➢ Critical care survivors are likely to have sustained neuromuscular weakness and impaired physical function ➢ Describes the pathophysiology of ICUAW and parameters to decide when to start mobilisation
de Jonghe et al 2009 **[42]**	France	Expert Opinion	ICUAW: Risk Factors and Prevention	➢ ICUAW is the main sign of critical illness neuromyopathy ➢ Electrophysiological examination can detect neuromyopathy ➢ Risk factors for neuromyopathy: multiple organ failure, immobilisation, hyperglycaemia, corticosteroids, neuromuscular blockers that introduce muscle toxicity and increase the effects of corticosteroids ➢ Prevention strategies: Treat conditions leading to multiple organ failure, promote EM, being careful with

				the use of corticosteroids. Nutritional interventions to reduce the loss of muscle mass ➢ More research needed on interventions to curb and reduce ICUAW
Bolton 2012 **[39]**	Canada	Expert Opinion/Commentary	Polyneuropathy in critically ill patients	➢ Author summarised 1984 and 1986 study findings ➢ Further research still needed on the use of the various techniques that identify polyneuropathy and on rehabilitation
Kress and Hall 2014 **[9]**	USA	Review Article	ICU-Acquired Weakness and Recovery from Critical Illness	➢ ICUAW is caused by an array of mechanisms (sepsis, neuromuscular blockade, hyperglycaemia, over-sedation, and immobilisation) ➢ ICUAW more emergent and receiving more awareness since ICU survival rates have improved over the years ➢ Features of ICUAW described as by Bolton and de Jonghe ➢ ICUAW includes CIP and CIM and diagnosed using the MRC scale to grade muscle strength ➢ Sedation should be minimised, and rehabilitation must start in ICU and continue long after hospital discharge ➢ More research on the long-term benefits of rehabilitation needed
Ntoumenopoulos 2015 **[36]**	Australia	Review	Rehabilitation during mechanical ventilation	➢ Mechanically ventilated patients are vulnerable to delirium and ICUAW (25-100% of patients) ➢ Describes risk factors for ICUAW ➢ Rehabilitation in critical care is safe and improves functional outcomes ➢ MDT collaboration using the ABCDE(F) bundle ➢ More research regarding the commencement, timing and dosage of rehabilitation is needed
Vanhorebeek 2020 **[38]**	Belgium	Narrative Review	ICU-acquired weakness	➢ ICUAW affects limb and respiratory muscles ➢ Pathophysiology of ICUAW still unclear ➢ ICUAW diagnosed with electrophysiological examination and clinical means (MRC score)

				➢ ICUAW increases risk of mortality, duration of mechanical ventilation, hospital LOS and out of hospital costs, and decreases physical outcomes and quality of life ➢ Studies on the effect of EM, NMES, and pharmacological intervention on ICUAW are of low quality ➢ Need for robust RCTs ➢ Describes features of and risks for ICUAW ➢ Light sedation, reduction/prevention of hyperglycaemia, and EM will reduce/prevent the development of ICUAW ➢ NMES used alone does not significantly improve muscle strength
Delirium				
Girard et al 2008 [5]	USA	Review	Delirium in the intensive care unit	➢ Delirium is an acute and fluctuating disturbance of consciousness and cognition ➢ It is a common manifestation of acute brain dysfunction in critically ill patients ➢ Occurs in up to 80% of critically ill patients ➢ Intensive Care Delirium Screening Checklist (ICDSC) and the Confusion Assessment Method for the ICU (CAM-ICU) used to diagnose/detect delirium ➢ Types of delirium: Hypoactive and Hyperactive ➢ Hypoactive delirium often not detected ➢ Risk factors for delirium: hypertension, alcoholism, severity of illness, exposure to sedatives and analgesics, immobilisation, sleep disturbances ➢ Delirium should be routinely monitored ➢ ICU clinicians should be aware of delirium and its management strategies ➢ Importance should be placed on reducing risk factors for its development and treated if it arises

Rains and Chee 2017 **[45]**	UK	Review	The role of occupational and physiotherapy in multi-modal approach to tackling delirium in the intensive care	➢ Advocates for MDT management care bundles to reduce delirium: PAD; ABCDE ➢ Three delirium types: hyperactive, hypoactive, mixed ➢ Delirium associated with increased mortality, increased ICU and hospital LOS, long-term cognitive problems, and poor functional outcomes ➢ Developed the **D-E-L-I-R-I-U-M** (drugs; environment; light; initiate cognitive tasks; routine; integrate MDT; underhydration/nutrition; mobility) mnemonic, which encourages MDT collaboration ➢ Further research needed on the effectiveness of this mnemonic ➢ Delirium screening tools: CAM-ICU; ICDSC (intensive care delirium screening checklist) ➢ EM helps reduce delirium; occupational therapists help address cognition
Post Intensive Care Syndrome				
Needham et al 2012 **[2]**	USA	Conference Report	Improving long-term outcomes after discharge from intensive care unit: Report from a stakeholders' conference	➢ Post intensive care syndrome (PICS) was agreed upon as the recommended term to describe new or worsening problems in physical, cognitive, or mental health status Three important points: 1. awareness and education on long-term impairments after critical illness episode 2. Understanding and addressing barriers to practice 3. Raising Identifying research gaps and resources arising after a critical illness and care that should persist beyond the critical illness episode
Davidson et al 2013 **[11]**	USA	Expert Opinion	Implementation of the PAD Guidelines and Promoting Patient Mobility to Prevent PICS	➢ Research needed to reduce impact of long-term sequelae of critical illness ➢ Explored relationship between PAD and PICS (physical and cognitive impairments that also involve family)

				➢ Cognitive impairments occur in up to 100% of patients at hospital discharge, and up to 56% years after ➢ Reduction of delirium will improve cognitive outcomes ➢ Adverse mental health effects of sedatives persist months after hospital discharge ➢ Early mobility in ICU to minimise the development and duration of delirium and greatly improve functional outcomes and ICUAW. Consensus is needed on dosage of mobilisation ➢ Culture of mobility with MDT collaboration is necessary to achieve EM in ICU ➢ ABCDE bundle can be used to promote mobility and improve PICS ➢ Post-ICU interventions also necessary to address physical, cognitive, and mental health issues ➢ Education to patient and family on PICS so that strategies can be implemented to address it ➢ Light sedation to allow patient to participate in activities and self-report on pain ➢ More research needed to determine if PICS can be prevented by these guidelines
Harvey and Davidson 2016 [50]	USA	Expert Opinion	PICS: Right Care Right Now…and Later	➢ More and more survivors of critical illness since improvements in science and practice ➢ Critical illness survivors have a long recovery after ICU discharge ➢ PICS definition: Worsening impairment in physical, cognitive, and mental health status due to critical illness ➢ PICS-F known as post intensive care syndrome-family ➢ PICS can persist for up to 6 years ➢ PICS has long term consequences for both the patient and their family

				➢ Those involved in critical care are increasingly aware of PICS, but this awareness also needs to be raised in patients, families, and outpatient stakeholders so that the long-term consequences of critical illness can be addressed ➢ Increased awareness of PICS can lead to increased outpatient follow-up Risk factors for PICS: ➢ Immobility, duration of MV, ICU LOS, heavy sedation, delirium, sepsis, ARDS, hypoglycaemia, hypoxia Prevalence of elements of PICS in patients: ➢ < 10% of patients on MV for > 4 days are alive and fully independent 1 year later ➢ Caregiver assistance is required by patients 1 year later ➢ Half of patients with ARDS have not returned to work 1 year later ➢ ICUAW can develop in 25-80% of those with sepsis or on MV for > 4 days ➢ Cognitive impairment develops in 30-80% of patients Depression occurs in 8-57% of patients ➢ Anxiety occurs in 23-48% of patients ➢ Posttraumatic distress syndrome occurs in 10-50% of patients Prevalence of elements of PICS in families: ➢ 10-75% of family have anxiety ➢ PTSD occurs in 8-42% of family ➢ Medication for anxiety or depression required by 33% of family ➢ Family members may develop prolonged or complicated grief ➢ And aggravation of their own chronic health conditions

				➢ Family relationship may be challenged, and their financial security may be at risk by having to take off from work to care for patient **Strategies to reduce PICS in patients:** ➢ Reduction of risk factors ➢ Promoting early mobility programs ➢ Follow-up rehabilitation after discharge ➢ Early psychologic intervention ➢ ICU diaries to describe the patients' experience during the ICU stay ➢ Healing environments of care i.e., sleep promotion, reducing noise, appropriate lighting, reducing anxiety and delirium, family involvement ➢ Functional reconciliation checklist that records the patient's progress (physical, cognitive, mental status) from pre-admission throughout their care ➢ ABCDEFGH bundle **Strategies to reduce PICS in families:** ➢ Measures to decrease stress and anxiety during the ICU stay and the impact of PTSD e.g., good communication regarding the patient's progress and prognosis ➢ Family participation in patient's care ➢ Family can also keep an ICU diary regarding their experience ➢ Family support through a psychologist ➢ Providing information and resources on PICS to the family
Care Bundles				
Hall 2010 **[115]**	USA	Expert Opinion	Creating the animated ICU	➢ Delirium and ICUAW very common occurrence in critical care associated with poor outcomes ➢ Advocates the ABCDE(F) bundle

Barr et al 2013 [46]	USA	Special Feature	PAD (Pain, Agitation, Delirium) Guidelines to improve clinical outcomes in ICU	➢ Pain should be routinely monitored in all ICU patients and treated with non-pharmacologic interventions ➢ Light sedation/daily sedation interruption that is analgesia-first should be used that will aid in improving patient outcomes ➢ Sedation should be monitored (Richmond Agitation Sedation Scale/Sedation Agitation Scale) ➢ Non-benzodiazepine sedatives should be used ➢ Delirium is associated with increased mortality, prolonged ICU and hospital LOS, and cognitive impairment ➢ Delirium should be routinely monitored (CAM-ICU) ➢ EM reduces the incidence and duration of delirium ➢ Neither Haloperidol nor antipsychotics should be used to minimise the risk of delirium development ➢ No evidence to support that Haloperidol reduces the duration of delirium ➢ Atypical antipsychotics may reduce duration of delirium ➢ Sleep promotion is encouraged ➢ Education, ICU ward rounds, and use of protocols amongst providers to facilitate the use of the PAD guidelines is recommended
Dang 2013 [47]	USA	Expert Opinion	ABCDEs (Awakening and Breathing Co-ordination, Delirium Monitoring/Management, and Early Mobility) of ICU: Early Mobility	➢ Barriers to EM need to be addressed for successful implementation ➢ Implement daily sedation interruptions and independent breathing trial from mechanical ventilation ➢ Implement EM programmes and protocols with an MDT approach ➢ Have a mobility champion that can implement rehabilitation programmes, promote staff education, and inform patient and family on expected outcomes

				➢ Early tracheostomy will make it easier to mobilise ventilated patients
Marra et al 2017 **[51]**	USA	Review	The ABCDEF Bundle in Critical Care	➢ An evidence-based guide for clinicians to coordinate multidisciplinary patient care in the ICU that will optimise functional outcomes **ABCDEF Bundle Includes** 1. Assess and prevent first, then manage pain 2. Both spontaneous awakening trials and spontaneous breathing trials (associated with reduced sedative use, delirium, MV duration, ICU, and hospital LOS) 3. Choice of analgesia and sedation (non-benzodiazepines) 4. Delirium monitoring and management (CAM-ICU and ICDSC best screening tools for delirium) 5. Early mobility and exercise (early mobilisation is the only known non-pharmacological intervention to reduce the duration of delirium) 6. Family engagement ➢ Behavioural Pain Scale (BPS) and Critical Care Pain Observation Tool (CPOT) are the best tools available to assess pain in ICU patients ➢ Delirium (huge risk factor for prolonged ventilation, ICU, hospital LOS, increased hospital costs, long term cognitive impairment and, mortality) monitoring and management is crucial
Dirkes and Kozlowski 2019 (Future Directions) **[10]**	USA	Feature	Early Mobility in the Intensive Care Unit: Evidence, Barriers, and Future Directions Focuses on aspects of care that affect patient outcomes	➢ EM is part of the ABCDE(F) bundle and can prevent/reduce delirium and improve patient outcomes ➢ Describes the ABCDE(F) bundle of care related to the PAD guidelines ➢ ABCDE(F) bundle shown to improve patient outcomes (i.e., decreased duration of MV, occurrence and

				duration of delirium, ICU and hospital LOS, and healthcare costs) ➢ Immobility results in deconditioning of the musculoskeletal system, and has cardiovascular and respiratory consequences ➢ Implementation of a mobility programme very important ➢ Barriers to mobility need to be identified ➢ Special beds that can sit or even stand patients aid in mobility of patients can be used
Safety and Feasibility of Early Mobilisation				
Kress 2009 **[7]**	USA	Review	Clinical trials of early mobilisation of critically ill patients	➢ Critical care survivors are very likely to develop neuromuscular dysfunction and have poor functional outcomes ➢ Mobilising mechanically ventilated patients is safe, feasible, improves functional outcomes and requires MDT involvement
Schweickert and Kress 2011 **[28]**	USA	Review	Implementing Early Mobilisation Interventions in Mechanically Ventilated Patients in the ICU	➢ ICUAW in critical care is a major problem ➢ EM is safe and feasible ➢ EM reduces ICU and hospital LOS, improves functional outcomes
Jang et al 2019 **[116]**	Korea	Expert Opinion	Pulmonary and Physical Rehabilitation in Critically Ill Patients	➢ ICU rehabilitation is safe and feasible ➢ Passive and active range of motion exercises are safe to do in patients with raised intracranial pressure ➢ Early detection and management of ICUAW can improve functional outcomes
Early Mobilisation				
Stiller K 2000 **[117]**	Australia	Review	Physiotherapy in Intensive Care	➢ Mobilisation helps to improve fluid distribution, decrease the detrimental effects of immobility, and improve functional outcomes ➢ Passive and active range of motion exercises do not significantly raise intracranial pressure

Morris and Herridge 2007 (Future Directions) **[111]**	USA Canada	Expert Opinion	Early Intensive Care Unit Mobility: Future Directions	➢ Barriers to EM: safety concerns, increased costs, lack of time ➢ Deconditioning an important contributor to ICUAW ➢ Need for further research on parameters and dosage for safe mobilisation ➢ Use ABCDE bundle of care ➢ Clear definition of roles in the MDT involved in mobilisation
Stiller K 2007 **[118]**	Australia	Expert Opinion	Safety Issues That Should Be Considered When Mobilizing Critically Ill Patients	➢ Published guidelines on various considerations of various body systems before mobilising patients ➢ No consensus available on type and dosage of mobilisation techniques in ICU
Bailey et al 2009 **[8]**	USA	Expert Opinion	Culture of early mobility in mechanically ventilated patients Review course of action to facilitate EM	➢ A change in ICU culture with MDT collaboration and co-ordination of care that prioritises early activity will facilitate EM ➢ EM is safe and feasible and may positively affect the deconditioning process ➢ Various barriers to the provision of EM need to be addressed ➢ Focus must be shifted from just physiologic care to long-term functional, patient-centred outcomes ➢ Create strategies to improve level of teamwork ➢ Sedation management import in EM ➢ Delirium risk development needs to be managed by mobilisation, proper sleep pattern, and management of benzodiazepines
Hanekom et al 2011 **[119]**	South Africa	Expert Opinion	The development of a clinical management algorithm for early physical activity and mobilisation of critically ill patients (using a Delphi process)	➢ Detailed guidance on early physical activity for unconscious, awake (and conditioned), and deconditioned patients ➢ Will help identify patients' readiness to mobilise ➢ EM plan must be implemented in consultation with MDT, the patient and family, with clear objectives and outcomes

Hodgson et al 2013 **[15]**	Australia	Clinical Review	Early patient mobilisation in the ICU	➢ EM defined as early activity within first 2-5 days of ICU admission ➢ Although EM is safe and feasible and improves functional outcomes, it requires intense labour and equipment ➢ More research required regarding standard practice with specific details on type and dosage of EM ➢ Usual care (passive and early active movements in ICU; full active movements only after illness has resolved) is not evidence-based
Vollman 2013 **[120]**	USA	Expert Opinion	Understanding Critically Ill Patients Hemodynamic Response to Mobilisation	➢ EM reduces duration of ventilation and improves functional outcomes ➢ A reduction in plasma volume, cardiac workload increase, and output decrease with immobilisation and bedrest, and cardiac atrophy occurs ➢ Orthostatic tolerances decrease with reduced mobility ➢ Haemodynamically unstable patients should be screened within 8 hours of ICU to determine the level of mobility necessary, if any ➢ Criteria to mobilise: patient verbal interaction; FiO_2 < 0.6; PEEP 10 or less; no orthostatic hypotension; no catecholamine drips ➢ Cardiovascular instability is a common occurrence when position is changed after long periods of immobility ➢ Mobilisation challenges the haemodynamics of critically ill patients: muscles demand oxygen from the blood (that may outweigh the supply), increase in heart rate, drop in blood pressure, and stroke volume (all return baseline supine levels in 10 minutes) ➢ "Mobilisation decision tree" and "mobility assessment for readiness" tools available to determine level of mobility for haemodynamically unstable patients

				➢ Rotational therapy (a function on ICU beds) can be used to acclimatise the patient to movement and position changes
Atkins and Kautz 2014 **[4]**	USA	Expert Opinion	Move to Improve: Progressive Mobility in the ICU	➢ Progressive mobility must become a cornerstone in intensive care ➢ Developing progressive mobility protocols is important ➢ Progressive mobility can prevent deconditioning of the patient and needs to be built up to the point where the patient can return to their previous level of function ➢ Escalate activities to be more challenging ➢ Chair egress position can be used in bed ➢ Consistent, lower levels of mobility will prevent complications/shock to a patient that may occur if they are just suddenly transferred out of bed without having had any prior mobilisation activity ➢ Education, MDT involvement and mobility champion important ➢ Common barriers to EM: lack of staff and equipment, over-sedation, delirium, nurse attitudes towards mobility
Hodgson et al 2014 **[17]**	Australia	Expert Consensus	Expert consensus and recommendations on safety criteria for active mobilisation of mechanically ventilated critically ill adults	➢ An ETT is not a contra-indication to mobilisation ➢ Categories for safety considerations: respiratory (FiO_2 < 0.6), cardiovascular (although no consensus on vasoactive drug dosage, vasoactive drugs is not an absolute contra-indication to mobility), neurological, and other considerations (surgical, medical, ICUAW, continuous renal replacement therapy, patient attachments) ➢ Traffic light system to assist in evaluating safety criteria

				➢ Level of mobilisation determined by the patient's strength and endurance, and evaluation of the safety criteria
Dubb et al 2016 **[20]**	Germany	Focused Review	Barriers and Strategies for Early Mobilisation of Patients in Intensive Care Units	➢ EM in ICU is safe and feasible, but its implementation is not easy (dependent on patient's acuity and ICU culture) ➢ Barriers: institutional, patient, provider ➢ Implement safety guidelines and use protocols ➢ MDT collaboration, education, and training ➢ Mobility champion ➢ Change ICU culture to prioritise EM
Bruce and Forry 2018 **[3]**	USA	Expert Opinion	Integrating a Mobility Champion in the Intensive Care Unit	➢ The mobility champion's role is to coordinate and implement EM, educate clinicians and patients on the benefits of early mobilisation, and organise training on EM ➢ A mobility champion can assist with overcoming ➢ almost all barriers to early mobility, reinforces the evidence on the benefits of EM, and coordinates EM of patients in ICU ➢ Preferred candidates for this role: Physiotherapist or Occupational Therapist (experts in the indications and ergonomics of early mobility)
Fuest and Schaller 2018 (Expert Opinion) **[14]**	Germany	Review	Recent evidence on early mobilisation in critically ill patients	➢ Still no consensus, but EM defined in this article as mobilisation within 72 hours of ICU admission ➢ EM is still not popular, despite it being well-tolerated even in patients receiving ventilatory support ➢ Culture change needed ➢ EM is safe and feasible, improves patient outcomes ➢ Needs to be implemented as part of the ABCDE(F) bundle with MDT collaboration ➢ Direction on adequate dosage of mobilisation and more research on EM I neurocritical care is needed

Kumar et al 2020 **[18]**	USA	Review	Early mobilisation in neurocritical care patients	➢ Clarification on the definition, dosage, and intensity of early mobilisation is needed ➢ EM may reduce ICU and hospital LOS-not certain of these benefits in neurocritical patients

Table 2.10: Abbreviation List for Clinical Reviews, Expert Opinion, Case and Conference Reports, Special Features, and Expert Consensus

ABCDE	Awakening and Breathing Co-ordination, Delirium Monitoring/Management, and Early Mobility
ABCDEF	Assess, prevent, and manage pain, Both spontaneous awakening trials and spontaneous breathing trials, Choice of analgesia and sedation, Delirium, Early Mobility, and Family engagement
ABCDEFGH	Airway management, Breathing trials, Coordination of care and Communication, Delirium assessment, Early Mobility, Family involvement, Follow-up referrals and Functional reconciliation, Good handoff communication, and Handout materials on post intensive care syndrome (PICS) and post intensive care syndrome family (PICS-F)
ARDS	Acute Respiratory Distress Syndrome
BPS	Behavioural Pain Scale
CAM	Confusion
CIM	Critical Illness Myopathy
CIP	Critical Illness Polyneuropathy
CPOT	Critical Care Pain Observation Tool
CSF	Cerebrospinal Fluid
EM	Early Mobilisation
EMG	Electromyograph
ETT	Endotracheal Tube
GBS	Guillain-Barre Syndrome
ICDSC	Intensive Care Delirium Screening Checklist

ICU	Intensive Care Unit
ICUAW	Intensive Care Unit Acquired Weakness
LOS	Length of Stay
MDT	Multidisciplinary Team
MRC	Medical Research Council
MV	Mechanical Ventilation
NMES	Neuromuscular Electrical Stimulation
PAD	Pain Agitation Delirium
PEEP	Positive End Expiratory Pressure
PICS	Post Intensive Care Syndrome
PTSD	Post-Traumatic Stress Disorder
UK	United Kingdom
USA	United States of America

2.3 Narrative Literature Synthesis

2.3.1 Intensive Care Unit Patient Profiles in the International Setting

Australia, New Zealand, and Canada, in both single and multi-centre observational studies of early mobility practice, reported that patient populations were mostly male, middle-aged (highest reported mean age=65 years), and the majority were admitted electively for respiratory and medical conditions. Adverse event rates were fairly low. The number of patients requiring mechanical ventilation ranged from 45% to 74% [24, 80, 84, 89, 104]. Conversely, two Brazilian studies reported high mortality rates of 19.83% [77] and 58.2% [73] respectively. Reasons for this high mortality in a low/middle income country context, could be linked to the high proportion of trauma and emergency admissions to ICU (23.03%) [77] with patients presenting with high illness severity (APACHE II) scores (20±7.3) [73]. Not all studies reported on ICU LOS, duration of MV, adverse events, or mortality rates, which suggests a lack of standardisation in the outcome measures and/or variables assessed during ICU research.

2.3.2 Intensive Care Unit Patient Profiles in the African Setting

Prospective and retrospective studies on early mobilisation were identified from a range of low-income African countries: Zimbabwe, Tanzania, and Malawi. These studies reported a much younger patient cohort than those mentioned above (median 27 and 34 years; mean 36 years) with very high mortality rates (up to 42%) [71, 74, 75]. Their admissions were delayed and mostly for trauma and emergencies, and the number of the patients requiring mechanical ventilation ranged from 45% to 54.2% [71, 74, 76]. Coupled with the fact that these studies were conducted in low-income countries, ICU resources were also limited in terms of specialised staff, infrastructure, and resources that could affect the level of care provided [71, 74-76].

Hanekom and colleagues conducted a 2006 South African prospective observational study that sought to describe the baseline data of patients admitted to a tertiary ICU, as well as their ICU discharge outcomes. The small cohort (159 patients) had a mean age of 49 ± 19.95 years. The mean APACHE II score on admission was 12.3±7.19 (higher APACHE II scores translate to higher severity of illness). Most of the patients (n=133; 83%) were admitted to ICU after emergency surgery (n=85; 64%) or traumatic injury (n=48; 36.1%). High-blood pressure was the most frequent co-morbidity (42%), and a mean ICU LOS of 5.94±6.55 days was reported. The mortality rate was reported to be 12.3%, which is lower than all the above-mentioned patient profile studies. This study found age, sex and co-morbidities to have no significant association with mortality or ICU LOS ($p > 0.01$), but instead reported a significant correlation between APACHE II scores, mortality and ICU LOS ($p < 0.001$) [72].

2.4 ICU-Acquired Weakness

ICU-acquired weakness (ICUAW) is weakness acquired during an episode of critical illness. This is a consequence of bedrest and immobility that contributes to patient morbidity, mortality, reduced physical outcomes, increased duration of ventilation, ICU and hospital LOS and costs, and decreased quality of life. In addition to reduced mobility, systemic illness, multiple organ failure, sepsis, hyperglycaemia, corticosteroids, neuromuscular agents all pose as risk factors to its development. ICUAW has three components, i.e., critical illness polyneuropathy (CIP), critical illness myopathy (CIM), and critical illness neuromyopathy (CINM) [9, 37, 38, 42, 67].

Multiple studies have shown that clinicians underestimate the incidence of ICUAW, with demonstrated gaps in knowledge. ICUAW is prevalent in up to 46% of critically ill patients, while CIP and CIM occurs in up to 100% of all patients in ICU [1, 37].

A 2015 prospective multi-centre study conducted in Australia and New Zealand found that more than 50% of the patient cohort had developed ICUAW upon ICU discharge significantly associated with 90-day mortality [35].

The pathophysiology of ICUAW is still unclear but the following mechanisms have been postulated:

The primary mechanism in ICUAW is likely to be peripheral nervous system organ failure due to decreased oxygen usage and therefore decreased axonal nutrient delivery. Other mechanisms include neuromuscular blockade drugs that are toxic to muscles, resulting in muscle deterioration, neuronal membrane inexcitability, and hyperglycaemia (high blood glucose), which further contribute to axonal injury and degeneration [32, 33, 39].

Since ICUAW is difficult to manage once it has already set in, preventing its development through mitigation of risk factors is important. Anekwe et al [59] conducted a systematic review and meta-analysis of nine RCTs which demonstrated that early rehabilitation reduces the development of ICUAW (odds ratio of 0.63 (95% CI: 0.43 to 0.92) in the screened population, and 0.71 (95% CI: 0.53 to 0.95) in the randomised population). Another recent RCT investigating the impact of early physiotherapy during septic shock on skeletal muscle (started at 28±9 hours after ICU admission, with two daily sessions in the intervention group, compared to physiotherapy started at 46±25 hours, once daily in the control group) reported that muscle fibres were better preserved in the intervention group, thereby minimising the development of ICUAW [43].

Even though management of ICUAW is challenging once it has set in, a RCT in Germany, showed that patients who developed ICUAW benefitted from resistance training and in-bed cycling, with improved lower limb strength, walking ability and cardiovascular endurance compared to those receiving standard care. Therefore, even after ICUAW sets in, it is still possible to improve patients' physical and functional outcomes with rehabilitation [44].

2.5 Delirium

Delirium is another common complication of critical illness. It is an acute manifestation of brain dysfunction and is associated with cognitive decline, increased mortality, longer ICU and hospital LOS, and poor functional outcomes and quality of life, and can persist for years after the critical-illness episode [5, 11, 46]. Delirium can present as either hyperactive, hypoactive, or mixed delirium [5]. Heavy sedation, mechanical ventilation, alcohol use, hypertension, and severe illness all put patients at risk of developing delirium [5]. Despite its common occurrence, delirium (especially hypoactive delirium) often goes unrecognised in ICU, making it important to screen for and monitor daily using the CAM-ICU or ICDSC screening tools [5, 45, 46, 48].

The utilisation of care bundles i.e., PAD guidelines and the ABCDE bundle are very much advocated for in the management of delirium [10, 45, 46]. An online survey conducted in 2014 on India-based physicians reported that despite awareness on the benefits of early mobilisation and delirium management strategies, these clinicians still use benzodiazepines, not analgesia-first medication, and do not screen for or monitor delirium [81]. On the other hand, in the US, a mixed-methods study identified that conducting daily MDT rounds, engaging implementation leaders, and organizing education on delirium management strategies facilitated the adoption of the ABCDE care bundle [93]. This was evident in a subsequent study reporting that US-based clinicians in critical care took heed of these recommendations and have implemented them in their delirium practices [102].

2.6 Current Early Mobility Practice Patterns in Critical Illness

There is not yet consensus on the standard definition of early mobilisation [12, 70, 101]. Some studies define early mobilisation as mobility initiated within 48 hours of ICU admission [1],72 hours of ICU admission [14], while others define it as mobilisation occurring within 2-5 days of ICU admission [15].

Semi-structured interviews, cross-sectional and prospective surveys, including recent ones, reported EM not being prioritised in critical care. Even though clinicians are aware that rehabilitation and mobility improves ICUAW and physical outcomes, many still deem EM low priority [83, 97, 99, 100]. Other studies report knowledge gaps and lack of training on EM that influence clinicians' decisions regarding mobility [1, 34, 81, 83, 95, 97, 107].

It has also emerged that there is currently no standard practice for EM, with no clear guidance due to a lack of protocols [36, 82, 121]. In addition to many studies concluding that EM should become a standard of care in ICU, they also highlight the need for direction regarding its exact dosage and intensity [36, 111].

Different clinician groups exhibit various levels of knowledge and place priority on different aspects of practice [79, 97, 98, 100]. This results in rehabilitation and mobility practice being highly variable. Having standard mobility protocols, with specification on the dosage and intensity in place, will reduce this variability in practice, and enhance generalisability of results for future studies on EM [23, 55, 78, 111, 122, 123].

Many studies on mobility practices in Australia, New Zealand, India, Brazil, France, Germany, UK, USA, and Switzerland reported that ventilated patients either did not or rarely received out-of-bed activities [25, 80, 85, 88, 90, 91]. An Australian study that investigated usual care physiotherapy on 100 ICU patients [84] reported that of the 80% that received mobility/rehabilitation activities, only 2% of those were tracheostomy ventilated patients. No patient ventilated via an endotracheal tube (ETT) received any mobility/rehabilitation activities. Only 47% of the 80 patients walked in the ICU, none of them while ventilated. Walking only commenced a median of 5 (3-8) days after ICU admission [84]. This is even less than two German and Swiss point-prevalence studies where only 8% and 7% (respectively) of patients with an ETT were mobilised out of bed [90, 94]. A 5-year Australian historical cohort study published in 2019 reported a delay in commencement of exercise for critically ill patients. In this cohort, 43% of stable patients did not mobilise into a sitting or an upright position despite the clinicians being aware of the benefits of EM [89].

In contrast to these studies, Lottering and Van Aswegen 's survey study describing the practices of physiotherapists in South African ICUs, reported that their physiotherapists perform in-bed activities (84.3%), strengthening activities (73.1%) and out-of-bed activities (77.8%), respectively. They concluded that mobilisation, in addition to respiratory therapy, was a main area of focus. The low response rate (33.9%), however, may have introduced selection bias and more studies are needed from this region [86].

2.6.1 PAD (Pain, Agitation, Delirium) Guidelines

These consensus guidelines were developed by a panel of experts to provide a blueprint for creating protocols that are evidence-based, and patient-centred in preventing and dealing with pain, agitation, and delirium in critical care [46].

It is important that pain be routinely monitored and treated with non-pharmacological interventions as far as possible. If pain medication is administered, the medication should be analgesia-first, rather than sedation-based [46].

Sedation should also be monitored and minimised, using non-benzodiazepines, owing to the increased risk of delirium associated with benzodiazepines. Optimal sedation monitoring and management ensures that the patient is awake/rousable and can therefore participate in their rehabilitation activities to optimise improvements in function [46].

Like with pain and sedation, delirium should also be routinely monitored. The administering of Haloperidol or other antipsychotics for delirium is highly discouraged as there is no evidence to show that they prevent delirium. While there is no evidence to support the safety of the use of Haloperidol, and its efficacy in reducing the duration of delirium, the use of atypical antipsychotics may achieve this reduction. Strategies like sleep promotion, with normal sleep cycles (awake during the day, asleep at night, lights on during the day, lights off at night), and early mobilisation must be utilised to prevent/minimise and reduce the duration of delirium [46, 51]. Conducting multidisciplinary ICU ward rounds and providing education and training on EM will help facilitate the adoption of these guidelines [46].

2.6.2 ACBDE(F) (Awakening and Co-ordination of Breathing, Delirium Monitoring/Management, Early Mobility, and Family) Bundle

This is an evidence-based set of guidelines created for clinicians to coordinate multidisciplinary patient care in the ICU to optimise ICU functional outcomes [47, 51].

This bundle includes:

Assess, prevent, and manage pain: The Behavioural Pain Scale (BPS) and Critical Care Pain Observation Tool (CPOT) are the best tools available to assess pain in ICU patients. According to the PAD guidelines, pain should be routinely monitored and analgesia-first medication instead of sedatives administered [46, 51].

Both spontaneous awakening trials (SATs) and spontaneous breathing trials (SBTs): Spontaneous awakening is essentially the stopping of medication (i.e., sedation interruption, using light sedation). This helps reduce the duration of mechanical ventilation and ICU LOS. Girard and colleagues conducted a RCT to assess a protocol that paired spontaneous awakening trials with spontaneous breathing trials. Patients were assigned to either a daily SAT followed by an SBT (intervention group) or sedation per usual care plus a daily SBT (control group). The primary outcome measured was the amount of time breathing unassisted. They were able to demonstrate that the patients in the intervention group spent more days breathing unassisted during the 28-day study period than those in the control group (14.7 days vs 11.6 days; mean difference 3.1 days, 95% CI 0.7 to 5.6; p=0.02) and were discharged from ICU (median ICU LOS 9.1 days vs 12.9 days; p=0.01) and hospital earlier than those in the control group (median hospital LOS 14.9 days vs 19.2 days; p=0·04) [64].

Spontaneous breathing trials are considered the most effective way to wean patients off MV. Co-ordination of both spontaneous awakening and spontaneous breathing trials is associated with reduced sedative use, delirium, MV duration, ICU, and hospital LOS [47, 51].

Choice of analgesia and sedation: According to the PAD guidelines, analgesia-first medication should be administered. They recommend the Richmond Agitation Sedation Scale (RASS) and the Sedation-Agitation Scale (SAS) as the best tools to measure the quality and depth of sedation in critically ill adult patients, and encourage the use of non-benzodiazepines, that are associated with better patient outcomes and lower risk of delirium development, compared to that of benzodiazepines (e.g., Lorazepam) [46, 51].

Delirium, which is a major risk factor for prolonged ventilation, ICU, hospital LOS, increased hospital costs, long term cognitive impairment and mortality, should be monitored and managed as discussed in the PAD guidelines [47, 51]. The CAM-ICU and ICDSC are recommended as the best and most frequently used screening tools for delirium [5, 45, 46].

Early mobility and activity must be started with the guidance of a mobility protocol, and multidisciplinary involvement. It is the only known non-pharmacological intervention to reduce the duration of delirium) [51]. Having a mobility champion in the unit that will rally for early activity, provide education, and implement rehabilitation protocols will facilitate the use of this care bundle and successful early mobilisation and rehabilitation of patients [47].

Family and caregiver engagement are an important aspect of the decision-making and treatment planning related to patient care. Involving these stakeholders (through family presence in ward rounds/at the patient's bedside, and communication with the family regarding the patient's care) will help provide appropriate input/information to the clinicians that may result in care that is tailored to

the patient's needs, and will help ameliorate family anxieties that arise from the critical illness episode [51].

2.7 Safety and Feasibility

2.7.1 Adverse Events

An adverse event can be defined as an unforeseen incident that happens to a patient while receiving care from a provider [6]. Adverse events are associated with having two or more co-morbidities, admission to ICU from theatre or wards, and readmission to ICU during hospital stay [104]. Adverse events are also associated with longer hospital stays and associated increased financial costs, and with increased mortality [6, 19].

The rate of adverse events reported during mobilisation in observational studies is generally low, ranging from 0.2% to a maximum of 21%. Most adverse events are mild and/or self-limiting, and include a drop in blood pressure, arrythmia, oxygen desaturation, dislodgement of attachments, respiratory complications, and hospital-acquired infections [24, 27, 80, 84, 90, 104].

Safety of early mobilisation has also been demonstrated in neurocritical and cardiothoracic patients, patients receiving extracorporeal membrane oxygenation [62, 124], in-bed cycling [26, 27], and patients being placed on tilt tables. Many studies reporting safety of early mobilisation, are however, variable, and of low methodologic quality (small sample sizes, study designs, methodologic limitations) [22]. Two RCTs of 104 [67] and 90 [66] adult patients in ICU both showed that early exercise/rehabilitation is safe, feasible, well-tolerated, and associated with improved functional status at hospital discharge. Recent systematic reviews have also reported that early mobilisation does not have any significant impact on adverse event or mortality rates [57, 59-61, 63].

The low reported rates of adverse events make early mobilisation of critically ill patients a safe intervention [21-23]. Early mobilisation is also feasible and may help to reduce in-and-out-of-hospital related costs through improved physical and functional outcomes [7, 8, 14, 15, 20, 23-25, 28, 36, 67].

2.8 Benefits of Early Mobilisation

ICU-acquired weakness, associated with immobility and critical illness, contributes to patient mortality, and predisposes to poor physical outcomes, increased duration of ventilation, ICU and hospital LOS costs, and decreased quality of life [28, 37, 38]. Another complication of critical illness, critical care and immobility is the development of delirium, which is associated with cognitive decline, increased mortality and ICU LOS, and the development of post intensive care syndrome (PICS), with potentially long-term physical, cognitive, and psychosocial impairments affecting both the patient and their family/caregiver [11].

Rehabilitation started early during ICU admission can mitigate these consequences of bedrest and immobility and thereby potentially improve patient outcomes, including mortality, quality of life and cognitive status after ICU stay, reduced ICU and hospital LOS, improved respiratory function and earlier weaning from mechanical ventilation, improved exercise tolerance, skeletal muscle strength and joint range of motion [30, 66, 125].

2.8.1 Studies Supporting the Benefits of Early Mobilisation

A range of RCTs, systematic reviews, case series, case-control, prospective and retrospective cohort studies conducted between 2013 and 2019 in various countries (mostly high-income countries) reported that early rehabilitation/mobilisation was associated with improved patient physical and functional outcomes, ventilation status, and decreased ICU and hospital LOS [22, 23, 55, 56, 60, 66, 67, 70].

A 2013 systematic review (17 varied studies; 1614 patients) investigated the safety and effectiveness of active mobilisation on physical function and outcomes in mechanically ventilated patients. They showed that early active mobilisation in the ICU is safe and has positive effects on physical function and hospital outcomes (improved: 6 MWD at hospital discharge and functional status; shorter duration of MV; more ventilator-free days; and shorter ICU and hospital LOS). The effect of early active mobilisation on mortality could not be shown as only one study reported a reduction in 1-year mortality rate linked to early activity. Also, due to the heterogeny of studies, and their low quality, more robust evidence is needed to support these findings [22].

A well-conducted study from 2016 that comprehensively reviewed 5 systematic reviews on the existing evidence for effectiveness of physical rehabilitation in patients with critical illness (including 24 RCTS and 3 meta-analyses) concluded that early rehabilitation/mobilisation in critical care is associated with improved ICUAW, quality of life, and mortality. The included systematic reviews scored medium to high gradings on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) and AMSTAR (Assessment of Multiple Systematic Reviews) quality appraisal scores that support their study quality [55]. They were, however, unable to show the benefits of physical rehabilitation on long-term outcomes of patients, highlighting the need for more robust RCTs and systematic reviews in this regard [55].

Another robust systematic review with meta-analysis (9 RCTs of 841 critically ill patients) published in 2019 showed that early rehabilitation can reduce the likelihood of developing ICUAW. This is the first study that clearly showed a positive effect of early rehabilitation on ICUAW. It also showed that early rehabilitation was associated with reduced ICU and hospital LOS. The authors of this study advocate for the widespread implementation of early rehabilitation in ICUs that will also serve to decrease hospital-related costs and improve the patients' quality of life after ICU [59].

Many well-conducted RCTs ranging from 2004 to 2020 in different countries were able to show that early mobilisation prevented muscle atrophy, improved functional outcomes, skeletal muscle strength, ventilation status, and decreased ICU and hospital LOS and costs [43, 44, 67, 70].

Schweickert and colleagues' RCT of 104 mechanically ventilated patients was able to show that early exercise and mobilisation (physical and occupational therapy) during sedation interruption in the intervention group facilitated return of more patients (n=29; 59%) to independent functional status at ICU discharge than the control group (n=19; 35%) which received daily sedation interruption with standard physical and occupational therapy as specified by the primary care team. No further detail to define standard therapy was provided. Other benefits included a shorter duration of delirium and more ventilator-free days in the intervention group [67].

A Belgian RCT of 21 patients demonstrated that early physical therapy during sepsis was safe, well-tolerated, and preserved cross-sectional muscle fibre. The intervention group had twice daily sessions that include mobilisation plus 30 minutes active/passive cycling, while the control group received once a day mobilisation. Skeletal muscle biopsies were taken, and electrophysiological tests

conducted on days 1 and 7 of the study to analyse the mechanisms that regulate protein synthesis, protein breakdown, and inflammatory markers [43].

Catabolic markers involved in protein breakdown (muscle atrophy F-box, and muscle ring finger-1 messenger RNA), were reduced at day 7 only in the intervention group) and showed the excessive breakdown of cross-sectional muscle fibre to be lower in the intervention group. The cross-sectional muscle fibre was preserved by exercise (–25.8% ± 21.6% in control vs 12.4% ± 22.5% in the intervention group; p = 0.005) [43]. Protein synthesis and Inflammatory markers, however, were unaffected by the intervention [43].

This was, however, a small study, and physiotherapists were not blinded to the allocation of patients to the two groups. Data on electrophysiological examination and muscle strength are also limited, and therefore they could not show the relationship between cross-sectional muscle fibre changes and muscle function. The MRC was used to test muscle strength, which is challenging to perform in critically ill patients as they would have to be conscious and able to participate. Standard testing of functional muscle strength should be included i.e., quadriceps muscle force. The benefits of the intervention could not be distinguished as the passive and active movements were often performed together and not evaluated separately. Long-term effects on atrophy and skeletal muscle fibre were not assessed and should be included in future studies [43].

A 2019 German exploratory randomised intervention trial of 50 mechanically ventilated patients with sepsis compared NMES plus early protocol-based physiotherapy to early protocol-based physiotherapy only. The early protocol-based physiotherapy group started mobilisation on the day of ICU admission, and thereafter performed daily with individualised goals. The NMES plus early protocol-based physiotherapy group had 20 minutes of NMES daily in ICU until day 28. Physicians at this centre made the clinical decision for mobilisation to commence. Mobilisation was carried out with no guidelines or protocols, and no MDT collaboration [69]. No difference was found in muscle strength, handgrip strength or functional mobility at first awakening, ICU discharge, and 12-month follow-up. Muscle biopsy at day 15, however, showed that NMES prevented muscle atrophy [69]. This study too was a single centre study with a small cohort of patients whose results cannot be generalised.

Veldema and colleagues' RCT of 39 patients investigated the effectiveness of cycle ergometer and resistance training in addition to standard care on lower limb strength, walking ability and cardiovascular endurance. Patients were divided into three groups:

1. Ergometer training
2. Resistance training
3. Control group (standard care)

Patients received intervention 5 days per week for 4 weeks (inpatient neurological rehabilitation), and were evaluated at baseline, after two weeks of treatment and at the end of the 4-week intervention period [44]. Ergometer (p = 0.012 and 0.005, respectively) and resistance training (p = 0.025 and 0.007, respectively) caused significant improvements in the 10-metre walk test from baseline to two weeks and from baseline to four weeks of intervention. However, the 10-metre walk test improved more with resistance training than with ergometer training between two and four weeks of intervention (p = 0.022). Ergometer training (p = 0.005) and standard care only (p = 0.004) significantly improved the timed up and go test from two to four weeks of intervention [44].

Maximum muscle force improved more with ergometer training compared to standard care, from baseline to four weeks of intervention ($p = 0.009$) and improved significantly between two and four weeks of intervention with ergometer training alone ($p = 0.005$) [44]. Cardiovascular endurance improved between baseline and two weeks of intervention in the ergometer training ($p = 0.001$) and resistance training groups ($p = 0.043$), but not in the control group. Heart rate after one-minute cool-down decreased better between baseline and two weeks, and between baseline and four weeks in the ergometer training group, compared to the control ($p = 0.001$ and 0.048, respectively) and resistance training groups ($p = 0.023$ and 0.035, respectively). The ergometer training group also had significantly improved cardiovascular endurance from baseline to two weeks ($p = 0.002$), and from two to four weeks ($p = 0.008$) [44]. As the interventions in this study were performed over a short period, more studies, performed over a longer period, are needed to determine the adequate amount of time/dosage of interventions to influence ICUAW [44].

A 2020 RCT of 99 ICU patients demonstrated that progressive early mobility improved functional status at ICU discharge. The intervention group participated in an early and progressive mobility program with five levels of activity, while the control group received conventional treatment without a pre-established routine. The results showed that the intervention group had better functional status and were more functionally independent than the control group (96% vs 44%; $p < 0.001$) [70]. The intervention group also had shorter ICU LOS than the control group, with no difference in hospital LOS. There was no difference in handgrip strength between the two groups, however, the intervention group performed better in the sit-to-stand test ($p < 0.01$) and the 2-minute walk test ($p < 0.001$) than the control group. The intervention group also had better maximum voluntary ventilation (MVV) values at ICU discharge (45 L/min ± 19 in control group vs 55 L/min ± 25 for intervention group; $p = 0.03$) [70].

2.8.3 Studies Contradicting the Benefits of Early Mobilisation

Despite all the above-mentioned reports of the benefits of early mobilisation in critical care, systematic reviews have also highlighted many limitations of these studies:

Calvo-Ayala and colleagues reviewed 14 RCTs (7417 ICU patients) to identify effective interventions that improve long-term physical function of critically ill patients. The Short Form-36 PF questionnaire (SF-36 PF), Barthel Index, 6-minute walk test, and ability to perform activities of daily living were used to assess physical function [54].

The only intervention they found that was effective in improving long-term physical outcomes was physical activity. However, sample sizes were generally small (ranged 16-4640 patients: only 3 studies with 300 patients), with a broad distribution of patient acuity (severity of illness), and a lack of double blinding. Five studies did not report even one measured outcome. Better quality research is needed that test the effect of different interventions on long-term physical outcomes of patients [54].

Tipping and colleagues' systematic review of 14 RCTs (1753 ICU patients) also identified the need for more robust studies to determine the effect of active mobilisation and rehabilitation on long-term outcomes of patients, and on the appropriate dosage and progression of rehabilitation. They found that active mobilisation and rehabilitation had no impact on mortality ($p > 0.05$). However, meta-analysis showed that active mobilisation improved muscle strength at ICU discharge according to the MRC sum score (mean difference 8.62 points, 95% confidence interval (CI) 1.39–15.86); improved patients' chances of walking unassisted (odds ratio 2.13, 95% CI 1.19–3.83); and resulted in more days alive out of hospital to day 180 (mean difference 9.69, 95% CI 1.7–17.66) [57].

Despite Stiller showing the benefits of early progressive mobility on safety, feasibility, functional status, and reduced ICU and hospital LOS, her systematic review (85 varied studies) revealed that the studies included were of variable methodological quality, and that the evidence from RCTs evaluating the effectiveness of routine multimodality respiratory physiotherapy is conflicting. More research is also needed on the appropriate dosage of mobilisation [23].

A systematic review of 12 RCTs (3885 ICU patients) conducted by Herling and colleagues sought to determine the effect of interventions on delirium, ICU mortality, number of delirium-free and ventilator free days, ICU LOS, and cognitive impairment. Usual care was compared to the following interventions: commonly used drugs (four studies); sedation regimens (four studies); physical therapy or cognitive therapy, or both (one study); environmental interventions (two studies); and preventive nursing care (one study) [49].

They found no difference in ICU delirium between groups, (risk ratio (RR) 1.01, 95% confidence interval (CI) 0.87 to 1.17) (moderate-quality evidence) [49].

Neither haloperidol nor placebo had any influence on: ICU delirium development and coma-free days (mean difference (MD) -0.60, 95% CI -1.37 to 0.17; 2 studies, 1580 participants (moderate-quality of evidence); in-hospital mortality (RR 0.98, 95% CI 0.80 to 1.22; 2 studies; 1580 participants (moderate-quality evidence); number of ventilator-free days (mean 23.8 (MD) -0.30, 95% CI -0.93 to 0.33) 1 study; 1439 participants, (high-quality evidence)); and ICU LOS (MD 0.18, 95% CI 0.60 to 0.97); 2 studies, 1580 participants; high-quality evidence [49].

Physical and cognitive therapy intervention versus standard care had no effect on: In-hospital mortality (RR 0.94, 95% CI 0.40 to 2.20, I2 = 0; 1 study, 65 participants; very low-quality evidence); number of delirium- and coma-free days (MD -2.8, 95% CI -10.1 to 4.6, $I^2 = 0$; 1 study, 65 participants; very low-quality evidence); number of ventilator-free days (within the first 28/30 days), median 27.4 (IQR 0 to 29.2) and 25 (IQR 0 to 28.9); 1 study, 65 participants; very low-quality evidence); ICU LOS (MD 1.23, 95% CI -0.68 to 3.14, $I^2 = 0$; 1 study, 65 participants; very low-quality evidence); and cognitive impairment measured by the Mini-Mental State Examination (MMSE) with higher scores indicating better function, (MD 0.97, 95% CI -0.19 to 2.13, I2 = 0; 1 study, 30 participants; very low-quality evidence); or measured by the Dysexecutive questionnaire (DEX) with lower scores indicating better function (MD -8.76, 95% CI -19.06 to 1.54, I2 = 0; 1 study, 30 participants; very low-quality evidence) [49].

The studies included in their systematic review were of low-quality: they had small sample sizes and lacked blinding of participants and staff. The evidence on the effects of physical and cognitive therapy on delirium are of poor quality, hence better-quality research is needed in this regard. Furthermore, the effects of pharmacological interventions on delirium are unclear, that warrants the need for more robust randomised control trials [49].

Higgins and colleagues reviewed 9 RCTs (3372 ICU patients) to determine the effect of early mobilisation on mortality, LOS and mechanical ventilation of trauma patients admitted to the ICU. Most studies used a progressive mobility protocol as their intervention. They were able to show a significantly shorter duration of mechanical ventilation in patients that received early mobilisation (mean difference -1.18 days, 95% CI, -2.17 – -0.19), but no difference in mortality between patients mobilised early and those receiving usual care. Despite these findings, because the sample sizes of the studies reviewed were small (15-1132 patients; median 63), the need for more robust RCTs to further support these benefits are warranted [60].

Doiron and colleagues reviewed 4 RCTs (690 ICU patients) to assess the effects of early mobilisation or exercise on both non-ventilated and mechanically ventilated patients, compared to usual care or delayed exercise [58].

In this review, three studies (454 participants) reported at least one measure of physical function. One study (104 participants) reported low-quality evidence of beneficial effects in the intervention group on return to independent functional status at hospital discharge (59% versus 35%, risk ratio (RR) 1.71, 95% confidence interval (CI) 1.11 to 2.64) [58].

The effects on physical functioning were uncertain for the following measures: Barthel Index scores (early mobilisation: median 75 vs control 55, low quality evidence); and number of ADLs achieved at ICU (median 3 vs 0, low quality evidence) or at hospital discharge (median 6 vs 4, low quality evidence) [58].

The effects of early mobilisation on physical function at ICU discharge were uncertain, according to the Acute Care Index of Function (ACIF): (early mobilisation mean: 61.1 vs control: 55, mean difference (MD) 6.10, 95% CI -11.85 to 24.05, low quality evidence) [58].

The Physical Function ICU Test (PFIT) score was 5.6 vs 5.4, MD 0.20, 95% CI -0.98 to 1.38, low quality evidence [58].

In summary, they reported low-quality, insufficient evidence on the effects of early mobilisation on physical function, muscle strength, adverse events, and quality of life. The studies included small sample sizes and lacked blinding of participants and staff. Interventions and measured outcomes were highly variable, and descriptions of what “usual care” as an intervention consists of were inadequate [58].

Anekwe and colleagues reviewed 9 RCTs (841 ICU patients) to evaluate how much early rehabilitation intervention reduces the incidence of ICUAW in critically ill patients versus usual care [59]. This is the first study that clearly showed a positive effect of early rehabilitation on ICUAW.

They found early mobilisation to be associated with a decreased risk of developing ICUAW: odds ratio (OR) 0.63 (95% CI: 0.43 to 0.92) in the screened population, and 0.71 (95% CI: 0.53 to 0.95) in the randomised population. ICUAW as an outcome was measured with the MRC sum score (which is challenging to perform in critically ill patients) instead of electrophysiological studies, which may not have reflected its true incidence [59].

Even though ICU LOS was shorter with rehabilitation in six studies, only one reported a significant decrease in LOS with early mobilisation: 2 days less in ICU, and 6.5 days less in hospital ($p = 0.01$) [59].They found no difference in the pooled OR for mortality reported in the ICU and the hospital (OR 1.19; 95% CI: 0.79 to 1.80 [59]. Interventions in the trials were variable: EM in five trials, NMES (neuromuscular electrical stimulation) in three trials, and both EM and NMES in one trial [59]. Despite the conclusion that early mobilisation is associated with a decreased risk of developing ICUAW, the wide confidence interval suggests that more well-conducted trials are needed to validate this finding [59].

Zhang and colleagues reviewed 23 RCTs (2308 ICU patients) to assess the evidence available on the effect of early mobilisation on critically ill patients [61]. They found that: early mobilisation decreased the incidence of ICUAW at hospital discharge (3 studies, 190 patients, relative risk (RR): 0.60, 95% confidence interval (CI) [0.40, 0.90]; p= 0.013, I^2= 0.0%); more patients were able to stand (one study, 50 patients, 90% vs. 62%, p= 0.02); patients had more ventilator-free days (six studies, 745 patients, standardised mean difference (SMD): 0.17, 95% CI [0.02, 0.31]; p= 0.023, I^2= 35.5%); and patients

were able to walk longer distances unassisted at hospital discharge (one study, 104 patients, 33.4 (0–91.4) metres vs 0 (0–30.4) metres, p= 0.004). More patients were discharged home directly from the ICU (seven studies, 793 patients, RR: 1.16, 95% CI [1.00, 1.34]; p= 0.046) [61]. Early mobilisation had no effect on adverse event and mortality rates in the ICU [61]. Despite these results, the evidence was of low-quality: different definitions of early mobilisation were used; interventions and outcomes measured varied; insufficient randomisation and blinding of participants and staff [61].

Okada and colleagues reviewed 11 RCTs (1322 ICU patients) to investigate the efficacy of early versus delayed mobilisation on mortality and health-related quality of life among critically ill adult patients [63]. They could not show that early mobilisation had any impact on these outcomes, as well as its effect on ICU and hospital LOS: the pooled relative risk (RR) for in-hospital mortality comparing early mobilisation to usual care was 1.12 (95% CI [confidence interval]: 0.80 to 1.58, I^2 = 0%); pooled mean differences for ICU and hospital LOS were -1.54 (95% CI: -3.33 to 0.25, I^2 = 90%) and -2.86 (95% CI: -5.51 to -0.21, I^2 = 85%), respectively; and the pooled mean differences at 6 months post-discharge, measured with the Short Form 36-Item Health Survey and Euro-QOL EQ-5D, were 4.65 (95% CI: -16.13 to 25.43, I^2 = 86%) for physical functioning and 0.29 (95% CI: -11.19 to 11.78, I^2 = 66%) for the visual analog scale [63].

The majority of studies have shown EM to be safe and feasible, with positive effects on functional status, ICU and hospital LOS, respiratory function, and duration of MV, exercise tolerance, and skeletal muscle strength. However, lack of standardisation of intervention and outcomes, study design limitations, small sample sizes, and lack of blinding make it challenging to confidently conclude that EM is safe and effective at improving patient outcomes. No studies were identified from Namibia, and very few overall from low/middle-income settings.

2.9 Barriers to Early Mobilisation

Even though early mobilisation has been shown to reduce the risk of ICUAW development and to improve physical and functional outcomes, and despite clinicians being aware of these benefits, EM is still given low priority [81, 98]. Different clinician groups possess various levels of knowledge on EM and identify different barriers that will affect their perceptions on suitability for mobilisation and the level of mobilisation delivered to a patient [79]. Many barriers to the implementation and provision of early mobilisation exist and can be grouped into three categories: patient-related; institutional-related; and provider-related barriers [1, 20, 34].

2.9.1 Patient-Related Barriers

Common barriers to the commencement of early mobilisation relate to the perceived or actual clinical picture of the patient and include medical instability, the presence of delirium and heavy sedation, cognitive impairment, risk of dislodgement of lines and other adverse events, and the presence of an endotracheal tube (ETT) [1, 34, 53, 97, 100].

2.9.2 Institutional-Related Barriers

These are obstacles that are linked to the operations of an institution or intensive care unit and include: routine bedrest orders on admission; lack of referrals for early mobilisation; limited time and equipment to deliver the early mobility; no leadership to take charge of early mobility (mobility champion); a lack of protocols and guidelines on sedation, delirium, and early mobility management [1, 34, 101, 114].

2.9.3 Provider-Related Barriers

These are obstacles that are perceived by clinicians as barriers to providing early mobility. They include limited staffing; inadequate training, education and skills that influence clinicians' decision to mobilise patients; safety concerns for both clinician and patient; limited staffing to provide early mobilisation; conflicting perceptions on suitability for mobilisation; and competing priorities in different aspects of patient care [1, 34, 53, 101, 114].

Many observational studies (cross-sectional surveys, focus groups, point prevalence) conducted in various countries all show similar barriers to early mobilisation [1, 80, 83, 88, 90, 94-97, 101, 126].

A recent point prevalence multi-centre Swiss study of 161 mechanically ventilated patients and 37 clinicians where mobilisation occurred infrequently, reported medical contraindications (n=22; 14%), cardiovascular instability (n=17; 11%), and deep sedation (n=8; 13%) as the most common perceived barriers to early mobilisation [90]. This coincides with an earlier point prevalence German study of 105 clinicians and 783 critically ill patients, where only 24% of all mechanically ventilated patients and 8% of patients with an endotracheal tube were mobilised out of bed. The most common barriers to early mobilisation were reported as cardiovascular instability (n=133; 17%) and deep sedation (n=117; 15%) [94].

Common barriers to EM mentioned above have been identified internationally under three categories i.e., patient-, institutional-, and provider-related barriers. No studies from Namibia were identified in this regard.

2.10 Quality Improvement Programmes

Though not easy to address, it is clear from this literature review that a shift away from the culture of bedrest and reduced mobility is advocated as best practice [8, 11, 20, 21]. The development and implementation of quality improvement programmes (QIP) in ICU can address this need by reducing delirium, ICU and hospital LOS, and the need for sedation [107]. Many QIPs [34, 106, 107, 110, 112, 113] have already been developed and implemented. They follow a similar structure that includes identification of the problem and planning/designing a programme, testing it, evaluating its effectiveness, and implementing re-interventions. The various models are described below:

2.10.1 The Four Es Model

This was a single centre study that included 112 patients receiving mechanical ventilation. Baseline data were collected on first out-of-bed mobilisation (sitting at edge of bed or out-of-bed activity); ICU LOS; number of therapy sessions (average 30 minutes each); hospital LOS; duration of ventilation and ventilator free days (first 28 days). The same data was collected for the duration of the project (4 years) [112]. This model included:

Engagement

A senior team of two intensivists, one nurse and one physiotherapist were established to lead the early mobilisation project. Two extra therapy support workers were employed to assist with delivering the early mobility activities to patients. Mobility champions were selected from nursing and physiotherapy [112].

Education

The entire team was trained to build up their expertise on the key elements involved in early mobilisation. The multidisciplinary team (MDT) was involved in ward rounds and early mobilisation workshops. The literature on early mobilisation was promoted, YouTube video demonstrations on early mobilisation were presented, and focus groups were held that identified barriers to mobilisation and discussed strategies to address them [112].

Execution

The early mobilisation protocol included twice-daily 30-minute rehabilitation sessions (started within 72 hours of intubation and ventilation through to ICU discharge) in addition to standard physiotherapy (usual care) for at least five days per week. Minimal sedation was ensured [112].

Evaluation

The outcomes of the project with evaluated via a three-month audit. The action taken at the end of the first improvement cycle was to re-engage new and existing members of the MDT, and to continue education, including monitoring of sedation and delirium (using the RASS and CAM-ICU tools) for assessment of patient-readiness for mobilisation [112].

The second improvement cycle commenced (like cycle 1), with the outcomes also audited at the end of the cycle [112].

Patients in this QIP started mobility earlier (from 16.3 days pre-QIP, to 4.3 days at the end of their second improvement cycle) and had a shorter ICU LOS (from 20.8 days pre-QIP, to 11.2 days at the end of their second improvement cycle) [112].

McWilliams and colleagues tested an already successful QIP, which used The Four Es Model, on 209 ICU patients to see if the positive results could be replicated at their institution. Implementing the QIP

was feasible, and patients were mobilised to higher levels. All patients were assessed for mobilisation readiness within 24 hours of admission by the physiotherapists who served as mobility champions. Initiation of mobilisation was much earlier (2 vs 3.5 days, $p < 0.001$) and more patients were mobilised (92% vs 73%, $p = 0.003$) than before the QIP. Further research, however, is necessary to determine the effect of this QIP on the long-term outcomes of patients [114].

Both the above studies were conducted in the UK) and were limited by a lack of blinding of the study teams, placing the study at risk of detection and performance bias.

2.10.2 Plan-Do-Study-Act (PDSA)

Engel and colleagues created a QIP across three centres in the USA using the PDSA approach to determine if early physical therapy provided to patients within 72 hours of admission to the ICU and 48 hours of intubation via an endotracheal tube was safe and feasible [107]. The PDSA approach entailed:

Plan (identify areas needing improvement)

All three centres established multidisciplinary early mobilisation team that consisted of critical care and rehabilitation clinicians from each discipline, led by a mobility champion. This team designed a standardised mobility protocol for mechanically ventilated patients [107].

An ICU mobility team nurse with no direct patient care duties screened all patients for eligibility to the early mobilisation programme. The ICU mobility team rotated through various ICUs and provided early mobility activities to eligible patients. ICUs at Wake Forest without the mobility team only provided the patients with usual care [107].

Baseline data was collected to show the low rate of patients receiving physical therapy pre-QIP (24% of patients at Johns Hopkins hospital received physical therapy; 58% of those same patients on deep sedation that negatively affected their ability to participate in their rehabilitation). Both Johns Hopkins and the University of California San Francisco (UCSF) Medical Centre implemented the planning and QIP using the Four Es model framework described above. Their multidisciplinary team met weekly for one year during the planning stage to identify problems and barriers to implementing the QIP. All the ICU clinical staff were educated on the benefits of early mobilisation and on using light sedation through promoting early mobilisation literature, sending out staff newsletters, posters and presenting ICU patient experiences to the staff. Experts in implementing ICU early mobility programmes were brought in to liaise with the mobility team members, who also went out to other centres with existing QIPs [107].

Do (test the interventions)

The Wake Forest early mobility team collected data on patient demographics that included all medications, central lines, rates of ventilator associated pneumonia, deep vein thrombosis, reintubation, and pulmonary embolism. Outcome measures were duration of ventilation (days), days to first out-of-bed activity, ICU, and hospital LOS. Patients who met eligibility criteria in the intervention group triggered an automatic referral for physical therapy whether they were conscious or not. Unconscious patients received passive movements three times daily, with rehabilitation being progressed once awake and able to actively participate in their rehabilitation [107].

Johns Hopkins also collected the same data as Wake Forest, and included delirium screening, medication dosage, the number of physical therapy sessions, and the frequency and type of mobility activity provided. They encouraged the use of light sedation with non-benzodiazepines as needed and pursued early mobilisation and rehabilitation for patients within 48 hours of ICU admission. Referral

for early mobility at Johns Hopkins was not automatic but initiated by a QI project coordinator based on screening guidelines [107].

The UCSF used the same QI model as Johns Hopkins, but instead of having a QI project manager, their project was led by the physical therapist in the ICU. Their ICU nurses were responsible for assessing readiness for mobilisation and were granted permission by the UCSF medical executive board to write referrals for physiotherapy to shorten timing of physical therapy after admission [107].

Study (review/audit the results)

After implementation, all three QIPs were assessed for barriers encountered, effectiveness of the early mobility protocols and referral systems, and feasibility [107].

At Wake Forest, 80% of patients in the intervention group had at least one physical therapy session compared to 47.4% in the usual care group. The ICU LOS was 5.5 days for the intervention group compared to 6.9 days for the usual group. Hospital LOS was 11.2 days for the intervention group compared to 14.5 days for the usual care group. The financial costs of the early mobility programme was lower than that of the usual care group [107].

At Johns Hopkins, the percentage of patients receiving physical therapy or occupational therapy increased from 70% to 93%. The average ICU and hospital LOS decreased during the QI period by 2.1 and 3.1 days, respectively. Barriers identified included a lack of: institutional and project leadership; staffing and equipment; physician referrals for physical therapy closer to ICU admission; and management of pain, delirium, activity tolerance and safety. They also demonstrated cost savings during the QIP [107].

The UCSF also demonstrated cost savings through the QIP. Regular updates on improvements associated with early mobility in the ICU were made available to ICU staff and all other staff via posters, e-mails, and presentations at medical centre-wide rounds. After implementation of the QIP, median number of days from ICU admission to initial physical therapy evaluation decreased from 3 to 1 day. Median ICU and hospital LOS both decreased by 2 days [107].

Act (implement reinterventions)

Wake Forest published their QI project and demonstrated that early physical therapy compared with a group receiving usual care was associated with significant improvements in clinical outcomes for ICU patients. They published a 1-year follow-up report on the long-term outcomes on ICU survivors of this QIP and provided their baseline data for an ongoing RCT on ICU early mobility. Johns Hopkins and UCSF used this study to develop and implement early mobilisation protocols for their respective ICUs, have both expanded their programmes published many articles on the financial impacts of early mobility programmes, and offer continuous professional development on early mobilisation in critical care [107].

Castro and colleagues also used the PDSA model at a single unit in the USA to evaluate and improve the mindset of SICU staff toward early mobilisation of patients receiving mechanical ventilation before, 6 months after, and 1 year after its implementation [110]:

Plan

The mindset of nursing staff and barriers to early mobilisation were assessed through a survey. Possible interventions to change the mindset were brainstormed [110].

Do

The nurses used a guide to assess patient readiness for mobilisation/rehabilitation, while their multidisciplinary team adopted a progressive early mobility protocol deigned by Morris and Herridge [111]. Education on the detrimental effects of immobility, appropriateness for early mobilisation and sedation practice was provided to the multidisciplinary team. The survey was distributed to the SICU staff nurses 2 weeks before, 6 months after, and 1 year after implementation of early mobilisation of mechanically ventilated patients [110].

Study

A change in the mindset of SICU staff toward early mobilisation of patients receiving mechanical ventilation occurred. They agreed that most patients receiving mechanical ventilation can get out of bed safely with assistance and that EM decreases ICU LOS, ventilator-associated pneumonia, deep vein thrombosis and skin deterioration [110].

Act

Interventions that were implemented to overcome barriers in the ICU are ongoing, and an early mobilisation protocol has been added to the unit's daily goal sheet and has also been added to the orientation of new nurses, surgical residents, and fellows [110].

2.10.3 Project BOOST (Better Outcomes by Optimising Safe Techniques)

A single centre study also conducted in the USA sought to qualitatively evaluate the experiences of patient, family, and staff members of an early mobilisation QIP implemented in a general medicine unit. Semi-structured interviews were conducted on four patients and eight staff members. The inclusion of family members was unsuccessful due to timing of visits and schedule restrictions [113].

This QIP employed the **Project BOOST** (Better Outcomes by Optimising Safe Techniques) which implements best practices for hospital discharge transitions: an interdisciplinary team focuses on patient education and team communication related to patient discharge. Both the treatment and control (comparison) group had a primary care physician, nurse case manager or social worker, a pharmacist, and nurses on board. One of the teams were supplemented with a physical therapist and mobility technician [113].

The physical therapist assessed each patient within 24-48 hours of admission to determine their functional status and level of mobility, which was monitored throughout their ICU stay. The physical therapist acted as a mobility champion, promoting mobility in the interdisciplinary rounds, while the mobility technician carried out the activities, and recorded the highest level of function of each patient on admission to the unit [113].

Evaluation of the Project BOOST QIP

A mixed methods case study approach was used, of which the quantitative results were reported separately. The results of the interviews conducted reported that early mobility bridged a gap in care (improved staff understanding of the patients' functional and mobility levels through the physical therapist promoting patient mobility), that the QIP confirmed the benefits of physical activity in patients, that early mobility was an important component of patients' function i.e., their

independence with ADLs. The QIP created an expectation in patients that they would be doing physical activity while hospitalised [113].

Only patients that participated in the mobility sessions were interviewed. This study therefore missed out on the experiences of the patients that did not participate in the mobility sessions [113].

2.10.4 Respiratory Care Process Model

The respiratory care process model was designed for patients with respiratory failure. Baseline data prior to the development of this model revealed that respiratory failure patients spent a mean of over three weeks hospital LOS, and about 40% of those patients had not returned to work at 1-year after discharge [105].

The respiratory care process model entailed [105]:

1. Having a manager with extensive clinical experience to coordinate care activities for the duration of hospital stay.
2. An MDT standard care process (designed by practicing clinicians) to guide patient care
3. Collection of outcomes-oriented data
4. Utilisation of Interdisciplinary documentation
5. The development of tools to manage the care process
6. Collection of longitudinal outcome data

The standard care process included standardised [105]:

1. Sedation management
2. Mechanical ventilation orders
3. Ulcer prevention
4. Deep venous thrombosis prophylaxis
5. Nutritional support
6. Maintenance of skin integrity
7. Physical activity
8. Treatment of sleep deprivation
9. Prevention/treatment of infectious complications
10. Prevention of aspiration

The respiratory care process model was implemented in eight stages [105]:

1. A sense of urgency was created by identifying the barriers to recovery (i.e., physical deconditioning, deep sedation, and bedrest)
2. Creation of the MDT guiding team
3. Creating a vision/goal: The team focused on reducing over sedation, increasing early activity, promoting sleep to decrease delirium, and protect newly extubated patients (cessation of mechanical ventilation)
4. Communicating the above-mentioned goal/s to other areas of the hospital so that activity could be started as early as possible (this was unsuccessful)
5. Getting others to implement the above-mentioned goals (time from hospital admission to ICU was reduced from 7-10 days to 2-3 days). Co-ordination of care, and finding nurses that agree with the respiratory care process model were found to be obstacles to patient activity
6. Creating short-term victories: data was provided to staff showing that as the number of patients to the unit increased, so did the staff numbers; a respiratory therapist became the shift coordinator; and patient activity levels increased

7. Consolidating improvements and continuously producing change: although recording night-time sleep was made a priority and added to the documentation charts by the authors, it was not documented regularly. This was addressed through staff education and eventually improved to 95% compliance
8. Institutionalising new approaches: A goal grid was posted to staff so they could see what projects were running regarding patient care. This respiratory ICU has earned itself a reputation for developing care process models

Early Activity Protocol at This Respiratory ICU

All ICU patients were assessed for early activity readiness within 24 hours of admission to the unit. Their criteria for initiation of early activity were: Neurological (the patient needs to respond purposefully to verbal stimulation); respiratory (an FiO_2 of no more than 0.6, and a PEEP of no more than 10cm H_2O); and circulatory (no low blood pressure due to position change or catecholamine drips) [105].

The patient then received twice-daily early activity with the involvement of the MDT (physical and respiratory therapists, nurse, and critical care technician). Activities were started with unsupported sitting at the edge of the bed, and progressed to sitting in a chair, then walking with a walking aid or manual assistance, to walking unassisted (with a wheelchair behind the patient in case of any adverse event) with a goal of walking more than 100 feet (30.48 metres) [105].

2.10.5 Other

Four-Part Quality Improvement Project

A single centre Australian study created a four-part QIP similar to the Four Es Model with the aim of increasing the mobilisation frequency in the ICU. These steps included [34]:

1. An audit to determine the baseline mobilisation frequency pre-QIP.
2. A staff survey on perceived barriers to mobilisation: medical instability and sedation were common barriers.
3. Identifying the barriers that could be changed (lack of knowledge of EM benefits; poor MDT communication; no mobility leadership/driver) and designing strategies to address them (education on EM benefits; promoting mobility in ward rounds; clarification of roles in the MDT; establishing a mobility champion)
4. Performing a follow-up audit on mobilisation frequency to determine effectiveness of the above-mentioned implemented strategies.

Despite the impression of this ICU being pro-mobilisation, the baseline (207 patients) and follow-up (200 patients) audits reported similar results, concluding that the QIP did not significantly improve mobilisation frequency of patients (n=142; 69% to n=148; 74%), (p = 0.276). Most of the patients that did not mobilise were intubated and mechanically ventilated (n=273; 62% to n=308; 67%). Other factors that influenced patients' ability to mobilise were identified, such as sedation (n=157; 36% to n=201; 44%) which need to be addressed through changing sedation practices [34].

Performance Improvement Project

Corcoran and colleagues sought to assess the efficacy of early mobilisation of patients with and without mechanical ventilation in the ICU on LOS and patient outcomes and to determine the feasibility of their performance improvement project (PIP). They prospectively collected patient data (n=160 in 2014) and compared it to a historical patient population (n=123 in 2012) [29].

Training was provided to the MDT, mobility guidelines were developed, and ward rounds conducted to encourage interprofessional collaboration and improve rehabilitation intensity in the ICUs of their hospital [29].

Rehabilitation intensity increased by 60 minutes from 2012 to 2014. The average ICU LOS also decreased from 4.6 days to 3.7 days ($p = .05$). More patients (40.5%) were discharged home without the need for further services compared to 18.2% before the PIP ($p < .01$). The improved rehabilitation services helped decrease costs by $1.5 million, clearly demonstrating that their PIP is feasible [29].

Multidisciplinary Mobility Programme

Bassett and colleagues created a QIP involving 13 centres using a model similar to the Four Es Model. They aimed to create an initiative that would enable ICU teams to address key issues so that mobility can be integrated into the daily care of patients. This initiative included [106]:

1. The design of a progressive mobility guide that takes sedation and agitation into consideration
2. Providing education on barriers to mobility and implementing strategies to transform ICU mobility culture, and address the barriers in the form of workshops, MDT involvement, and the establishment of a mobility champion
3. Creating support for adopting new practices in the form of resources, discussion forums, and incentives for adopting the new mobility culture
4. Qualitative evaluation of the above-mentioned processes (improved mobility culture and an expectation of mobility for patients) and quantitative evaluation of ventilator days (decreased from 3 to 2.1 days) and timing of physical therapy. No statistically significant differences in ICU mortality (7.7 vs. 6.2, $p = .51$) and ICU LOS (5.0 vs. 5.2, $p = .60$) were reported

Financial Implications of Starting a Mobility Protocol

Knoblauch and colleagues sought to determine the financial implications of implementing a progressive mobility protocol in their ICU. The protocol consisted of three phases of progressive mobility interventions appropriate for the patient's capabilities [108].

Additional nursing assistants were employed, and education provided to implement the mobility protocol. However, additional time spent by nurses in mobility activities was in addition to their usual duties and did not generate extra cost [108].

An unexpectedly large proportion of patients with ARDS were managed in the ICU due to the H1N1 pandemic in early 2011.This phenomenon was linked to the increase in average ICU LOS (from 5.45 days per month to 10.31 days in February 2011) and incidence of pressure ulcers during the implementation of the mobility protocol. The incidence of pressure ulcers was correlated with high patient acuity on admission (high APACHE II scores) and LOS, linked to the ARDS admissions influx [108].

Overall cost reduction of implementing the progressive mobility protocol in their ICU could not be demonstrated due to this ARDS influx. It is also possible due to the lack of direction on the exact dosage and intensity of mobility that the intervention was not adequate to influence cost [108].

Physical Therapy-driven Quality Improvement Project

Harris and Shahid described a physical therapist-led mobility programme on 21 ICU patients. A physical therapist was appointed as mobility champion to promote early mobility in the ICU. Before implementation of this programme, physical therapy referrals were ordered on an *ad hoc* basis, and patients were put on a physical therapy "hold" after being transferred into the ICU from the wards. It emerged from discussions that the intensivist was not aware of this practice, and that they expected the nurses to manage patient readiness for mobilisation. Interdepartmental, MDT meetings and staff education to increase staff knowledge on early mobility, its benefits and feasibility all contributed to a change in departmental policy that abolished this physical therapy "hold". Barriers to mobilisation (i.e., nurse resistance, patients with multiple lines, and lack of co-ordination of care between physical therapists and nurses) was also discussed with management and subsequently addressed. Interdisciplinary and MDT collaboration was an important catalyst in supporting early mobilisation in the ICU and facilitated the sharing of knowledge amongst disciplines regarding the safety and appropriateness for mobilisation [109].

Based on the charts of the 21 patients, more physical therapy evaluations were performed (from 364 in 2011-2012 to 542 in 2012-2013) after starting this programme [109].

2.11 Conclusion

It is evident from the literature that a global culture of bedrest still exists, combined with gaps between early mobilisation knowledge and practice. Adding to this uncertainty are the lack of consensus on the definition of early mobilisation, and a lack of clear guidelines on the exact timing, dosage, and intensity of mobilisation, which results in variation in mobility practice [12, 15].

Despite the positive effects of early mobilisation reported in the studies included in this literature review, research is still needed on its long-term outcomes of patients. The effects of both pharmacological and physical activity interventions on delirium, duration of ventilation, and ICU LOS (except for Higgins and colleagues' systematic review [SR]) are also uncertain. The occurrence of adverse events and mortality is not influenced by EM nor pharmacologic intervention [60].

The evidence presented in these studies are mostly of low quality, with small sample sizes, different definitions of early mobilisation, varied interventions and outcomes, and inadequate randomisation and blinding of participants and staff/researchers. Many more well-conducted, large-scale RCTs are therefore needed to validate the findings presented in this literature review.

Although a plethora of available research on early mobilisation exists, at the time of this study, no published studies could be found on ICU patient profiles, early ICU-based activity, and mobility practices in the Namibian context. This highlights a research gap, which will be addressed through the research studies in chapter 3.

Chapter 3 Methodology

This chapter describes the research process followed during this study. The research design and study sites will be outlined, that include the standard rehabilitation/mobilisation practice of one of the study sites, followed by details of selection and recruitment, inclusion and exclusion criteria, sample size determinants, variables, and how missing data was dealt with.

3.1 Research Design

The following two quantitative study designs were utilised to answer the research questions:

Table 3.1 Study Designs

Research Design	Strengths	Weaknesses
Retrospective, descriptive record review	Inexpensive, quick and easier than prospective studies No loss to follow-up	Inferior quality of evidence compared to prospective studies Cannot determine causation, only association Prone to misclassification bias
Descriptive, cross-sectional, self-administered survey	Quick and easy to conduct Data is only collected once Many variables can be studied	Cannot measure incidence Prone to low response and misclassification bias

3.2 Study Sites

The study sites were two private ICUs in Windhoek:

- Roman Catholic Hospital, a private institution with a modern 10-bed ICU, a cardiac unit, and an estimated 1200 ICU admissions annually.
- Mediclinic Windhoek, a private institution with a 9-bed general ICU and an estimated 480 ICU admissions annually. Whether this hospital has written mobilisation protocols are uncertain. The mobility practice of the physiotherapists at this hospital is unknown.

The Namibian Society of Physiotherapy also emailed the survey to its members.

3.3 Standard Rehabilitation/Mobilisation Practice of Study Sites

Roman Catholic Hospital

The physiotherapists and nurses at this hospital follow a protocol for orthopaedic (Appendix and VI Appendix VII) and cardiac surgery (Appendix VIII) patients in ICU that carry over into the ward and extends beyond hospital discharge for later stages of rehabilitation.

The cardiothoracic surgeon and one of the orthopaedic surgeons email a list of planned surgeries to the physiotherapy practice at this hospital one to two weeks in advance. A daily theatre list is emailed to all the wards and the physiotherapy practice here.

All the planned cardiac surgery patients (except in the case of emergencies), and most planned total knee and total hip replacement patients (all except one surgeon's patients) get admitted to hospital one day before the date of surgery and are evaluated in a pre-operative session by a physiotherapist where the physiotherapy procedures, goals, and expectations related to the surgery are explained. Information booklets (Appendix IX, X, XI, and XII) on physiotherapy after surgery are given to the patients, and the exercises relevant to their procedure are practiced with the physiotherapist.

Most orthopaedic (joint replacements and fixed fractures) and cardiac surgery patients at this hospital are mobilised out of bed day 1 after surgery and should be seen once to twice daily for mobilisation, when appropriate and in the absence of complications.

Orthopaedic patients are normally transferred to the ward day 1 post surgery, while cardiac surgery patients are transferred to the ward between day 2-3 post surgery. Patients who had undergone angiograms and received stents normally only stay one night and are discharged home from ICU the very next morning.

Joint replacement patients normally stay in hospital between 4-5 days, while cardiac surgery patients normally stay between 5-7 days in hospital, both in the absence of complications.

Mediclinic Windhoek

It is unknown whether the physiotherapy practice here, or whether this hospital has rehabilitation/mobility protocols in place. The mobility practice of the physiotherapists at this hospital is unknown.

3.4 Record Review

3.4.1 Participant Selection and Recruitment

Adult patients admitted to ICU between 01 January 2016 and 31 December 2016 were eligible for inclusion in the record review. The researcher arranged with the two hospital and ICU unit managers to obtain patient records.

3.4.2 Sampling Strategy

A sample of convenience was used. The two private hospitals included in this study were the only institutions that gave permission to conduct the research. The other two private hospitals in Windhoek refused permission, while the permanent secretary office in charge of the two public hospitals in this region abandoned the process of attending to the student's research request.

3.4.3 Inclusion Criteria

All adult patients older than 18 years, admitted to the ICU of either study site, with a confirmed documented admission diagnosis were eligible for inclusion in the record review.

3.4.4 Exclusion Criteria

Participants were excluded from the study if they had incomplete datasets or illegible records.

3.4.5 Sample Size Determinants

A convenience sample was used. Because this study did not use hypothesis testing, a sample size analysis was not conducted.

3.4.6 Missing Data

Participants with incomplete datasets were excluded from the study.

3.4.7 Variables

The following variables were extracted from participants' charts and medical records, using a self-designed electronic data abstraction form. Feedback and comments from participants of the pilot project at Groote Schuur Hospital, Cape Town, South Africa, were used to confirm usability of the data abstraction form.

Categorical Data:

- Sex (male/female)
- Admission diagnosis
- Time of admission
- Admission source (casualty, wards, theatre, other hospital, unspecified)
- Admission type (emergency or elective) and timing [immediately (< one hour) or delayed (> one hour)]
- Ventilation status (non-invasive ventilation or invasive mechanical ventilation) and type (mode of ventilation)

In addition, physiotherapy techniques performed; timing and frequency of mobilisation; presence of delirium; ICU outcome (discharge to ward, hospital transfer, discharged home, death), adverse events during physiotherapy and in-ICU mortality (survived or died) were documented.

Continuous Data:

Age (years), duration of mechanical ventilation and ICU stay (days), and readmission rate (number of readmissions for that patient in the year 2016).

3.5 Survey

3.5.1 Participant Selection and Recruitment

Nurses, doctors, and physiotherapists working in any Namibian ICUs were targeted for inclusion in the survey. The student researcher arranged with the two hospital and ICU unit managers to distribute the paper survey to the clinicians working in ICU. The Namibian Society of Physiotherapy was also approached to distribute the survey to its members.

3.5.2 Sampling Strategy

Because Windhoek is a small city, with a relatively small study population, *purposive* sampling (total population sampling) was used. This targeted ALL nurses, doctors and physiotherapists working in ICU who fulfilled the inclusion criteria.

3.5.3 Inclusion Criteria

Survey respondents had to meet the following criteria:

Qualified nurses, doctors, and physiotherapists with at least one year of post-qualification ICU working experience, and voluntarily consented to participate in the study.

3.5.4 Exclusion Criteria

Participants were excluded if they were receiving intern training in ICU.

3.5.5 Sample Size Determinants

The sample size was based on a guide for the design and conduct of self-administered surveys of clinicians by Burns and colleagues [127]. Of the estimated 686 nurses, doctors and physiotherapists working in Namibian ICUs, the required sample size was calculated as 153 respondents, with a 95% confidence level and 7% margin of error.

3.5.6 Missing Data

Incomplete survey responses were included in the analysis, indicated as "unanswered" in the results section.

3.5.7 Variables

A survey http://cmajopen.ca/content/suppl/2016/08/18/4.3.E448.DC1/2016-0021-1-at.pdf

(Appendix XIII) developed by Koo and colleagues [1] was adapted and tested during the pilot project for usability. Pilot project participants gave feedback and comments on the design of the survey tool.

Early mobilisation was defined in the survey glossary as physiotherapy and acute rehabilitation starting within 48 hours of admission to ICU and may begin while patients are receiving mechanical ventilation.

The survey started with a screening question that asked: "Do you have at least one year of experience working in ICU?" This question was followed by: "If yes, you may continue answering the questionnaire. Please state number of years of experience you have working in ICU".

Nominal and Ordinal Categorical Data:

Clinician Demographics

There were six closed questions on clinician demographics. Participants had to select one check box for each question, except where the question asked the participant to select all that applied. A free-text section was provided for doctors to specify their area of specialisation. Participants were asked to select all options that applied regarding the types of ICU they work in.

Perceptions

Four questions in this section evaluated perceptions on early mobilisation through a Likert-style question that asked participants to select one option that best described their view of early mobilisation; a multiple-choice question that asked when they would initiate mobilisation in the ICU (they could select more than one answer); as well as a free-text section for options not covered in the question. Two case scenarios were included where participants had to select the highest activity -level they would allow for each condition in the scenario given. They were only allowed to select one answer for each condition.

Knowledge

Four questions evaluated participants' knowledge on early mobilisation in ICU. Participants were asked what they thought the approximate incidence of ICU acquired weakness was, whether they were familiar with the current literature or clinical trials on early mobilisation, what the clinical studies on early mobilisation of critically ill ICU patients show, and how well trained and informed they felt to mobilise mechanically ventilated patients. Participants had to select one answer from the list and were asked to select all that applied in one of the questions.

Practice

Assessment for Need of Rehabilitation

This section included four "yes"/ "no"/ "unsure" questions. If the participant answered "yes" to whether their ICU had a clinician serving as an early mobility champion, they had to select which

profession that person was from. Participants were asked to select one response from a list on who the first healthcare provider was to identify if a patient is ready for mobilisation. A free-text section was provided for responses not on the list.

Sedation Practices

Participants were asked if daily sedation protocols were used in their ICU and had to select one option: "routinely", "frequently", "sometimes", "infrequently", "never", or "unsure" from a Likert-style list.

The last question in this section asked doctors only to answer: "Do you use standardised sedation scales to titrate sedation, according to patient activity level"? This was a Likert-style question where participants had to select "routinely", "frequently", "sometimes", "infrequently", "never", or "unsure".

Duration, Frequency, and Intensity of Mobilisation

The duration, frequency and intensity of mobilisation section asked only physiotherapist participants to answer. The Likert-style questions on duration and frequency of mobilisation asked participants to select one response for each condition in the two questions.

The question on intensity of mobilisation asked participants to select more than one answer for each condition. This section also included six "yes"/ "no" questions on progression of mobilisation.

Staffing in the ICU

All participants were asked to answer the two questions on staffing in the ICU. Participants were required to select answers from a list on who participates in the mobilisation of patients in their ICU. A free-text section was provided for options not covered in the list. Participants were also asked to select one option for the question: "Is there a designated physiotherapist working in your ICU during the following times?". Participants had to select "full assessments and mobilisation", "limited assessments and mobilisation", "chest physiotherapy only", "not available", or "unsure".

Physiotherapy Techniques Performed

Physiotherapists only were required to answer the questions on physiotherapy techniques performed.

Physiotherapy participants were asked how often each of a pre-populated list of techniques were used in ICU. They were required to select "never", "infrequently", "sometimes", "frequently", "routinely", or "unsure". A free-text section for techniques not covered in the list was provided.

Physiotherapist Workload

Physiotherapy participants were asked to enter how many patients on average they assessed and/or managed daily in ICU, in total (hospital and ICU), and what the duration of their shift was. Participants had to select from a list whether they worked full-time or part-time.

Rehabilitation After ICU Discharge

This section included two questions: firstly, participants were asked if patients with suspected ICU-acquired weakness were routinely referred to an outpatient clinic after ICU discharge for long term rehabilitation ("yes", "no" or "unsure" options).

If participants selected "yes", they were then asked where those patients were referred, and to select all that applied from a pre-populated list. A free-text option was also provided.

Barriers to Early Mobilisation in the ICU

The barriers to early mobilisation in ICU included three questions on institutional, patient, and provider level barriers. Participants could check all answers that applied, and an optional free-text section was provided for additional barriers.

3.6 Permissions and Ethical Approvals to Conduct Study

Ethical approval was obtained from the Human Research Ethics Committee of the University of Cape Town (HREC REF no 116/2018) (Appendix XIV, XV, and XVI), as well as the Mediclinic Human Research Ethics Committee (Appendix XVII).

Four hospitals and five professional bodies were approached for permission to conduct the study; however, only two hospitals and one professional body granted permission (Appendix XVIII and XIX).

3.7 Pilot Project

Groote Schuur Hospital's medical superintendent granted permission to conduct a pilot record review and survey amongst a small group of nurses, doctors and physiotherapists working in ICU. The pilot project was used to trial the data abstraction form and survey and determine the usability thereof. No data from this project were analysed nor included in the results. Groote Schuur hospital staff were used to pilot the data collection instruments rather than Namibian ICU staff, as the former have clinical and research experience in this field. Furthermore, we did not want to overburden the small research population in Namibian ICUs, in order to optimise the survey response.

3.7.1 Pilot Project Setting

The project setting was at a teaching hospital in Cape Town, South Africa.

3.7.2 Procedure

The medical records and charts of all allocated patients admitted to the spinal, respiratory, and surgical ICUs were reviewed on a single day. A sample of convenience of ten adult patients with complete datasets were reviewed. Chart information was recorded on paper and no patient-identifying information was abstracted.

The survey was piloted amongst a convenience sample of 13 professionals working at Groote Schuur Hospital (identified by management): five doctors from various specialisations; six ICU nurses; and two physiotherapists.

The researcher met with each professional group separately after obtaining informed consent from each participant. Participants were asked to provide feedback on the layout of the data collection tools; the appropriateness and complexity of questions in the survey; the time needed for survey completion; and other suggestions on wording and additional items to include in the survey and data abstraction form.

3.7.3 Adjustments Made Following Pilot Project

The following comments and subsequent adjustments were made for the data abstraction form and survey (Table 3.1):

Table 3.2: Data Abstraction Form Comments

Participant Comments	Adjustments Made
1. Provide more blocks to answer in as many patients have more than one diagnosis	Added more blocks to indicate multiple diagnoses

2.	Type of Mechanical Ventilation: Maybe add something about how much support the patient is getting e.g., FiO_2, PEEP	Did not add as this detail was not considered necessary
3.	Add suctioning as a chest physiotherapy technique: multidisciplinary team sees it as a physio technique	Did not add suctioning as a physiotherapy-specific technique as suctioning is mostly performed by nursing staff
4.	Mobilisation: Walking option: Add "with or without assistive device or assistance of physiotherapist"	Added "with or without assistive device", and/or "assistance of physiotherapist"
5.	Acuity level of patients need to be considered	Did not include this as Roman Catholic Hospital does not record APACHE scores nor any other illness severity score on admission

The following additional changes were made to the data abstraction form to provide more options to closed questions:

- Added "Not Applicable" to: *Type of Mechanical Ventilation, Frequency of Mobilisation, and Adverse Events During Physiotherapy*
- *Added* "None" to: *Physiotherapy Techniques Performed, Adverse Events During Physiotherapy*
- *Added* "Not Mobilised" to: *Timing of Mobilisation*
- *Added* "Not Indicated" to: *Presence of Delirium*

Table 3.2 itemises the comments and subsequent adjustments made to the survey tool, based on pilot participant feedback.

Table 3.3: Survey Comments

	Participant Comments	Adjustments to Survey
1.	Difficult to answer questions on mobilisation and physiotherapy techniques from a medical and nursing standpoint. Doctors are aware of some of the physiotherapy techniques used, but not all that physiotherapists do.	Physiotherapists only to answer more detailed questions on mobilisation, physiotherapy techniques and physiotherapist workload and availability
2.	Missing tick boxes	Added missing tick boxes
3.	Typing errors in questions	Corrected typing errors in questions
4.	Last question in survey too complex. Must be rephrased	Rephrased last question and made more reader-friendly
5.	Print survey in both sides of paper. Easier to follow	Printed survey on both sides of paper
6.	Add "verbal referral" to question 17.	Integrated "verbal referral" into question 17
7.	Tables difficult to follow. Make sure headings are present at top of new page of tables.	Simplified tables and added headings to top of all tables

8.	Not applicable to answer question 20 if question 19 is not "yes"	Changed question to: "If yes, which discipline is he/she from"?
9.	Survey is too long, monotonous, tiresome. Cut down to half and be specific.	Survey made more succinct and specific
10.	Add "spinal unit" to question 3	Added "spinal unit" to list of options in question 3
11.	First sentence in statement of consent (informed consent form) a bit confusing to read and understand	Corrected wording in the statement of consent

3.8 Main Study Procedure

3.8.1 Data Collection and Management

The student researcher arranged with the hospital and ICU unit managers to obtain patient records and distribute the paper survey to clinicians working in ICU.

Record Review

The hospital managers each assigned a staff member from their archive department to retrieve the requested records, and these were delivered in batches to a private room where the student researcher abstracted the data. Data were recorded electronically on a laptop and stored on an encrypted removable device only accessible to the researchers. Raw data were captured at the hospital and coded at a later stage to ensure anonymity. Each batch of folders was immediately collected after abstraction and a new batch delivered by the same staff member to avoid loss or physical damage to the records.

Survey

After briefing the ICU unit managers (who were independent of the study), they distributed the surveys to all staff working both day and night shifts. The student researcher also briefed the potential participants before the surveys were distributed. Consenting nurses, doctors and physiotherapists who met the inclusion criteria completed one survey (Appendix XX) each in their own time (to minimise the Hawthorne Effect) and placed them in a collection box situated at the ICU administration station. Participation was voluntary. Surveys were anonymous, and completed surveys were stored in a locked cupboard. Survey data were captured electronically and stored in a password-protected folder on a laptop accessible only to the researchers. The unit managers were reminded weekly about the surveys needing completion.

A representative of the Namibian Society of Physiotherapy (NSP) handed out the survey to its members at a fun run hosted by the NSP. The researcher was present to explain the details of the study and to answer any questions that respondents had. Respondents completed the surveys in their own time. The NSP also emailed the survey to its members, thereby maintaining anonymity.

3.8.2 Data Quality

For data quality assurance, the student researcher conducted a pilot project to trial and fine-tune the research tools; interruptions and time pressure during data extraction were minimised, and a standardised data abstraction protocol was followed. The student researcher first reviewed the entire medical chart and folder before extracting data, clearly documented inclusion and exclusion criteria

for the chart review and survey and had documented rules for dealing with missing information and multiple values.

A glossary (Appendix XXI) defined each data element, prioritised critical data elements and created check boxes to cover all possible answers that did not overlap and had very few free text sections. All data elements were objective and only original records were used for the abstraction.

The same data extraction form was used at both participating hospitals: data were entered directly onto the laptop to reduce human transcription error, and computerised error checks were implemented during and after data entry to alert for missing, out-of-range or illogical values. Manual checks were also done where computerised checks did not detect errors.

3.8.3 Statistical Analyses

Descriptive statistics were used to summarise the profile of participants admitted to ICUs in Windhoek, and to summarise survey respondent demographics, perceptions, knowledge, mobility practice, and perceived barriers to early mobilisation of patients in the ICU. Continuous data were tested for normality using Shapiro Wilks W test, and central tendency was presented according to distribution-means and standard deviations (SD) for normally distributed data, and medians (interquartile range, IQR) for non-parametric data. Length of stay data in the record review is presented throughout as median (IQR) as this data was non-parametric.

Comparison of length of stay between patients mobilised and those not mobilised were analysed on Statistica Version 13 (StatSoft Inc, Tulsa, USA) using the Mann-Whitney U test. Significance was accepted at $p \leq 0.05$.

Table 3.4: Data Type and Analysis Explanation

Objective	Instrument	Data Type	Statistical Analysis Method
1. To determine the profile of patients admitted to ICUs in Windhoek	Electronic Data Abstraction Form	Categorical and continuous	Descriptive; Median and Interquartile Ranges; Mann-Whitney U
2. To determine the mobility practices of ICUs in Namibia	Electronic Data Abstraction Form; Self-administered Survey	Categorical and continuous	Descriptive
3. To determine nurse, doctor and physiotherapist attitudes, perceptions, and perceived barriers on early mobilisation in Namibian ICUs	Self-administered Survey	Categorical	Descriptive

3.9 Ethical Considerations

Because the researcher conducted the study on human participants, it was important to consider the ethical aspects according to the Declaration of Helsinki (2013) [128]: respect for persons (autonomy); confidentiality; non-maleficence; beneficence; and justice.

3.9.1 Record Review

3.9.1.1 Autonomy

Owing to the low-risk, non-interventive nature of the study, as well as feasibility, the need for informed consent was waived by the University of Cape Town's Faculty of Health Sciences' Human Research Ethics Committee (HREC). Data were de-identified for analysis.

3.9.1.2 Confidentiality

Participating hospitals were deidentified and coded *'Hospital 1'* and *'Hospital 2'* on the data abstraction form. The student researcher did not capture patient names and replaced them with number codes. She performed the review on the hospital premises and did not photocopy or take photographs of the records. Data extraction was performed electronically, stored on an encrypted removable storage device.

3.9.1.3 Non-maleficence

Since the record review was a non-interventional study, there was no physical risk of harm to patients. The only potential risk was breach of confidentiality, which was minimised by steps outlined earlier in the section on confidentiality.

3.9.1.4 Beneficence

No direct benefits resulted from participation in this study. It is hoped the results will contribute to the body of knowledge on ICU rehabilitation practice in Southern Africa, inform future research needs, and direct practice improvement initiatives.

3.9.1.5 Vulnerability

Critically ill patients admitted to adult ICUs are a vulnerable patient group. Given the nature of their condition, many critically ill adults lack capacity to provide consent and are largely dependent on healthcare professionals for their care whilst in ICU. However, in order to optimise healthcare in the ICU, it is imperative that research be conducted in this specific patient group. Both parts of this study were considered low risk by the HREC, and no interventions occurred which could have impacted on patient care.

3.9.1.6 Justice

All patients admitted to the ICUs during the study period were eligible for inclusion in the record review with no systematic exclusions that could be considered unjust.

3.9.2 Survey

3.9.2.1 Autonomy

Participant recruitment was entirely voluntary. To avoid coercion into taking the survey: participants were not approached in isolation; nor offered monetary incentives for participation. Participants could withdraw anytime without explanation or penalty. The researcher supplied full study details, explained risks and benefits, and provided opportunity for questions to consenting participants before starting.

The student researcher obtained informed consent (Appendix XXII) from all participants enrolled into the paper survey study. The electronic survey participant completed the informed consent document and emailed it to the secretary of the Namibian Society of Physiotherapy, who forwarded it to the student researcher. The consent form supplied detailed information on the study and participants' role. There was no incentive for completing the survey. Withdrawing from the study did not bear any consequences.

3.9.2.2 Confidentiality

Participants' anonymity was protected, and no identity-revealing questions were asked in the survey. Participants placed their completed paper surveys in a collection box at the two ICUs. After data collection, the student investigator stored all documents in a locked cupboard. Informed consent forms were stored separate from the questionnaires. The researcher kept a scanned copy of the signed consent forms and completed surveys on an encrypted removable drive, stored in another locked cupboard in case of damage or loss. Only the researchers had access to these documents, which will soon be archived.

3.9.2.3 Non-maleficence

This was a non-interventional survey study that did not obtain sensitive information. No participants were harmed during the research. The only foreseeable harm which could have arisen was confidentiality breach, and steps were in place to minimise risk, i.e.: no names, addresses or contact numbers were added on the survey; the storage cupboard with the data was *always* locked; and the data files on the removable storage device were all encrypted.

3.9.2.4 Beneficence

No direct benefits resulted from participation in this study. It is hoped the results will contribute to the body of knowledge on ICU rehabilitation practice in Southern Africa, inform future research needs, and direct practice improvement initiatives.

3.9.2.5 Vulnerability

The survey study did not knowingly include any particularly vulnerable groups.

3.9.2.6 Justice

The researcher recruited all eligible participants working in ICU to take the survey, so that they were representative of the group that would benefit from the results. Participating hospitals in the record review and survey did not draw any economic burden or benefit. To avoid out-of-pocket expenses, participants completed the survey during their free time.

3.9.3 Reimbursement and Remuneration

There was no payment for participation in this study. Out-of-pocket expenses to participants were avoided by allowing participants to take the survey during their free time.

3.9.4 Dissemination

Following completion of this research project, the researcher will email important study findings to the unit managers of the participating hospitals in Namibia. Findings will be submitted to a scientific peer-reviewed journal for publishing and the findings will be presented at either a local conference in Namibia, or internationally, to reach the broader research community.

The researchers will make their postal, email addresses and telephone contact information available in the published work so that those affected by the study can express their views and needs.

This study's results will be used to inform and direct future quality improvement projects at Roman Catholic Hospital, and other ICUs across Namibia.

The next chapter will discuss the results of the data collected during the record review and survey.

Chapter 4 Results

This chapter describes the findings of the record review and survey regarding the mobility practices, attitudes and perceptions of nurses, doctors, and physiotherapists on early mobilisation of critically ill patients in Namibian ICUs. The results of the record review will be described first, followed by the survey.

4.1 Record Review

Objectives of the record review were to describe:

- The profile of patients admitted to two private ICUs in Windhoek
- The ICU mobility practices in Windhoek

Descriptive statistics were used to summarise the profile of participants admitted to ICUs in Windhoek. Continuous data were tested for normality using Shapiro Wilks W test, and central tendency was presented according to distribution-means and standard deviations (SD) for normally distributed data, and medians (interquartile range, IQR) for non-parametric data. Length of stay data in the record review is presented throughout as median (IQR) as this data was non-parametric.

Two private hospitals in Windhoek granted permission for the review. Folders of 879 patients (61.8% male) were reviewed on both hospital premises: 859 (97.7%) from hospital 1, and 20 (2.3%) from hospital 2. The unit manager of hospital 2 gave the student researcher their ICU admissions book of 2016 to select the folders. The student researcher viewed the admissions list from January to February 2016 and selected all consecutive folders from those months (excluding paediatric folders) from the admissions book. Hospital 2 only delivered 20 folders (out of the estimated 480 folders) for abstraction to the student researcher and did not hold to their agreement on providing the student researcher with more folders for the rest of 2016, despite numerous reminders and requests for more batches. None of the 20 folders reviewed were excluded as they all had complete datasets.
Nine patients with missing record data from hospital 1 were excluded, resulting in 870 participants (61.8% male) being included in the data analysis. Participants' characteristics are presented in Table 4.1.

4.1.1 Participant Characteristics

Table 4.1: Participant Characteristics (n=870)

Characteristic	Category	N (%)
Sex	Male	538 (61.8)
	Female	332 (38.2)
Age range (years)	18-49	266 (30.6)
	50-64	344 (39.5)
	65-74	171 (19.7)
	75-84	82 (9.4)
	>85	7 (0.8)
Admission source	Theatre	391 (44.9)
	Cath lab	179 (20.6)
	Casualty	125 (14.4)
	Wards	94 (10.8)
	Other hospital	78 (9)
	Unspecified	3 (0.3)
Admission type	Elective	577 (66.3)
	Emergency	293 (33.7)
Admission timing	Immediate	849 (97.6)

	Delayed	21 (2.4)
Diagnosis group	Coronary angiogram	179 (20.6)
	Cardiac condition	113 (13)
	Cardiac surgery	90 (10.3)
	Total knee replacement	86 (9.9)
	Medical condition	59 (6.8)
	Spinal surgery	55 (6.3)
	Motor Vehicle Accident (MVA)	54 (6.2)
	Abdominal surgery	49 (5.6)
	Respiratory condition	46 (5.3)
	Total hip replacement	43 (4.9)
	Other*	96 (11)
Ventilated (Yes/No)	Yes	173 (19.9)
	No	697 (80.1)
Mode of Ventilation	Non-invasive CPAP	7 (0.8)
	Invasive CPAP with pressure support	9 (1)
	NAVA	1 (0.1)
	Proportional assist ventilation	0 (0)
	Pressure regulated volume control	1 (0.1)
	Airway pressure release ventilation	0 (0)
	Pressure controlled inverse ratio ventilation	0 (0)
	Pressure support ventilation	0 (0)
	Pressure controlled ventilation	0 (0)
	SIMV	153 (17.6)
	Assist-control ventilation	2 (0.2)
MVA=Motor Vehicle Accident; CPAP=Continuous Positive Airways Pressure; NAVA=Neurally Adjusted Ventilatory Assist; SIMV=Synchronized Intermittent Mechanical Ventilation **One diagnosis of Delirium grouped here*		

Mean age of all patients was 56 (SD 14.9, range 18-90) years. Most admissions came from theatre (n=391; 44.9%), Cath lab (n=179; 20.6%), and casualty (n=125; 14.4%). The majority of admissions were elective (n=577; 66.3%). Most patients (n=849; 97.6%) were admitted to ICU without delay. Coronary angiogram (n=179; 20.6%), cardiac conditions (n=113; 13%) and cardiac surgery (n=90; 10.3%) were the main admission diagnoses. Most of the patients (n=697; 80.1%) were not mechanically ventilated.

4.1.2 Length of Stay in ICU and Duration of Mechanical Ventilation

Mean length of stay in ICU was 3.41 (SD 3.3, range 1-37) days with the majority (n=471; 54.1%) spending less than 3 days in ICU. Mean duration of mechanical ventilation was 0.7 (SD 2.1, range 0-20) days.

4.1.3 ICU Outcome

The majority of participants of 625 (71.8%) were discharged to the ward from ICU, while 45 (5.2%) patients died in ICU.

4.1.4 Physiotherapy Techniques Received in ICU

Three-hundred-and-fifty-two (40.5%) patients received physiotherapy whilst in ICU. All but seven (2%) patients who received physiotherapy were mobilised whilst in ICU.

A wide range of physiotherapy techniques were documented (Figure 4.1), most commonly manual chest physiotherapy (n=202; 57%), mobilisation to a chair (n=164; 47%), and active range of motion exercises (n=124; 35%). Most participants received several physiotherapy modalities.

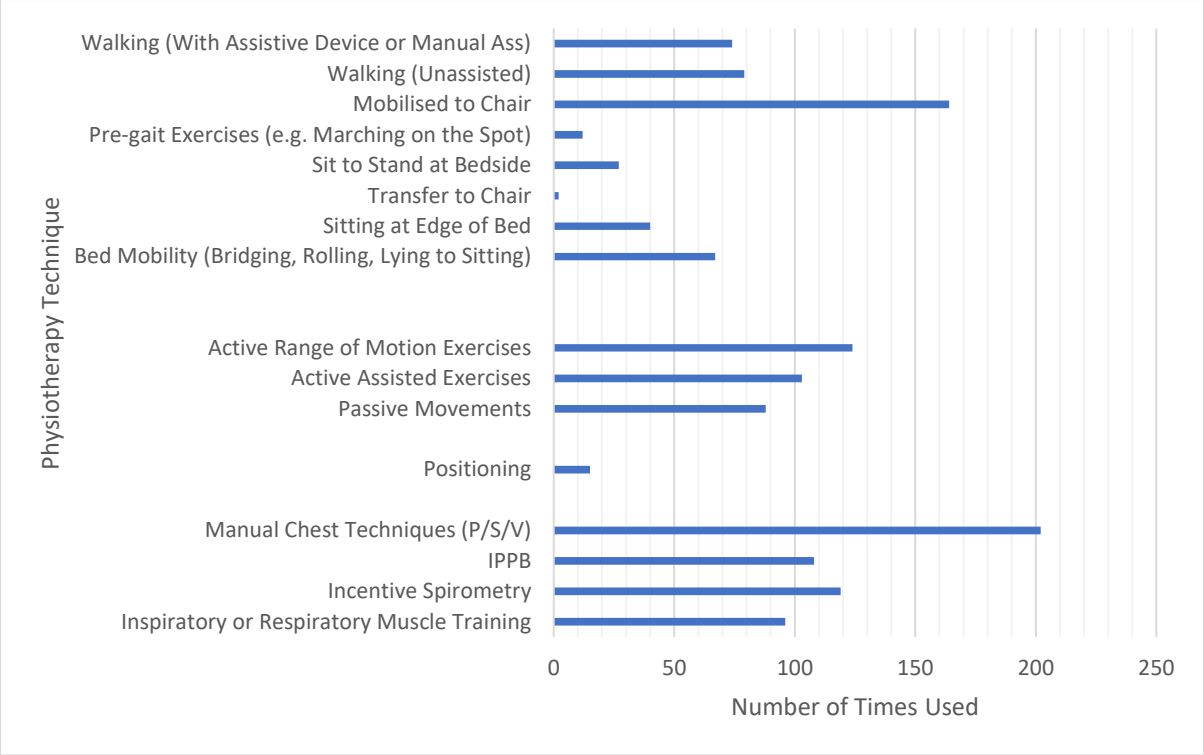

Figure 4.1: Physiotherapy Techniques Received Whilst in ICU (Intensive Care Unit)

IPPB=Intermittent Positive Pressure Breathing; P/S/V=Percussion/Shaking/Vibration; Ass=Assistance

4.1.5 Timing of Mobilisation

Three-hundred-and-forty-five (39.7%) patients were mobilised through assisted and active participation (passive movements, bed mobility, sitting, standing, ambulation or active exercises) during their ICU admission. The majority (n=253; 73.3%) of these patients were mobilised within 48 hours of admission.

4.1.6 Frequency of Mobilisation

Of the 345 patients who were mobilised, most (n=271; 78.6%) were mobilised once daily, and 72 (20.9%) patients twice daily.

4.1.7 Mobilisation Versus ICU Length of Stay

Comparison of length of stay between patients mobilised and those not mobilised were analysed on Statistica Version 13 (StatSoft Inc, Tulsa, USA) using the Mann-Whitney U test. Significance was accepted at $p \leq 0.05$.

The median length of ICU-stay for patients not mobilised in ICU was 2 days (IQR 2-3), compared to 3 days (IQR 2-5) for those who were mobilised while in ICU ($p < 0.0001$).

4.1.8 Mobilisation vs ICU Mortality

Table 4.2: Mobilisation vs ICU Mortality (n=870)

	Died *N (%)*	*Discharged* *N (%)*
Mobilised	8 (17.84) 17.8% of those who died	337 (327.16) 40.8% of those discharged
Not mobilised	37 (27.16) 82.2% of those who died	488 (497.84) 59.1% of those discharged
P value	0.004	0.004

Comparison of mortality between patients mobilised and those not mobilised were analysed on Statistica Version 13 (StatSoft Inc, Tulsa, USA) using the Yates corrected Chi² test.

Of the 45 (5.2%) patients who died, 8 (17.8%) had been mobilised in ICU compared to 337 (40.8%) of patients who survived to ICU discharge (Table 4.2; Yates corrected Chi² = 8.55; p = 0.004).

4.1.9 Adverse Events During Physiotherapy

Of the 352 patients who received physiotherapy during their ICU admission, five (1.4%) experienced a change in systolic blood pressure to <90mmHg or >200mmHg during mobilisation with the physiotherapist. This was the only documented adverse event that occurred during physiotherapy.

4.1.9.1 Delirium

None of the included patients had a delirium score or clinical assessment of delirium documented in their records at any stage during their ICU stay.

4.2 Survey

Objectives of the survey were to determine:

- The mobility practices in Namibian ICUs
- Nurse, doctor and physiotherapist attitudes, perceptions, and perceived barriers on early mobilisation in Namibian ICUs

Descriptive statistics were used summarise survey respondent demographics, perceptions, knowledge, mobility practice, and perceived barriers to early mobilisation of patients in the ICU.
A total of 174 surveys were distributed, with a response rate of 24.1% (n=42). One-hundred-and-thirty-three surveys were sent to physiotherapists, of which 13 (10.2%) responses were received. Thirty-two surveys were hand-delivered to the ICU unit managers of the two consenting private hospitals in Windhoek for the nurses to complete, of which 21 (65.6%) responses were received. Nine surveys were hand-delivered to doctors' consulting rooms, who all work at all four private hospitals in Windhoek, of which 5 (55.6%) responses were received. The rest of the doctors were unreachable. Three participants who did not meet inclusion criteria were excluded from analysis after they completed the questionnaire. Emails were sent, after multiple failed telephonic attempts, to the Nursing Association of Namibia and the Medical Association of Namibia, requesting them to distribute the survey to its members. There was no response to the email requests. The margin of error, using the total estimated population of 686 nurses, doctors and physiotherapists working in ICU in Namibia, confidence level of 95%, and a sample size of 39, was calculated to be 16%.

4.2.1 Participant Demographics

The 39 eligible participants consisted of 21 (53.8%) nurses, five (12.8%) doctors, and 13 (33.3%) physiotherapists. Of the 33 participants who answered the question, most participants (n=14; 42.4%) had between 1 and 5 years of ICU experience, with a median of 7 (IQR 19-4) years' experience. Median years of ICU experience for nurses, doctors and physiotherapists were 7 (IQR 7-4.5), 26 (IQR 30.5-20.25) and 4 (IQR 10-2.25) years respectively (Figure 4.2).

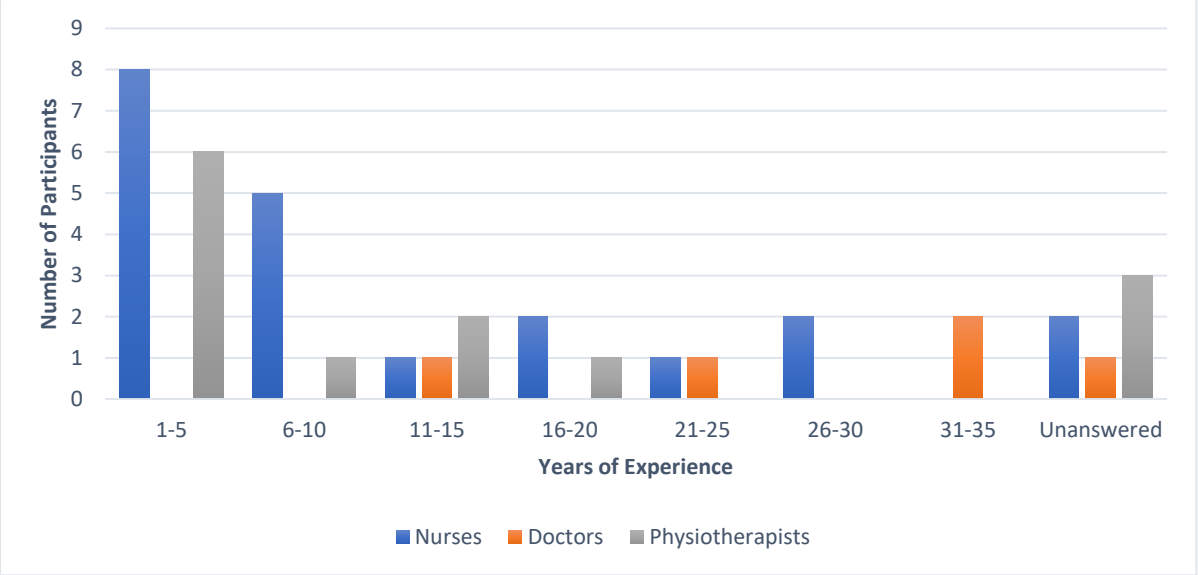

Figure 4.2: Years of Experience (n=33)

Thirty-three (84.6%) participants had experience in adult intensive care while 6 (15.4%) participants had both adult and paediatric ICU experience. No participant reported solely paediatric experience.

Of the 38 participants that answered the question on postgraduate ICU training, 7 (18.4%) nurses, 4 (10.5%) doctors, and 1 (2.6%) physiotherapist had received this level of training. Eight (20.5%) nurses reported specialisation training in ICU.

Most of the physiotherapy participants received their undergraduate training at: University of the Western Cape (n=3; 23.1%), Stellenbosch University (n=3; 23.1%), and University of Pretoria (n=3; 23.1%). Most of the nurse participants received their undergraduate training at the University of Namibia (n=17; 81%). Doctor participants received their undergraduate training at: Stellenbosch University (n=2; 40%); University of Cape Town (n=2; 40%), and University of Pretoria (n=1; 20%).

4.2.2 Knowledge

This section tested participants' knowledge on early mobilisation, i.e., their familiarity with published clinical trials and other literature on early mobilisation of critically ill ICU patients; knowledge on what the clinical studies on early mobilisation show; the incidence of ICU acquired weakness (ICUAW) in patients; and their perceived confidence in practical and technical skills involving mobilising patients.

Are YOU familiar with any clinical trials or literature on early mobilisation of critically ill patients?

Of the thirty-seven that answered, eighteen (48.6%) participants reported familiarity with published clinical trials and/or literature on ICU mobilisation. Nineteen (51.4%) participants reported not being familiar with the literature at all.

What do the clinical studies on early mobilisation of critically ill patients in ICU show? Select ALL true responses.

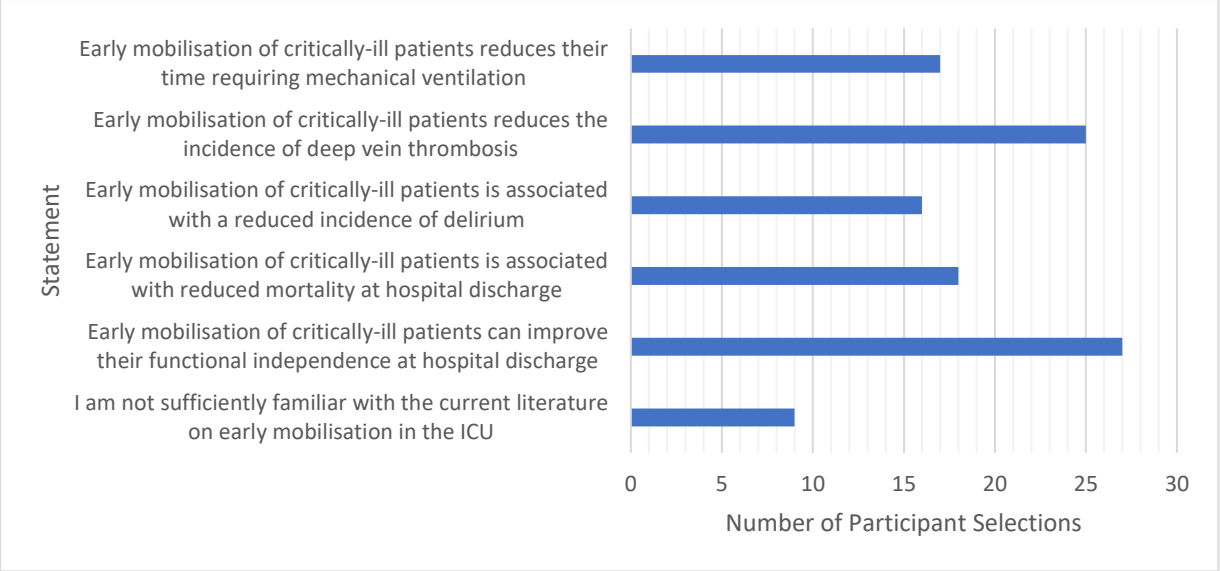

Figure 4.3: Knowledge on Early Mobilisation Literature (n=39)

This question tested participants' knowledge of what the clinical studies on early mobilisation of critically ill patients showed, with multiple allowed responses (112 total responses).

Participants mostly thought that early mobilisation: can improve patients' functional independence (n=27; 24.1%); reduces the incidence of deep vein thrombosis (n=25; 22.3%); and is associated with reduced mortality at hospital discharge (n=18; 16.1%) (Figure 4.3).

What do YOU think is the incidence of ICUAW in the population of ICU patients?

Table 4.3 shows participants' perceived incidence of ICUAW in patients. One participant did not answer this question. Most of the participants underestimated the likely incidence of ICUAW in ICU. Only a small fraction (n=6; 15.8%) of participants selected the correct answer.

Table 4.3: Perceived Incidence of ICUAW in Critically Ill Patients (n=38)

				No. (%) of Participants
Incidence	All (n=38)	Nurse (n=20)	Doctor (n=5)	Physiotherapist (n=13)
<5%	3 (7.9)	3 (15)	0 (0)	0 (0)
5-10%	1 (2.6)	0 (0)	0 (0)	1 (7.7)
11-20%	3 (7.9)	3 (15)	0 (0)	0 (0)
21-40%	17 (44.7)	5 (25)	3 (60)	9 (69.2)
>40%*	6 (15.8)	2 (10)	2 (40)	2 (15.4)
Don't Know	8 (20.5)	7 (35)	0 (0)	1 (7.7)
*Correct Answer				

How well trained and informed do you feel to mobilise mechanically ventilated patients?

Table 4.4: Practical and Technical Skills (n=38)

	No. (%) of Participants			
	All (n=38)	Nurse (n=20)	Doctor (n=5)	Physiotherapist (n=13)
I feel well trained and informed to mobilise mechanically ventilated patients	11 (28.9)	5 (25)	1 (20)	5 (38.5)
I feel somewhat trained and informed to mobilise mechanically ventilated patients	18 (47.4)	9 (45)	1 (20)	8 (61.5)
I do not feel sufficiently trained or informed to mobilise mechanically ventilated patients	9 (23.7)	6 (30)	3 (60)	0 (0)

One participant did not answer this question.

More than half of the physiotherapist participants (n=8; 61.5%) only felt somewhat trained to mobilise mechanically ventilated patients. Of the twenty nurses that answered this question, most (n=9; 45%) felt somewhat trained to mobilise mechanically ventilated patients. Most of the doctor participants (n=3; 60%) felt insufficiently trained to mobilise mechanically ventilated patients (Table 4.4).

4.2.3 Mobility Practice

This section describes the mobility practice in Namibian ICUs; how patients are assessed for commencement of mobilisation; sedation practice; type of physiotherapy techniques; and duration, frequency, and intensity of mobilisation. Long term rehabilitation after ICU discharge; ICU staffing; the presence of a mobility champion in ICU; and the perceived precautions/contraindications to mobility are also reported on.

Assessment of Readiness for Mobilisation (n=37)

Most participants (n=25; 67.6%) reported that patients were not automatically assessed by physiotherapists for mobilisation and that a verbal or written doctor's referral for initial assessment was necessary (n=31; 83.8%). Physicians/doctors were reported to be the first practitioners to identify patients ready for mobilisation (n=24; 64.9%).

Mobility Protocols (n=39)

Approximately half the participants (n=19; 48.7%) reported that their ICUs did not have a mobility protocol.

Mobility Champion (n=39)

Twenty (51.3%) participants reported that their institution did not have a mobility champion.

Participants could choose one or more of four pre-populated options related to which discipline the mobility champion was from if they answered "yes" to the question. Of the eleven participants that reported their institution having a mobility champion, some selected more than one option in their answer, resulting in 19 responses. Seven (36.8%) participants indicated that the mobility champion was a medical doctor; six (31.6%) said the champion was a physiotherapist; and three (15.8%) reported the champion to be a nurse. Three (15.8%) participants were unsure.

Sedation Practices

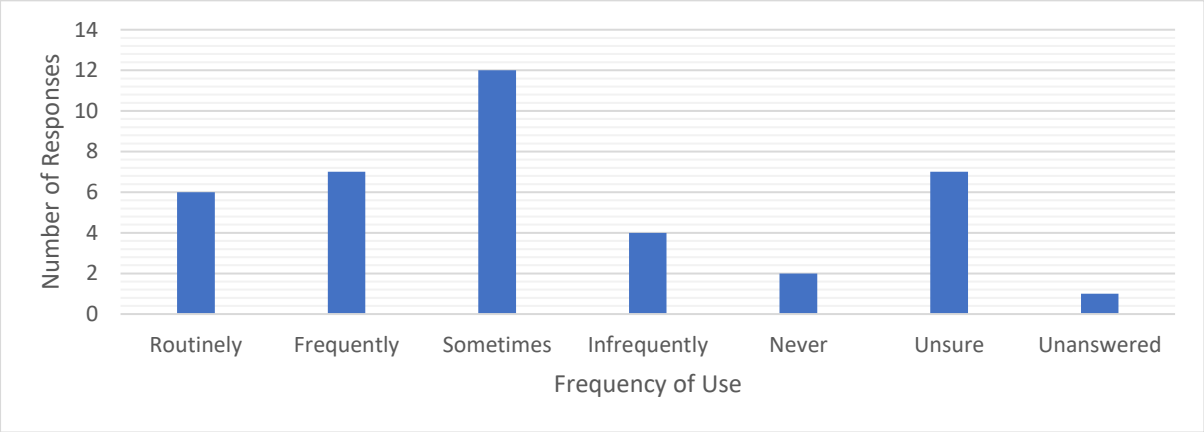

Figure 4.4: Sedation Protocols in ICU (n=38)

Many participants (n=12; 31.6%) reported sedation protocols or daily interruption of sedation being used sometimes in their ICU while seven (18.4%) indicated frequent use (Figure 4.4).

Three (60%) of five doctors reported routinely using standardised sedation scales according to patient activity level. Doctors in private Namibian ICUs did not all use the same sedation protocols. They reported giving orders to the nurses who then carry the protocols out. Physiotherapists in Namibian ICUs (despite familiarity with sedation medications) were not at all involved in sedation management of patients.

Duration, Frequency, and Intensity of Mobilisation

As seen in Figure 4.5, physiotherapist participants were asked to report on how much time they would spend mobilising a patient for each of a variety of clinical scenarios.

> On average, what is the daily duration of mobilisation performed by physiotherapists in YOUR ICU on the following types of critically ill patients?

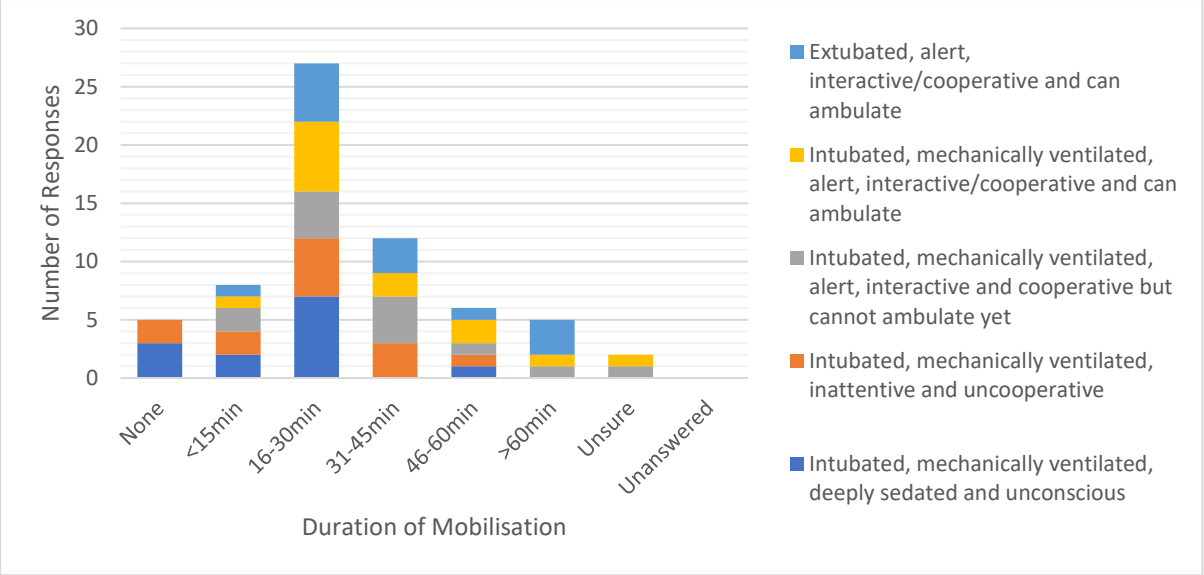

Figure 4.5: Mobilisation Duration (n=13)

For all scenarios listed in Figure 4.5 (65 total responses), most physiotherapists (n=27; 41.5%) reported that they would spend 16-30 minutes on mobilisation activities.

> How frequently is mobilisation performed by a physiotherapist in YOUR ICU on the following types of critically ill patients?

The figure below also gave various patient scenarios (65 total responses). Physiotherapists were asked to report how frequently they would mobilise patients in each clinical scenario (n=65 responses). Physiotherapists reported that they would mobilise patients once (n=25; 38.5%) or twice (n=31; 47.7%) daily for all scenarios presented in Figure 4.6.

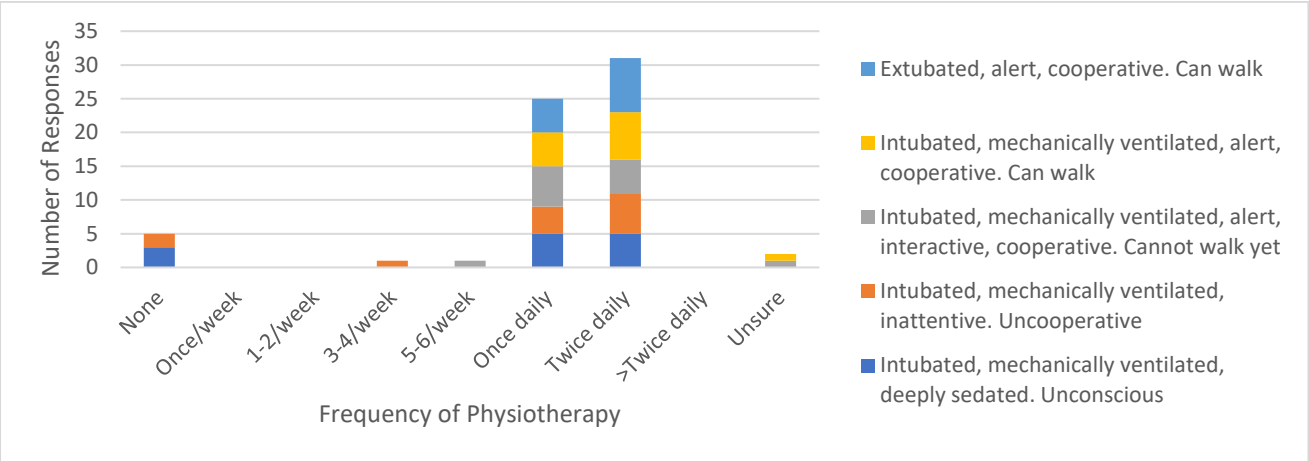

Figure 4.6: Physiotherapy Frequency (n=13)

With what intensity do physiotherapists in YOUR ICU mobilise the following types of critically ill patients?

In Figure 4.7 (194 total responses), physiotherapists were asked to indicate the level of intensity they would mobilise critically ill patients in specific scenarios. They were asked to select all that applied.

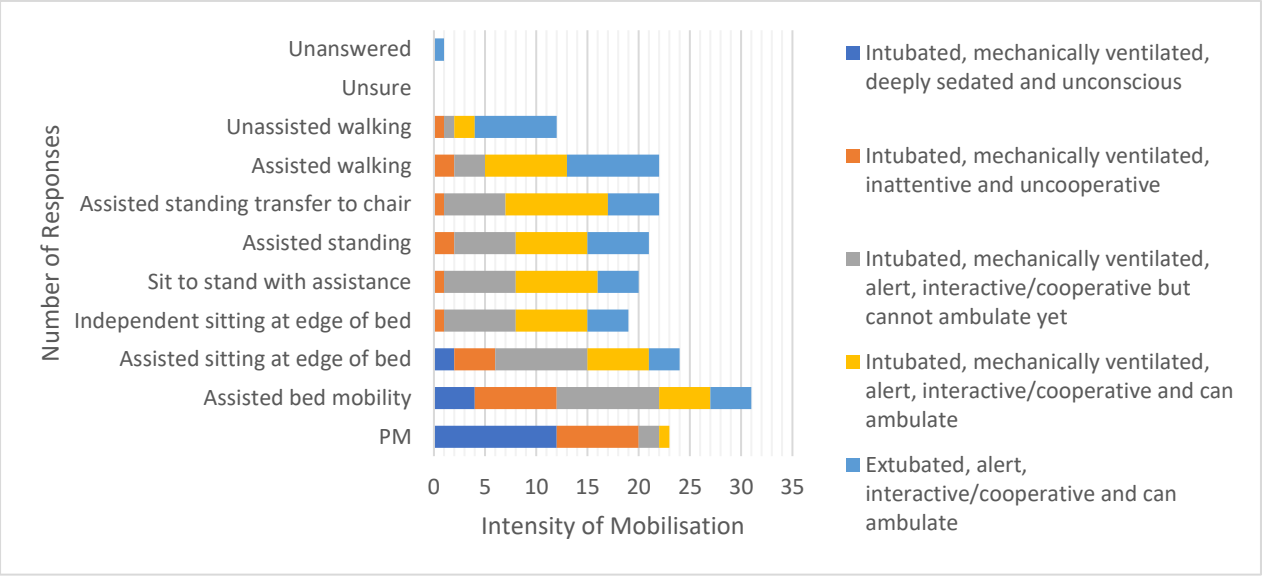

Figure 4.7: Intensity of Mobilisation (n=12)

PM=Passive Movements

Intubated, mechanically ventilated deeply sedated and unconscious patients (18 responses):

Physiotherapists reported they would mostly do passive movements (n=12; 66.7%).

Intubated, mechanically ventilated inattentive and uncooperative patients (28 responses):

Physiotherapists would mostly do passive movements (n=8; 28.6%), assisted bed mobility (n=8; 28.6%), and assisted sitting at edge of bed (n=4; 14.3%).

Intubated, mechanically ventilated, alert, interactive patients that cannot ambulate (51 responses):

Physiotherapists would mostly do assisted bed mobility (n=10; 19.6%), assisted sitting at edge of bed (n=9; 17.6%), independent sitting at edge of bed (n=7; 13.7%) and sit to stand with assistance (n=7; 13.7%).

Intubated, mechanically ventilated, alert, interactive patients that can ambulate (54 responses):

Physiotherapists would mostly do assisted standing transfer to chair (n=10; 18.5%), sit to stand with assistance (n=8; 14.8%), and assisted walking (n=8; 14.8%).

Extubated, alert, interactive/cooperative, and can ambulate (43 responses):

The intensity level of mobility physiotherapists would use were assisted standing (n=6; 14%), assisted walking (n=9; 20.9%), and unassisted walking (n=8; 18.6%).

Physiotherapists were asked how they would progress mobilisation of their patients (Figure 4.8).

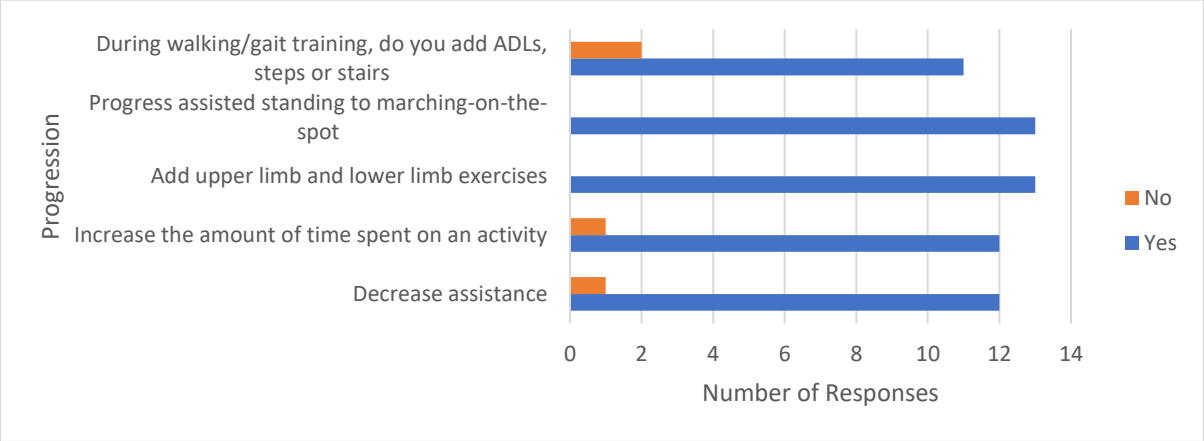

Figure 4.8: Mobilisation Progression (n=13)

Most physiotherapists reported that they would progress mobilisation during walking/gait training by including ADLs, steps, or stairs (n=11; 84.6%) and by progressing from assisted standing to marching on the spot (n=13; 100%). Other participants reported they would add upper limb and lower limb exercises (n=13; 100%), increase the duration of an activity (n=12; 92.3%), and decrease the amount of assistance provided (n=12; 92.3%).

Staffing in the ICU

Participants were asked to report on who was involved in patient mobilisation. They were allowed multiple answers, resulting in a total of 97 responses (Figure 4.9).

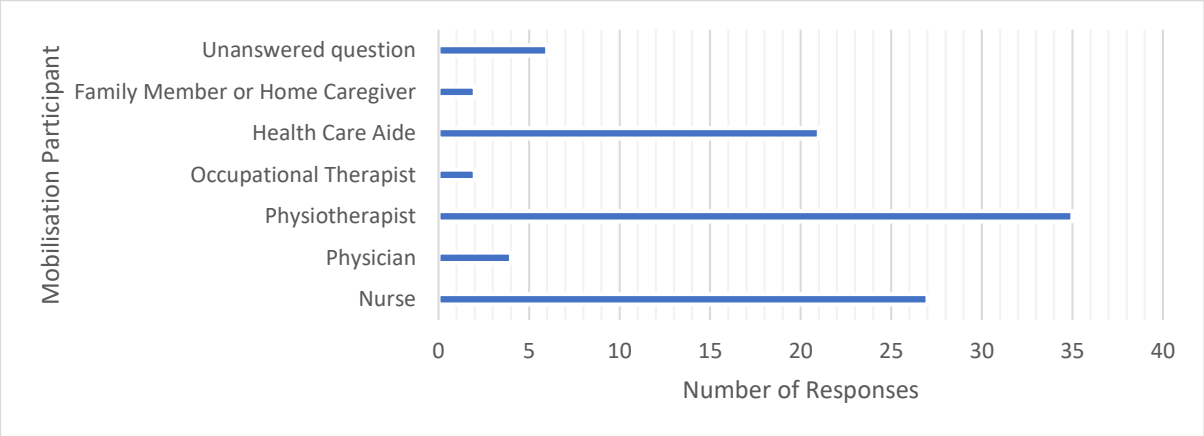

Figure 4.9: Mobilisation Participants (n=33)

Participants reported that physiotherapists (n=35; 36.1%) nurses (n=27; 27.8%), and health care aides i.e., porters (n=21; 21.6%) were mainly involved in patient mobilisation.

Of the 12 physiotherapists that responded to the question on availability in ICU, most reported they were available for full assessments and mobilisation: from 8am to 5pm from Monday to Friday (n=11;

91.7%); after 5pm from Monday to Friday (n=11; 91.7%); and on weekends and public holidays (n=11; 91.7%). Only one (8.3%) physiotherapist reported that they were not available during the above-mentioned times.

Physiotherapist Workload

Physiotherapists had an average daily workload of 2.58 (SD 1.3, range 0-4) ICU patients and 8.75 (SD 3.8, range 0-14) patients (hospital and ICU).

Most physiotherapists (n=8; 61.5%) worked part time in ICU, while 4 (30.8%) worked full time in ICU. One (7.7%) physiotherapist reported that they do not currently work in ICU.

Physiotherapy Techniques Performed

Physiotherapists were asked to report on techniques they routinely use in the ICU. Participants had to select ONE answer for each technique (Figure 4.10).

> How often are these physiotherapy techniques used on ICU patients suitable for rehabilitation?

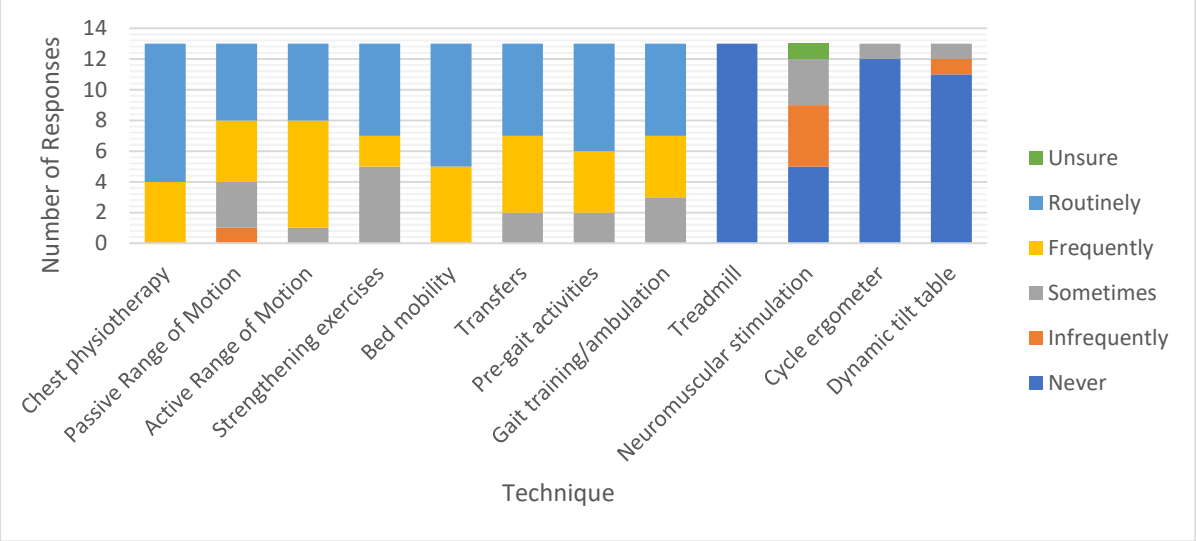

Figure 4.10: Physiotherapy Techniques Used on ICU Patients (n=13))

Manual chest physiotherapy (n=9; 69.2%), bed mobility (n=8; 61.5%), and pre-gait activities (n=7; 53.8%) were reported to be the most commonly used physiotherapy techniques.

Long-term Rehabilitation After ICU Discharge (n=33)

More than half the participants (n=19; 57.6%) reported that patients with suspected ICU-acquired weakness were referred for rehabilitation after ICU discharge. Five (15.1%) said this did not happen, nine (27.3%) were unsure.

Of the 19 responses (26 total selections), physiotherapists (n=15; 57.7%), occupational therapists (n=6; 23.1%), and step-down facilities (n=5; 19.2%) were reported to be the places patients were most referred to for long-term rehabilitation.

4.2.4 Attitudes and Perceptions of Nurses, Doctors and Physiotherapists to EM in ICU

This section describes participants' attitudes and perceptions on early mobilisation in ICU. It reports their views on how important early mobilisation is, when they feel mobilisation should commence, and what they perceive as barriers to early mobilisation.

Attitudes and Perceptions

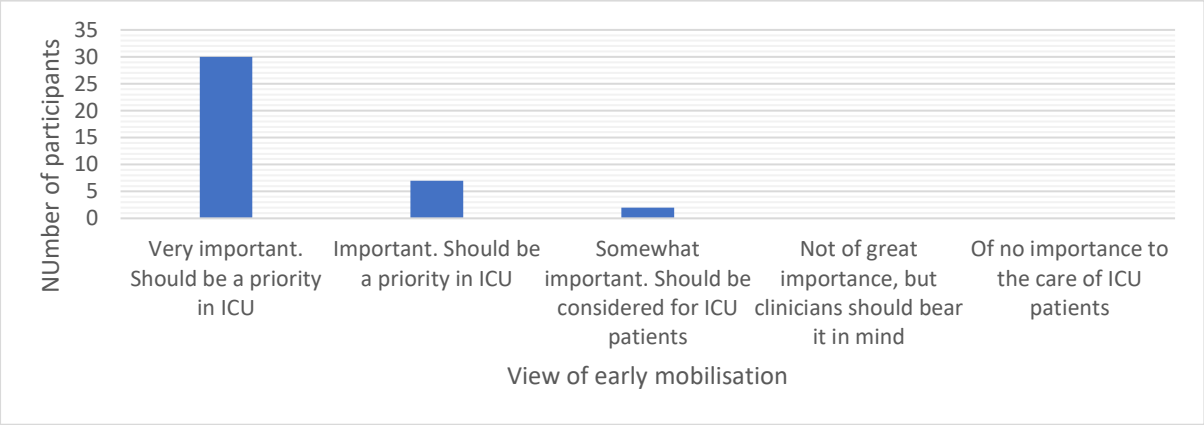

Figure 4.11:Perception of the Importance of Early Mobilisation (n=39)

Most participants (n=30; 76.9%) highlighted early mobilisation as being very important and a priority in ICU (Figure 4.11).

Responses on when participants would initiate mobilisation in the ICU are shown in Figure 4.12. Multiple selections were allowed, resulting in 94 responses:

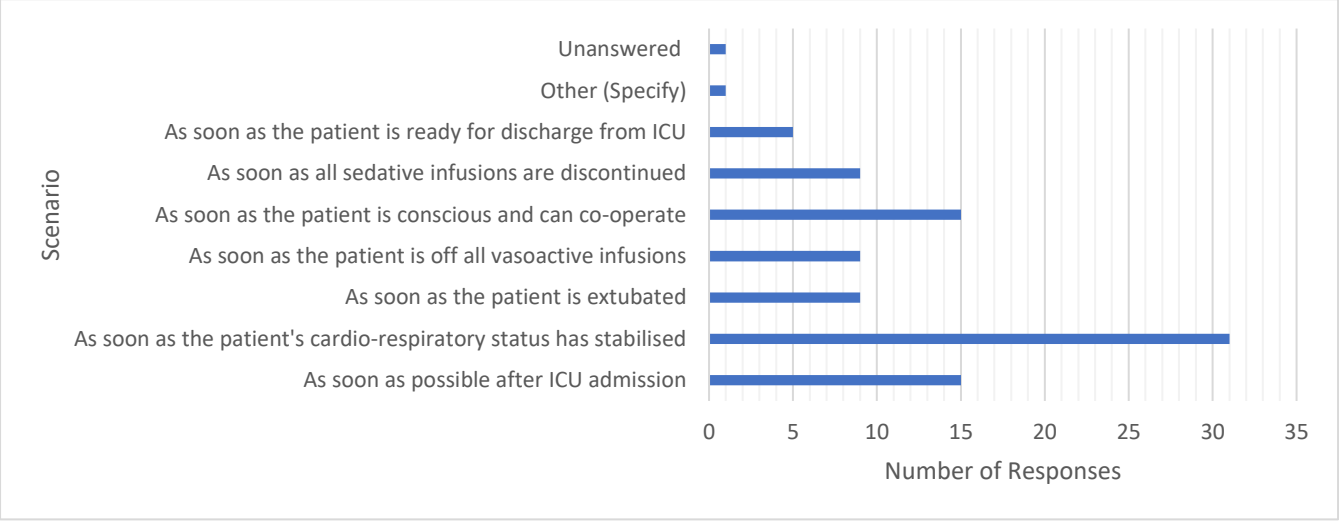

Figure 4.12: When to Initiate Mobilisation in ICU (n=38)

Most participants reported that they would initiate ICU mobilisation: as soon as the patient's cardio-respiratory status has stabilised (n=31; 33%); as soon as possible after ICU admission (n=15; 16%); and as soon as the patient is conscious and can co-operate (n=15; 16%).

4.2.5 Perceived Contra-indications/Precautions to ICU Mobility Practice

The following two scenarios sought to assess the highest level of activity survey respondents would allow their patients to perform in various situations. The responses to these questions show what they perceive as contra-indications and/or precautions to mobility practice in ICU.

Question 9 in the survey asked all participants to indicate the highest patient activity level they would allow for a previously ambulatory patient, currently physiologically stable, on mechanical ventilation, on no inotropes, and minimally sedated in various scenarios (Table 4.5).

> In the following scenarios, assume the patients are previously ambulatory, currently physiologically stable on mechanical ventilation, receiving no inotropes and minimally sedated. They have purposeful motor response and can obey verbal commands. What is the HIGHEST patient activity level you would allow in each scenario? Please select ONE response for each.

Table 4.5: Scenario 1: Perceived Contra-indications/Precautions to ICU Mobility Practice

	No. (%) of Participants							
Scenario	*Bedrest*	*AROM*	*PROM*	*Standing*	*Transfers to Chair*	*Walking*	*Not Sure*	*Unanswered*
Head trauma without increased intracranial pressure	1 (2.7)	**12 (32.4)**	8 (21.6)	0 (0)	5 (13.5)	**10 (27)**	1 (2.7)	2 (5.1)
Head trauma with increased intracranial pressure	**17 (45.9)**	9 (24.3)	5 (13.5)	2 (5.4)	1 (2.7)	1 (2.7)	2 (5.4)	2 (5)
Cervical Spinal Injury†	12 (30.8)	**13 (33.3)**	5 (12.8)	0 (0)	3 (7.7)	4 (10.3)	2 (5.1)	0 (0)
Thoracolumbar Injury†	**13 (35.1)**	8 (21.6)	5 (13.5)	1 (2.7)	2 (5.4)	5 (13.5)	3 (8.1)	2 (5.1)
Within 24 hours of treated myocardial infarction (cardiac enzymes persistently elevated)	**20 (54)**	3 (8.1)	6 (16.2)	1 (2.7)	3 (8.1)	2 (5.4)	2 (5.4)	2 (5.1)
Within 24 hours of treated myocardial infarction (cardiac enzymes decreasing)	2 (5.3)	**14 (36.8)**	7 (18.4)	0 (0)	2 (5.3)	9 (23.7)	4 (10.5)	1 (2.6)
Coagulopathy (INR>3)	6 (16.7)	7 (19.4)	5 (13.9)	1 (2.8)	4 (11.1)	**8 (22.2)**	5 (13.9)	3 (7.7)
Thrombocytopaenia (platelet count <20x10 g/l)	4 (11.4)	6 (17.1)	4 (11.4)	1 (2.9)	6 (17.1)	**7 (20)**	**7 (20)**	4 (10.3)
Delirium	3 (8.1)	6 (16.2)	**8 (21.6)**	2 (5.4)	7 (18.9)	7 (18.9)	4 (10.8)	2 (5.1)
Within 24 hours of uncomplicated coronary bypass surgery	2 (5.3)	10 (26.3)	2 (5.3)	3 (7.9)	**13 (34.2)**	5 (13.2)	3 (7.9)	1 (2.6)
Deep vein thrombosis (on anti-coagulants)	**11 (29.7)**	6 (16.2)	6 (16.2)	2 (5.4)	1 (2.7)	10 (27)	1 (2.7)	2 (5.1)
Obesity	0 (0)	2 (5.1)	5 (12.8)	2 (5.1)	4 (10.3)	**24 (61.5)**	2 (5.1)	0 (0)
Frailty	1 (2.8)	7 (19.4)	2 (5.6)	1 (2.8)	11 (30.6)	**11 (30.6)**	3 (8.3)	3 (7.7)
Pulmonary artery catheter	9 (27.3)	5 (15.2)	4 (12.1)	0 (0)	2 (6.1)	3 (9.1)	**10 (30.3)**	6 (15.4)
Intra-aortic balloon pump	**16 (44.4)**	2 (5.6)	5 (13.9)	0 (0)	1 (2.8)	4 (11.1)	8 (22.2)	3 (7.7)
Femoral central venous catheter	3 (7.9)	4 (10.5)	**12 (31.6)**	1 (2.6)	4 (10.5)	9 (23.7)	5 (13.2)	1 (2.6)

Radial arterial catheter	0 (0)	1 (2.7)	**11 (29.7)**	3 (8.1)	7 (18.9)	**11(29.7)**	4 (10.8)	2 (5.1)
Dialysis line inserted at subclavian site (during non-dialysis periods)	2 (5.4)	2 (5.4)	6 (16.2)	0 (0)	6 (16.2)	**20 (54.1)**	1 (2.7)	2 (5.1)
Dialysis line inserted at femoral site (during non-dialysis periods)	4 (10.5)	2 (5.3)	7 (18.4)	2 (5.3)	5 (13.2)	**16 (42.1)**	2 (5.3)	1 (2.6)
Continuous renal replacement therapy	9 (24.3)	5 (13.5)	6 (16.2)	0 (0)	3 (8.1)	4 (10.8)	10 (27)	2 (5.1)
Extra corporeal membrane oxygenation	2 (5.7)	2 (5.7)	3 (8.6)	2 (5.7)	2 (5.7)	3 (8.6)	**21 (60)**	4 (10.3)
High frequency oscillation	7 (19.4)	5 (13.9)	3 (8.3)	0 (0)	2 (5.6)	1 (2.8)	**18 (50)**	3 (7.7)
Conventional mechanical ventilation via endotracheal tube	5 (12.8)	**11 (28.2)**	7 (17.9)	2 (5.1)	7 (17.9)	5 (12.8)	2 (5.1)	0 (0)
Conventional mechanical ventilation via tracheostomy	3 (8.3)	7 (17.9)	9 (23.1)	2 (5.1)	**11(28.2)**	5 (12.8)	2 (5.1)	0 (0)
Chest tube	1 (2.6)	4 (10.5)	7 (18.4)	3 (7.9)	7 (18.4)	**14 (36.8)**	2 (5.3)	1 (2.6)
Non-invasive positive pressure ventilation	1 (2.7)	6 (16.2)	6 (16.2)	2 (5.4)	**13 (35.1)**	7 (18.9)	2 (5.4)	2 (5.1)
Foley catheter	0 (0)	0 (0)	7 (18.4)	0 (0)	3 (7.9)	**24 (63.2)**	4 (10.5)	1 (2.6)
Full anti-coagulation	0 (0)	3 (7.7)	7 (17.9)	3 (7.7)	6 (15.4)	**15 (38.5)**	5 (12.8)	0 (0)
† There was no indication whether the spinal injuries were stable or not. Participants' answers were based on their perception of the injuries								
AROM=Active Range of Motion; PROM=Passive Range of Motion								
Highest response for each scenario indicated in bold								

Most participants reported that they would restrict head trauma patients with raised intracranial pressure (n=17; 45.9%) to bedrest, whereas those without raised intracranial pressure were allowed passive range of motion (n=12; 32.4%). Patients with cervical (n=12; 30.8%) or thoracolumbar (n=13; 35.1%) injuries, on an intra-aortic balloon pump (n=16; 44.4%), within 24 hours of a treated myocardial infarction (with persistently elevated cardiac enzymes) (n=20; 54%) were also restricted to bedrest, and passive range of motion (n=14; 36.8%) if the cardiac enzymes were decreasing. Others felt (n=9; 23.7%) that walking should not be restricted in patients with decreasing cardiac enzymes. Many participants (n=13; 34.2%) believed that patients could be transferred to a chair within 24 hours after uncomplicated cardiac surgery. Some (n=11; 29.7%) participants would only permit passive range of motion in patients with deep vein thrombosis (even while the patient is on anti-coagulants). Conversely, just fewer than a third (n=10; 27%) felt this type of patient should be walking. Most participants (n=24; 61.5%) felt walking should not be restricted in obese patients. Frail patients were not restricted from transferring (n=11; 30.65) to a chair or walking (n=11; 30.6%). Most participants would allow walking in a patient with a subclavian dialysis line (n=20; 54.1%) and a femoral dialysis line (n=16; 42.1%) during non-dialysis periods.

Most participants were unsure what mobilisation modality was appropriate for a patient receiving extra corporeal membrane oxygenation (n=21; 60%) and high frequency oscillation ventilation (n=18; 50%). Some participants would only allow passive range of motion in patients receiving conventional mechanical ventilation via endotracheal tube (n=11; 28.2%) and active range of motion in patients receiving mechanical ventilation via tracheostomy (n=9; 23.1%). Patients receiving non-invasive positive pressure ventilation would be limited to transfer to a chair (n=13; 35.1%). Only fourteen participants (36.8%) felt patients with a chest tube should walk, and the presence of a Foley's catheter was not perceived a contraindication to this level of activity by most (n=24; 63.2%).

Question 10 asked all participants to indicate the highest patient activity level they would allow for a patient admitted to ICU, intubated, and mechanically ventilated in various scenarios (Table 4.6).

> Consider a patient admitted to ICU, intubated, and mechanically ventilated. What maximum patient activity level would you allow for each scenario? Please select ONE response for each.

Table 4.6: Scenario 2: Perceived Contra-indications to ICU Mobility Practice

	No. (%) of Participants							
Scenario	*Bedrest*	*PROM*	*AROM*	*Standing*	*Transfers to chair*	*Walking*	*Not sure*	*Unanswered*
Three or more vasopressors or inotropic infusions	**19 (51.3)**	7 (18.9)	4 (10.8)	1 (2.7)	0 (0)	0 (0)	6 (16.2)	2 (5.1)
Two vasopressors or inotropic infusions	**13 (37.1)**	7 (20)	8 (22.9)	1 (2.9)	0 (0)	0 (0)	6 (17.1)	4 (10.3)
One high dose vasopressor or inotropic infusion	**14 (37.8)**	8 (21.6)	6 (16.2)	1 (2.7)	3 (8.1)	0 (0)	5 (13.5)	2 (5.1)
One medium dose vasopressor or inotropic infusion	6 (17.1)	**12 (34.3)**	5 (14.3)	2 (5.7)	5 (14.3)	0 (0)	5 (14.3)	4 (10.3)
One low dose vasopressor or inotropic infusion	3 (8.1)	**10 (27)**	8 (21.6)	1 (2.7)	9 (24.3)	1 (2.7)	5 (13.5)	2 (5.1)
No vasopressors or inotropes	1 (2.7)	7 (18.9)	**5 (13.5)**	2 (5.4)	**5 (13.5)**	12 (32.4)	**5 (13.5)**	2 (5.1)
Minimal pressure support on conventional mode mechanical ventilation	4 (10.8)	**11 (29.7)**	6 (16.2)	3 (8.1)	7 (18.9)	5 (13.5)	1 (2.7)	2 (5.1)
Moderate pressure support on conventional mode mechanical ventilation	2 (5.3)	**14 (36.8)**	9 (23.7)	3 (7.9)	8 (21.1)	0 (0)	2 (5.3)	1 (2.6)
Advanced mode of mechanical ventilation	11 (28.9)	**14 (36.8)**	5 (13.2)	1 (2.6)	1 (2.6)	0 (0)	6 (15.8)	1 (2.6)
Unresponsive to verbal and motor stimulation	8 (21.1)	**21 (55.3)**	4 (10.5)	0 (0)	4 (10.5)	0 (0)	1 (2.6)	1 (2.6)
Purposeful motor response, not obeying verbal commands	4 (10.5)	**17 (44.7)**	10 (26.3)	1 (2.6)	4 (10.5)	1 (2.6)	1 (2.6)	1 (2.6)
Purposeful motor response, obeys verbal commands	3 (8.1)	2 (5.4)	11 (29.7)	1 (2.7)	7 (18.9)	**12 (32.4)**	1 (2.7)	2 (5.1)

AROM=Active Range of Motion; PROM=Passive Range of Motion

Highest response for each scenario indicated in bold

Most participants felt that patients receiving high levels of cardiovascular support should be restricted to bedrest (n=19; 51.3%). As the level of cardiovascular support decreased, participants allowed higher levels of patient activity. Most participants would limit patient activity levels to passive range of motion regardless of the level of respiratory support. Patients with impaired cognition and inability to obey commands would be restricted to passive range of motion (n=21; 55.3%). Fewer than a third of the participants (n=12; 32.4%) would allow a responsive patient to walk.

4.2.6 Barriers to Early Mobilisation in ICU

This section describes what the participants perceived as barriers to early mobilisation in the ICU.

Institutional Level Barriers

Table 4.7: Perceived Institutional Level Barriers to Early Mobilisation in the Intensive Care Unit

				No. (%) of Participants
Barrier	All (n=34)	Nurses (n=17)	Doctors (n=5)	Physiotherapists (n=12)
Routine bedrest orders on admission	13 (38.2)	5 (29.4)	1 (20)	7 (58.3)
Physician orders required prior to mobilisation	22 (64.7)	10 (58.8)	1 (20)	11 (91.7)
Insufficient equipment for early mobilisation	9 (26.5)	5 (29.4)	0 (0)	4 (33.3)
No written guidelines or protocols for mobilisation	16 (47.1)	8 (47.1)	1 (20)	7 (58.3)
Not enough physical space	1 (2.9)	1 (5.9)	0 (0)	0 (0)
No clinician champion to promote early mobilisation in ICU	13 (38.2)	5 (29.4)	0 (0)	8 (66.7)
Perceived an expensive intervention by administrators or unit leaders	1 (2.9)	0 (0)	1 (20)	0 (0)
No institutional barriers	7 (20.6)	3 (17.6)	3 (60)	1 (8.3)
Other institutional barriers†	1 (2.6)	0 (0)	0 (0)	1 (8.3)
†Included: different physicians seeing patient with poor understanding of need for EM				

The question in the table above allowed multiple answers.

The biggest institutional barriers were perceived as: physician orders being required prior to mobilisation (n=22; 64.7%); the absence of written guidelines or protocols (n=16; 47.1%); routine bedrest orders on admission (n=13; 38.2%); and the absence of an early mobility champion (n=13; 38.2%).

In terms of the individual professional groups: nurses (n=10; 58.8%) and physiotherapists (n=11; 91.7%) perceived the requirement of physician orders for mobilisation as the biggest institutional barrier, while most of the doctors did not feel that any institutional barriers existed (n=3; 60%).

Patient Level Barriers

Table 4.8: Perceived Patient Level Barriers to Early Mobilisation in the Intensive Care Unit

				No. (%) of Respondents
Barrier	All (n=33)	Nurses (n=17)	Doctors (n=4)	Physiotherapists (n=12)
Medical Instability	24 (72.7)	13 (76.5)	3 (75)	8 (66.7)
Endotracheal intubation	14 (42.4)	6 (35.3)	3 (75)	5 (41.7)
Physical restraints	7 (21.2)	3 (17.6)	0 (0)	4 (33.3)
Risk of dislodgment of devices or lines	13 (39.4)	7 (41.2)	2 (50)	4 (33.3)
Cognitive impairment/cognitive age	6 (18.2)	0 (0)	2 (50)	4 (33.3)
Excessive sedation	18 (54.5)	6 (35.3)	2 (50)	10 (83.3)
Delirium	5 (15.2)	1 (5.9)	2 (50)	2 (16.7)
Inadequate analgesia	9 (27.3)	4 (23.5)	2 (50)	3 (25)
Obesity	2 (6.1)	0 (0)	1 (25)	1 (8.3)
Frailty	7 (21.2)	2 (11.8)	1 (25)	4 (33.3)
Inadequate nutritional status	1 (3)	1 (5.9)	0 (0)	0 (0)

No patient barriers	5 (15.2)	3 (17.6)	1 (25)	1 (8.3)
Other patient barriers	0 (0)	0 (0)	0 (0)	0 (0)

The question in the table above allowed multiple answers.

Medical instability (n=24; 72.7%), excessive sedation (n=18; 54.5%), and endotracheal intubation (n=14; 42.4%) were reported as the biggest patient level barriers to early mobilisation.

In terms of the individual professional groups: nurses perceived medical instability (n=13; 76.5%); doctors perceived medical instability (n=3; 75%) and endotracheal intubation (n=3; 75%); and physiotherapists perceived excessive sedation (n=10; 83.3%) as the biggest patient level barriers to early mobilisation.

Provider Level Barriers

Providers are critical care physicians, registered nurses, physiotherapists and referring consultants/primary surgeons. What is/are the most important provider level barrier/s to early mobilisation in YOUR ICU? If you believe that the listed barrier is important, please select ALL provider/s that contribute to the existence of that barrier. Alternatively, if you believe the listed barrier is NOT an important barrier, select "None".

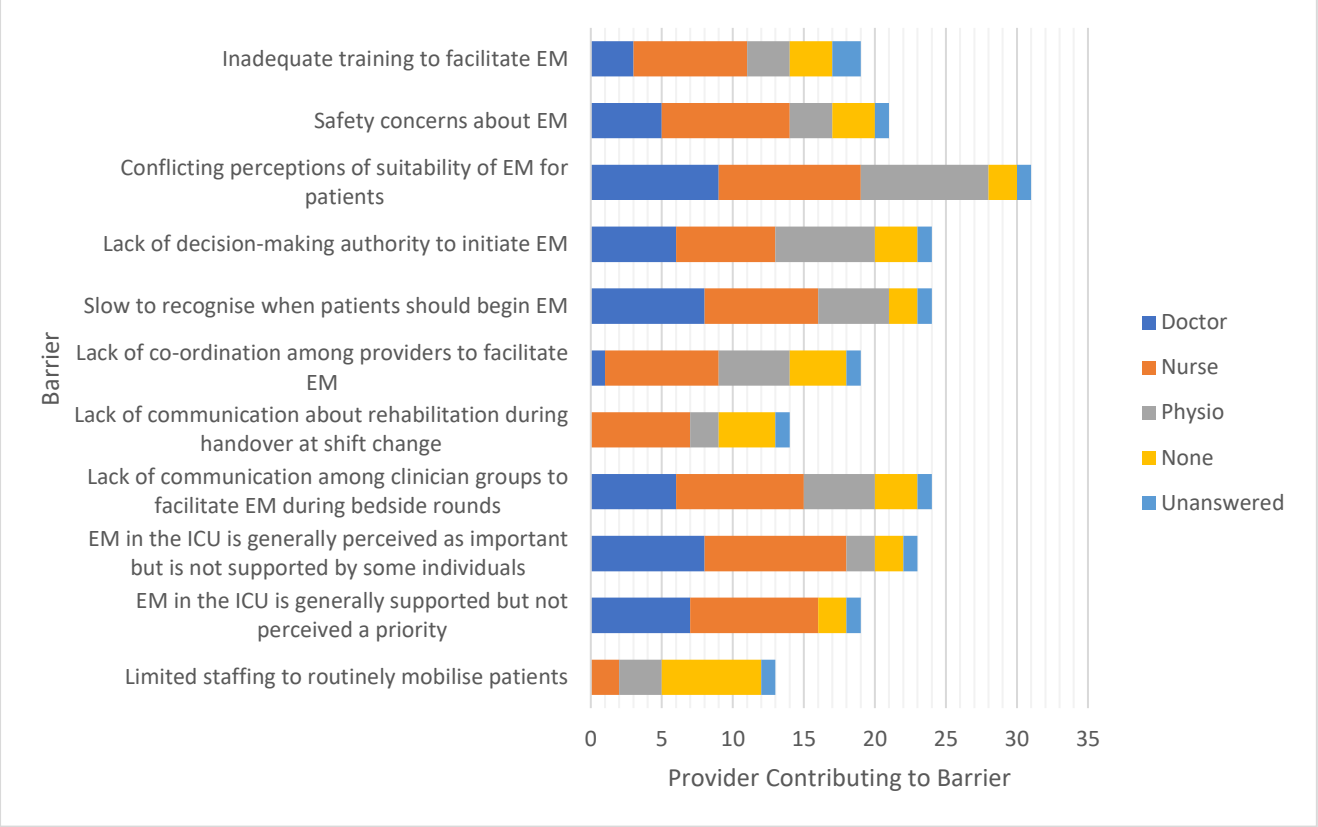

Figure 4.13: Providers Contributing to Barriers as Perceived by Physiotherapists

While physiotherapist participants believed that doctors (n=9; 32.1%), nurses (n=10; 35.7%), and physiotherapists (n=9; 32.1%) all contribute to conflicting perceptions of patient suitability for early mobilisation, they also believed that nurses contribute to most of the above-listed barriers i.e. that early mobilisation is generally perceived as important but is not supported by some individuals (n=10; 45.5%); that early mobilisation is generally supported but not perceived a priority (n=9; 50%); the lack

of communication among clinician groups to facilitate early mobilisation during bedside rounds (n=9; 39.1%); and safety concerns about early mobilisation (n=9; 45%).

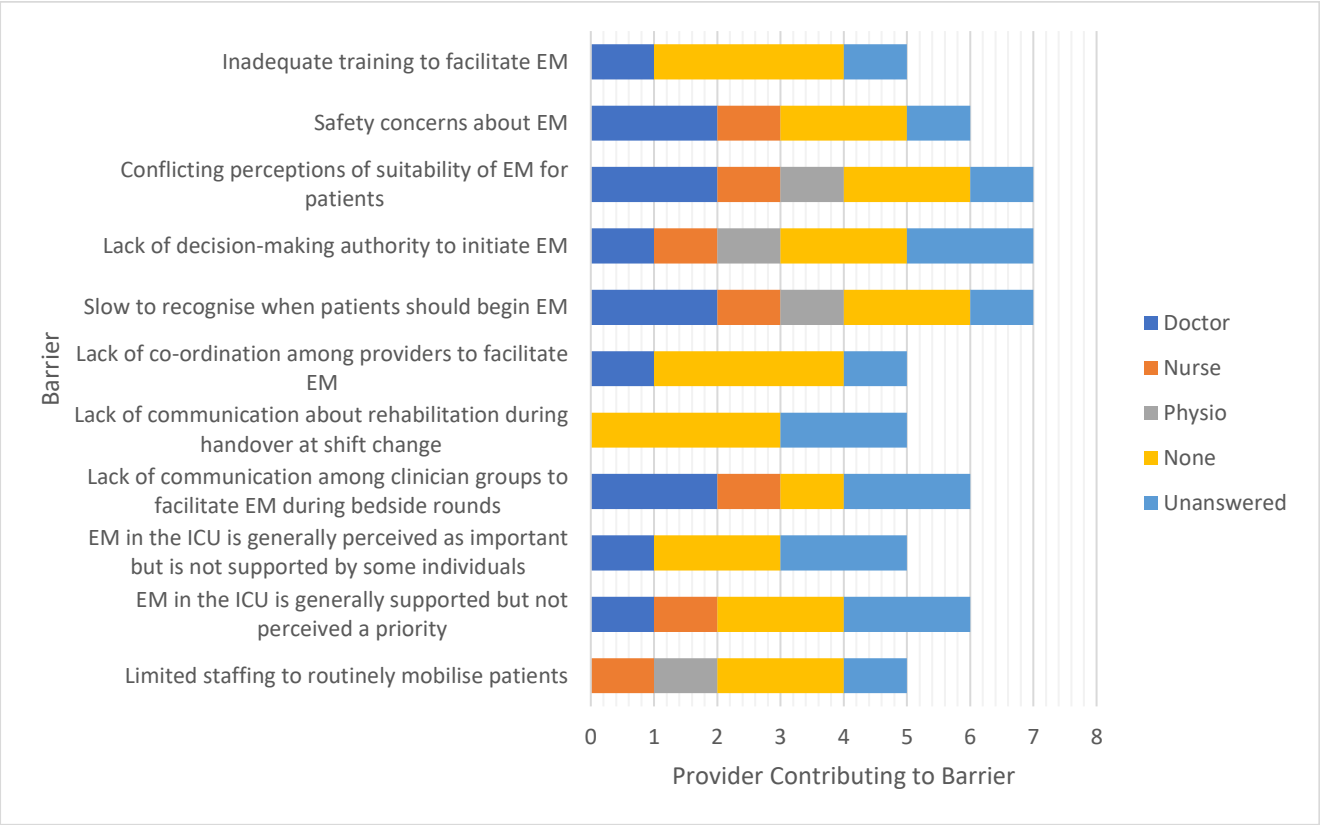

Figure 4.14: Providers Contributing to Barriers as Perceived by Doctors

While doctors believed that their profession contributes largely to safety concerns about early mobilisation (n=2; 40%); conflicting perceptions of suitability of early mobilisation for patients (n=2; 33.3%); being slow in recognising when patients should begin early mobilisation (n=2; 33.3%); and the lack of communication among clinician groups to facilitate early mobilisation during bedside rounds (n=2; 50%), most were of the opinion that the above-listed barriers were not important.

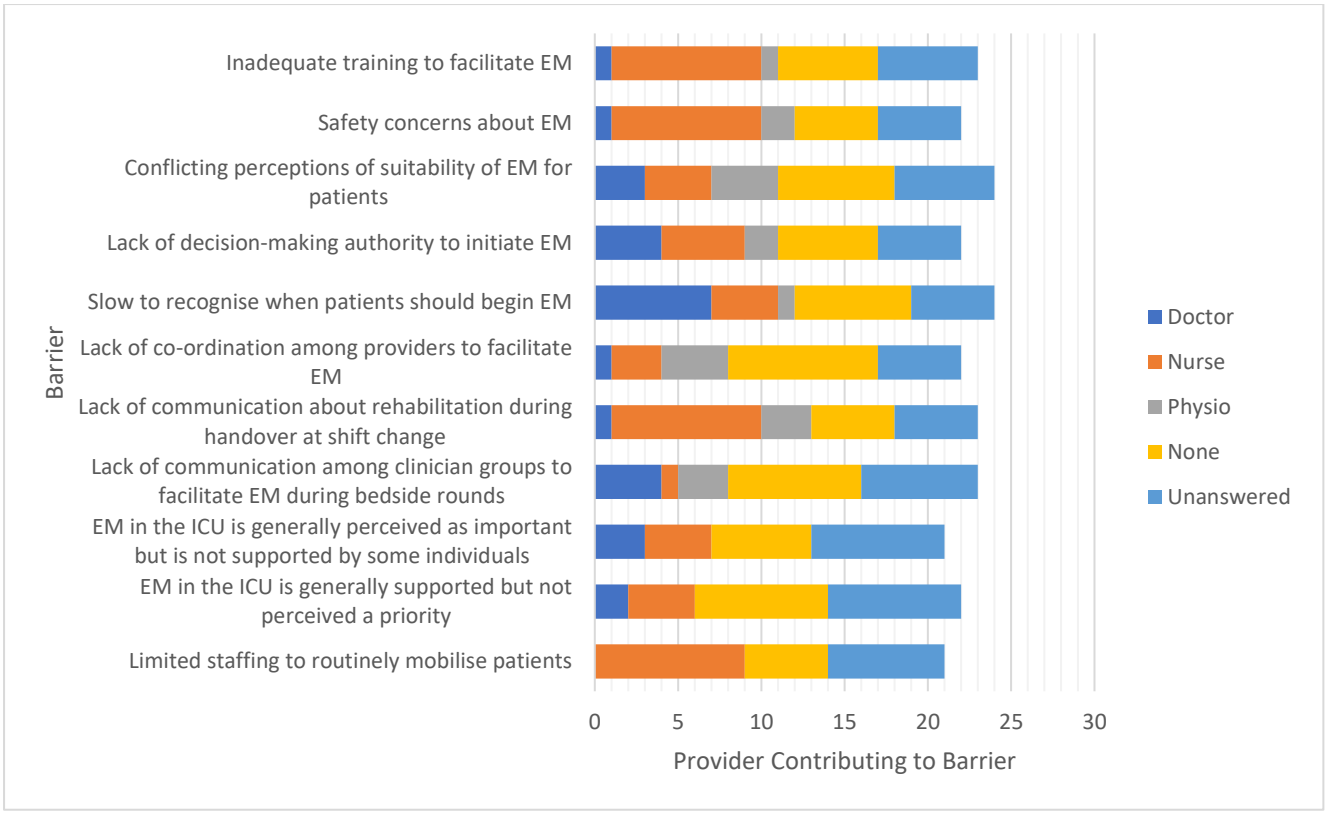

Figure 4.15: Providers Contributing to Barriers as Perceived by Nurses

Nurses felt that their profession largely contributes to inadequate training to facilitate early mobilisation (n=9; 52.9%); safety concerns about early mobilisation (n=9; 52.9%); the lack of communication about rehabilitation during handover at shift change (n=9; 50%); and limited staffing to routinely mobilise patients (n=9; 64.3%).

Chapter 5 Discussion

This two-part study was the first of its kind to describe ICU patient profiles, mobility practice, and clinician attitudes and perceived barriers to early mobilisation of critically ill patients in Windhoek, Namibia.

5.1 Record Review

This study described the profile of participants admitted to private ICUs in one region of Namibia. They were mostly male, aged 50-64, admitted to ICU electively largely for cardiac-related management. The average length of stay in ICU was 3.41 (1-37) days, and 0.7 (0-20) days on mechanical ventilation. Most patients that were mobilised were done so within 48 hours of ICU admission. Commonly used physiotherapy techniques received in ICU were chest physiotherapy, mobilisation to a chair, and active range of motion exercises. Patients in these ICUs were typically mobilised once daily. A very small number of patients experienced adverse events during physiotherapy, and mobilisation was shown to have no impact on patient mortality.

5.1.1 Participant Characteristics

The patient profiles of this study are similar to that of well-resourced countries like Australia, New Zealand, and Canada [24, 80, 84, 89, 104]. Similar to these reports, patients in this study were mostly male, however, they were slightly younger (mean age of 56 compared to 65) and were admitted to ICU electively (mostly for cardiac-related conditions) with low adverse event rates.

Our patient profile, however, differs from reports from low-income African countries like Zimbabwe, Tanzania, and Malawi, where patients had a much younger patient cohort (median 27 and 34 years; mean 36 years). Admissions were largely emergencies that were often delayed, with high mortality rates (range 17.5% to 41.4%), compared to the 5.2% mortality rate reported in our study. The young patient cohort in these African studies could be linked to the high number of trauma-related admissions [74-76].

Unlike many patients in both low and high-income countries needing mechanical ventilation (between 45% to 74%) [24, 71, 74, 76, 80, 84, 89, 104], only 19.9% of all admitted patients in the two Windhoek ICUs required mechanical ventilation. This could be attributed to the large number of patients admitted after elective cardiac surgery.

More than half of the patients in our study were male (61.8%), with a mean age of 56 years, which is similar to reports from two Brazilian studies with patient cohorts of more than 50% males, and similar mean ages (56.64 and 60.5) [73, 77].

Most of the admissions to ICU in our study were elective (66.3%), unlike other studies in Brazil, Zimbabwe, Tanzania, and South Africa where most patients were admitted for emergency reasons [72-74, 76]. Patients were admitted mainly after coronary angiogram (20.6%), for cardiac conditions (13%) and after cardiac surgery (10.3%), which is very different to the other profiling studies where patients were admitted mainly for circulatory system diseases, trauma surgery, and emergency surgery. This could be attributed to the fact that the one study site has a dedicated cardiac unit, which is the only one in the country.

It is likely that the older patient age in our study, compared to the younger cohort in other African countries, where patients were admitted mainly for trauma and emergency surgeries, could reflect the high number of patients admitted electively and with cardiac-related diagnoses, as would be expected considering the one study site has the only dedicated cardiac unit in the country.

Unlike many patients in the Zimbabwean, Tanzanian, and Malawian studies needing mechanical ventilation (between 45% to 54.2%) [71, 74, 76], only 19.9% of all admitted patients in the two Windhoek ICUs required mechanical ventilation. This could be attributed to the large number of patients admitted after elective cardiac surgery.

Our study reported a low mortality rate (5.2%) compared to other African countries like Zimbabwe (17.5%), Malawi (38%), Tanzania (41.4%), and Uganda (40.1%), where trauma, head injuries, medical, and gynaecological conditions accounted for most of the admissions [71, 75, 76, 129]. It is also lower than that of the two Brazilian studies (19.83% and 58.2% respectively) [73, 77], the latter which reported high illness severity scores on admission. Our low mortality rate could be attributed to the high number of elective cardiac admissions, and due to 80% of the patients not requiring ventilatory support.

These findings highlight the need to replicate this study at larger, general hospitals in Namibia, including those in the public health sector. Furthermore, since data was collected largely from one private hospital, including other institutions from both private public sectors will increase generalisability of results, and likely reflect a considerably different patient profile.

5.1.2 Length of Stay in ICU and Duration of Mechanical Ventilation

The average length of stay in ICU was 3.41 days, which is shorter than that of other countries like South Africa, Brazil, Tanzania, Zimbabwe, and Australia) where patients stayed up to 27.8 days in ICU [73, 74, 76, 84, 130]. It is surprising to note that this LOS is shorter than the mean ICU LOS of patients in neighbouring South African ICUs (5.94 ± 6.55 days) [131]. The average duration of mechanical ventilation was 0.7 days, compared to 4.0 [76] and 3.0 days [25] reported in Zimbabwe and Brazil, respectively. This short average LOS and duration of mechanical ventilation could be attributed to the large number of cardiac patients admitted into ICU, including post-operatively. These patients would normally be ventilated for less than a day after surgery and discharged to the ward by day 2 or 3 post surgery if no complications develop. It will therefore be important for in-bed mobilisation to commence as soon as possible after admission to the ICU, and mobilisation out of bed as soon as possible after extubation before they are discharged to the ward.

5.1.3 Mobility Practice

Less than half of the patients (n=352; 40.5%) received physiotherapy whilst in ICU, however, 98% of those who received physiotherapy were mobilised using different modalities including passive movements, bed mobility, sitting, standing, ambulation or active exercises. Most patients (n=253; 73.3%) were mobilised within 48 hours of ICU admission. It is concerning that 60% of all patients admitted to ICU did not receive any physiotherapy and had no documented mobilisation events. The reason for this could be that patients in these ICUs are not automatically assessed for mobilisation by the physiotherapists, unlike in Australia where physiotherapists in almost 90% of their ICUs countrywide make this clinical decision [78, 84]. Lottering and Van Aswegen's study on physiotherapy practice in South Africa also reported that their physiotherapists frequently assessed patient readiness for mobilisation autonomously [86]. This is an important aspect of mobility practice that could influence the number of patients receiving mobilisation and should be addressed through quality improvement programmes.

5.1.3.1 Mobilisation Timing

The results show that most patients were mobilised less than 48 hours after ICU admission, which is comparable to studies conducted in the USA, UK, and Brussels where patients received their first physiotherapy session between 1.5 and 2 mean days after admission [13, 87, 114]. The reason why

most patients in our study were mobilised within 48 hours could be explained by the presence of cardiac and orthopaedic protocols that guide mobility practice.

5.1.3.2 Mobilisation Frequency

Almost 80% of the patients mobilised received mobilisation once daily, which is different to the Zimbabwean patient profiling study that reported their patients receiving twice daily active-assisted exercises and respiratory therapy [76]. Moreover, an Australian study by Skinner and colleagues reported a higher frequency of patients receiving physiotherapy in the ICU compared to the wards [84]. Furthermore, a Belgian RCT of 21 patients showed that twice daily mobilisation plus 30 minutes of active/passive cycling in the intervention group facilitated the return of more patients to independent functional status at ICU discharge than the control group who received once daily mobilisation [43]. Once daily physiotherapy and mobilisation may therefore not be sufficient for patients in ICU to improve their physical and functional outcomes. This is another area of mobility practice that is amenable to improvement through quality improvement programmes.

5.1.3.3 Physiotherapy Techniques Received in ICU

A wide range of physiotherapy techniques were documented with manual chest physiotherapy, mobilisation to a chair, and active range of motion exercises most often performed in ICU. This is similar to studies that reported on physiotherapy/mobility practice in South African ICUs where mobilisation was a main focus, followed by exercise therapy and respiratory therapy, and in Australian ICUs where mobilisation was the most common technique used, followed by active and active-assisted exercises, positioning, ventilator lung hyperinflation, and suctioning [78, 84, 86]. The Zimbabwean patient profiling study reported mostly active-assisted exercises and respiratory therapy being performed [76]. Two Brazilian studies reported passive and bed exercises for mechanically ventilated patients [25, 91], while one of these studies also reported the presence of a mobility protocol to be associated with a 3-fold chance of patients receiving mobilisation [91].

As presented in the literature review, several studies have shown the numerous benefits of EM, and translation of this into practice seems to have been implemented in the two Windhoek ICUs.

Since there is currently no standard practice for mobility, variation in practice exists [55, 78, 111, 122, 123], which is dependent on many factors, including country, condition, or level of expertise [23]. More research (multi-institutional, randomised control trials with large sample sizes) is therefore needed regarding the timing, type, and dosage of rehabilitation and mobilisation. Standard practice will decrease variability in practice and enhance generalisability of results in future studies [36, 122].

5.1.4 Mobilisation versus Length of Stay in ICU

The median length of stay for patients not mobilised in ICU was 2 days (IQR 2-3), compared to 3 days (IQR 2-5) for those mobilised while in ICU ($p < 0.0001$). Other studies have suggested an association between early mobilisation and reduced ICU LOS [23, 125, 132], however, it is important to note that our study was not designed to determine the effect of early mobilisation on LOS, and association cannot be equated with causation. Our finding likely simply reflects that patients staying longer in ICU are more likely to be mobilised [25], and that post-operative cardiac patients routinely referred for mobilisation one day after uncomplicated surgery normally stay two to three days in ICU. This is comparable to a 2017 study [87] that showed a culture of strong commitment to mobilising appropriate cardiac patients in their unit.

5.1.5 Mobilisation versus ICU Mortality

Most (95%) patients survived and were discharged from ICU regardless of being mobilised or not, which suggests that mobility status does not influence ICU mortality. This is comparable to recent

systematic reviews that showed early mobilisation having no impact on mortality [57, 60], and a medical record review that showed no significant relationship between the timing of rehabilitation and mortality in patients after ventilator associated events [133]. This, however, does not negate all the other benefits of early mobilisation i.e. preventing ICUAW, delirium [11, 67, 81], fewer ventilation days and ventilator-associated events, improved muscle strength and mobility status [57, 60, 66, 67, 107, 108, 133, 134].

5.1.6 Adverse Events During Physiotherapy

The small prevalence of adverse events while receiving physiotherapy (mainly blood pressure changes) is comparable with other studies (randomised control trials, systematic reviews, point prevalence, retrospective, and prospective studies) [25-27, 88, 98, 134, 135], reinforcing that early mobilisation of critically ill patients appears to be safe.

5.1.7 Delirium

None of the patients had a delirium score or assessment documented on their charts. It is concerning that this complication of critical care is not being monitored as it is associated with increased mortality, prolonged ICU and hospital LOS, poor functional outcomes, and cognitive impairment [5, 7, 45]. It will be important for delirium monitoring and management to be addressed in quality improvement programmes.

5.2 Survey

Most survey participants underestimated the likely incidence of ICUAW. Only 15.8% (n=6) participants selected the correct answer. Most participants reported that patients are not automatically assessed for mobilisation on ICU admission, and that they rely on a doctor's referral for commencement. About half of the participants reported their ICU not having mobility protocols, nor a mobility champion. Sedation protocols are not routinely used in the ICU, and delirium is not monitored.

Participants indicated they would allow low levels of mobility for patients receiving mechanical ventilation. About half the participants indicated they would mobilise patients once and twice daily. The routinely used physiotherapy techniques reported are manual chest physiotherapy, bed mobility, and pre-gait activities. Patients with suspected ICUAW are referred for rehabilitation after hospital discharge.

While most participants thought EM a priority in ICU, mechanical ventilation and increasing levels of respiratory support seem to limit to level of mobility deemed safe. Moreover, while most participants acknowledged the importance of EM, they also reported knowledge gaps and a lack of confidence in mobilising patients.

The main barriers to EM (that are amenable to change) were reported under patient-, institutional-, and provider-related barriers, that are similar to those cited in the existing literature.

5.2.1 Participant Demographics

Participants comprised twenty-one nurses, five doctors, and thirteen physiotherapists.

Most participants (42.4%) had 1-5 years of primarily adult ICU working experience, which differs from that of the Canadian study from which this survey was adapted. Just more than half the participants in that study had between 5-20 years of ICU working experience [1]. Only nurses had received ICU specialisation training, and the minority of participants had ICU postgraduate training. This highlights the need for potential postgraduate ICU training in Namibia.

5.2.2 Knowledge

This study, like others, highlights knowledge gaps on ICUAW and early mobilisation as reported by participants **[1, 93, 99, 101, 136]**. Even though participants correctly indicated the broad range of EM benefits, a large number reported being unfamiliar with published literature on early mobilisation, and only the minority reported feeling sufficiently well-trained to mobilise mechanically ventilated patients. This could be attributed to possible lack of interest in reading and/or learning new information, or simply a lack of training opportunities in Namibia. This is similar to other studies that demonstrated limited awareness of existing literature on this subject [97, 137]. There are also several studies that point out that the varying levels of knowledge on EM and therefore confidence in mobilising critical-ill patients vary according to different clinician groups [79, 97, 98, 100], which is evident in our results. The incidence of ICUAW, which is >40% [35, 38] was underestimated by most participants in this study, which also correlates with other studies [1]. This reinforces the identified need for further education and skills training to improve knowledge and practice to prevent the development of ICUAW and detect it early enough to optimise patient outcomes and functional recovery [38, 116].

5.2.3 Mobility Practice

Assessment for Readiness of Rehabilitation

Almost half the participants reported feeling "somewhat trained" to mobilise mechanically ventilated patients, and the same proportion require a doctor's referral for initiation of mobilisation. These results are similar to other studies [1, 86, 97, 106], but different from most Australian ICUs where a blanket referral system exists. In the neighbouring country, South Africa, physiotherapists in many ICUs assess all patients' readiness for mobilisation daily to make clinical decisions and implement rehabilitation without the need for referral [84, 86, 117]. Multidisciplinary education and training on EM are clearly needed in Namibia: all practitioners in ICU need to have adequate knowledge of EM to be able to make the clinical decisions regarding rehabilitation. This will help transform ICU culture in combination with the development and implementation of quality improvement programmes that will change the way patients are assessed for mobilisation.

Mobility Protocols/Mobility Champion

Approximately half (52%) of participants, reported that their ICUs have mobility protocols, and 48% indicated that their units have a mobility champion. This speaks to Hospital 1 that has protocols in place for cardiac, orthopaedic (where the majority of record review data originated), medical, and other surgical patients. The presence of mobility protocols has been shown to be associated with increased mobility levels [91, 138], which is also shown in our record review with most patients mobilised within 48 hours of ICU admission).

Sedation Practices

Sedation protocols are not standardised, and according to participants, are only sometimes used in Namibian ICUs according to the patient's activity level. This is similar to sedation practice in Canada and especially India, where both pain and delirium are not routinely monitored, and benzodiazepines are still primarily being used in ICU instead of the analgesia-first approach [1, 81]. This is an area of concern, as delirium monitoring is an important aspect of patient care that will influence a patient's ability to actively participate in activity. [90, 97, 98, 100, 120]. Minimal sedation allows patients to mobilise when appropriate [11, 65, 96], and therefore, sedation protocols that include sedation vacations need to be implemented in ICU. These vacations will give patients requiring sedation an opportunity to actively participate in mobilisation activities [46, 47, 65].

Physiotherapy Techniques Performed, Duration, Frequency, and Intensity of Mobilisation

Traditionally, physiotherapy in ICU is focused on manual chest physiotherapy, which was still the case in Zimbabwe, according to a prospective record review published in 2015 [76]. In our survey, manual chest physiotherapy, bed mobility, pre-gait activities, and strengthening exercises, similar to the record review findings, are the most used techniques in Windhoek ICUs. Our findings are similar to South African (neighbouring country) physiotherapy practice where physiotherapists employ a variety of techniques i.e. respiratory therapy, exercise therapy and mobilisation in ICU [86]. This similarity in practice may be related to the fact that the majority (n=11; 84,6%) of physiotherapy participants in this study trained at South African Universities, and therefore likely had received similar training and developed a similar culture of practice.

Fewer than 50% of physiotherapy participants reported that they would mobilise their ICU patients twice daily, which is not consistent with the Zimbabwean and Australian studies mentioned previously where patients received physiotherapy-facilitated mobilisation twice daily, and more frequently in ICU than the wards [76, 84].

Patients are mobilised by a team that includes physiotherapists, nurses, and porters. There is very little reported family involvement with patient mobilisation, which could be addressed through quality improvement programmes. A 2017 study reported family engagement and empowerment to be important in improving the perceived quality of care, as well as patient and family satisfaction. However, a change in mindset of healthcare professionals to adopt patient- and family-centred care was needed [139]. This may explain the low family involvement in patient mobilisation.

Physiotherapy sessions were reported to last approximately 16-30 minutes. Progressive rehabilitation would be employed as the patient improves, which is consistent with other studies recommending progressive early mobility, emphasising its role in reducing ICU length of stay and improving functional outcomes at discharge from ICU [4, 23, 70, 140].

Another point to note from the 2016 South African study by Lottering and Van Aswegen is that physiotherapists are also involved in training of other physiotherapists to ensure ICU practice is safe [86]. In Namibia, the Health Professions Council accredits physiotherapy practices (amongst other disciplines) to provide training of newly qualified physiotherapists, who are called interns, and to provide continual professional development activities. The physiotherapy practice at Hospital 1 holds both these accreditations, to ensure that physiotherapy treatment is safely and effectively performed. This also explains why this practice possesses written protocols for physiotherapy treatment both in and out of hospital.

Participants in our survey indicate that a designated physiotherapist is readily available for full assessment and treatment during normal weekday hours, as well as after-hours and on weekends. This, however, is self-reported practice that included responses from nurses and doctors who did not necessarily have adequate knowledge whether the physiotherapist was designated exclusively to the ICU, or whether they treated patients in the wards as well. Actual practice may not reflect this. Ensuring that the ICUs have a designated physiotherapist, who could also serve as a mobility champion to improve the frequency of patient mobility, should be included in quality improvement programmes.

Long-term Rehabilitation After ICU Discharge

Participants in our study indicated that patients with suspected ICUAW after hospital discharge are referred for long-term rehabilitation to physiotherapists, occupational therapists, and step-down

facilities. This practice correlates with a 2016 American study where physiotherapists and occupational therapists developed home exercise programmes to guide the patients' families in assisting with rehabilitation after hospital discharge [141]. Conversely, a 2019 Canadian survey of three hospitals reported that most patients were not referred at all for long-term rehabilitation after ICU discharge [97].

5.2.4 Attitudes and Perceptions of Nurses, Doctors and Physiotherapists to EM in ICU

Attitudes and Perceptions

From the survey findings, it appears that the importance of mobilisation is recognised but not always implemented in practice. The reason behind this could be the self-perceived lack of knowledge and skills to safely and effectively mobilise patients, as reported in the Canadian study by Koo and colleagues from which this survey was adapted [1]. This report is similar to a variety of recent studies conducted in high-income countries i.e., Australia, Canada, USA, and UK, that include observational studies in the form of questionnaires and interviews, and a quality improvement programme, where up to 49% of participants did not perceive EM as top priority [83, 97-100, 109].

Perceived Contra-indications/Precautions to ICU Mobility Practice

The survey results suggest that participants were generally conservative in the level of activity they would allow, especially in patients on ventilatory support. When the level of cardiovascular support to patients is decreased, participants would mobilise patients with substantial caution. Even patients following head injuries without raised intracranial pressure, and those with subacute myocardial infarctions, deep vein thrombosis, coagulopathy (excessive bleeding), thrombocytopaenia (low platelet count), obesity, and frailty would only be mobilised with caution. This is unlike what was reported by Koo and colleagues where participants would not restrict activity for patients with the above-mentioned conditions [1]. Other studies explain that passive and active range of motion exercises do not increase intracranial pressure and could therefore be implemented in patients with brain injury [68, 116, 117]. Mechanical ventilation via an ETT or tracheostomy and other respiratory support aspects seem to limit the level of activity deemed safe by participants. However, the description of the scenarios given in the survey may not have provided sufficient information to make a clear clinical decision.

Most participants were unsure which activities were appropriate for patients receiving extracorporeal membrane oxygenation. This likely because of the self-reported knowledge gaps and the unavailability of ECMO in Namibian ICUs. Two studies, which included a systematic review and a quality improvement programme showed that it is safe and feasible to start early activity with these patients, guided by protocols to ensure safety, and that it is acceptable even to mobilise such complex patients out of bed for ambulation [62, 140]. If ECMO is implemented in Namibia, there would need to be a specific training programme for physiotherapists working in these areas, to ensure safe and effective management.

5.2.5 Barriers to Early Mobilisation in ICU

The perceived barriers to EM by our participants are similar to those cited by clinicians worldwide in many studies that include common institutional, patient, and provider-related barriers.

Institutional Barriers

Requiring a doctor's referral for mobilisation and routine bed rest orders on admission to ICU in our study is unlike mobility practice in the UK, Australia, and South Africa, where all patients are assessed

for mobilisation within 24 hours of admission [114], and where the physiotherapists decide when patients should start exercise [78, 84, 86]. The absence of mobilisation protocols and an ICU mobility champion/leader are other reported institutional barriers to EM consistent with international studies [1, 20, 53, 101]. Bakhru and colleagues' international survey on organisational characteristics affecting EM practice showed that the presence of a dedicated physiotherapist in ICU is associated with EM practice [85]. The modifiable barriers mentioned here can all be addressed through the design and implementation of quality improvement programmes.

Patient Level Barriers

Like other studies, we found medical instability, excessive sedation, and endotracheal intubation (though the presence of an ETT is not a contra-indication to EM) to be considered the biggest patient level barriers to EM [1, 4, 13, 34, 53, 88, 90, 92, 94, 98, 100] . Education and training on safe parameters for mobilising patients, and indications/contraindications for mobilisation [17, 119], would better inform clinicians on these aspects of care.

Provider Level Barriers

In this study, it is perceived that nurses contribute the most to barriers of early mobility i.e., inadequate training to facilitate EM, safety concerns, lack of communication amongst nurses about rehabilitation at shift change, limited staffing, and that EM is perceived as low priority. These barriers seem to be universal and have been reported in many international studies [1, 4, 13, 53, 83, 92, 93, 95, 97, 99-101, 111]. Education on the benefits of EM and skills training of nurses on mobilisation of critically ill patients may better equip them to provide EM and to help change their perceptions and priorities.

Physiotherapists were perceived to contribute the least to provider level barriers. This may be attributed to the various levels of knowledge in clinician groups, and hence variation in the level of mobility allowed among clinician groups [79, 97, 98, 100]. Physiotherapists also mobilise patients to much higher levels than nurses do [79, 82, 88], most likely because physiotherapists are trained more in depth in mobilisation and rehabilitation than nurses are.

All three clinician groups contribute to conflicting perceptions of patient suitability for early mobilisation. This is likely also due to varying levels of knowledge amongst different clinician groups which is something that can be addressed through quality improvement programmes and the presence of standardised protocols.

Most of the doctor participants did not perceive many of the provider level barriers as being important. This could be that because their scope of practice differs to that of nurses and physiotherapists, or because they have a different understanding of the challenges associated with mobility and focus on other barriers/aspects of care instead. It is therefore important to educate the MDT on all the aspects related to early mobilisation of patients, which can be done through quality improvement programmes.

5.3 Study Limitations and Future Research

The record review included the following limitations:

The retrospective design of the record review constitutes a limitation of this study, considering that the data collected was reliant on adequate documentation and there was no standardisation in this regard. Charts of patients with missing information had to be excluded from analysis. Future audits should be of a prospective nature, as prospective studies can have a more focused approach i.e., these studies are able to plan what data to collect and how to obtain the information; the recording of information on charts can be standardised, that will enable the abstraction of systematically standardised information. A prospective audit would also be able to demonstrate causal relationships, while the retrospective record review can only establish association.

A pilot feasibility project was conducted instead of a formal pilot study. No data from the project was analysed, and there was no formal validation of the research instruments. Furthermore, the pilot study was conducted in neighbouring South Africa, where the style of documentation and service delivery are different. Future studies would need to include a pilot study in the same country/setting as the main study, so that research instruments can be properly validated, and so that the consenting hospitals can be familiarised and sensitised to the study.

The source of the patient charts for the record review was mainly from one private hospital in Windhoek, which creates substantial bias. This resulted when one of the consenting hospitals stopped supplying charts for the record review. The results of the review therefore cannot be generalised to the entire Namibia and are limited to this study population. Conducting a pilot study, as stated above, in the same country/setting as the main study would help familiarise and sensitise consenting institutions to the research, that will minimise the risk of a consenting institution from withdrawing from the study. Further research that successfully includes other institutions, including public hospital ICUs, would serve to widen the generalisability of results to be more representative of the Namibian ICU patient profile.

The mode of ventilation on the day of admission was recorded, while changes in ventilation settings and ventilation status throughout the patients' stay in ICU were not. It was not explicitly stated on the data abstraction form which day in ICU should be recorded, and this should be clearly stated in future studies, especially if there are more than one data abstractor. Future studies should also record the progression/change in patients' ventilation status during their stay in ICU.

Documentation of patients mobilised by members of the MDT, other than physiotherapists or mobilising independently were not reported on. Future studies need to account for a larger range of mobility practice.

The following limitations are evident in the survey:

The survey population was very small with a low overall response rate (24.1%). The response rate of physiotherapists was even lower (10.2%). These small numbers are not representative of the intended study population, and our lack of confidence in this representation is confirmed by the high margin of error (16%). Future studies with larger sample sizes are recommended. It is, however, unclear how many physiotherapists have experience working in ICUs exclusively, as this is a highly specialised area of practice. Future surveys should include a question asking if participants work exclusively in ICU, the wards, or both.

We did not ask the participants to indicate whether they work in the public or private sector, or both. Service delivery and processes are different in the public and private sectors, and it will therefore be important to include this question in future studies, especially if the public sector is to be included.

The clinical information given in the case scenarios may not have been sufficiently detailed, which may have influenced the answers selected by participants. Because this was quite a lengthy survey, participants may have also become fatigued, resulting in response bias in the form of inaccurate responses. Future surveys would need to be adequately detailed, whilst remaining as succinct as possible.

The Ministry of Health and Social Services did not grant permission to include public hospitals in the study, therefore public institutions could not be included, making the results based on private institutions alone. Further attempts to include the public health sector in future research should be made that will provide a true representation of the Namibian ICU patient profile and mobility practice in critical care.

5.4 Clinical Implications

The body of evidence in this area of research is growing internationally. This study, however, is the first to be conducted in Namibia. The results of this study are two-fold: in the record review we found that most of the patients that received physiotherapy were mobilised within 48 hours of ICU admission; and in the survey we found that clinicians are generally overly conservative in their approach to mobilisation of patients in critical care. Patients received mobilisation once daily according to the record review, and in the survey, physiotherapists reported they would mobilise patients once to twice daily. Furthermore, documentation of delirium monitoring and management could not be found. It will be important for delirium monitoring and management to be included as part of routine care in ICU.

There is a mismatch between knowledge on the various aspects of EM and the implementation thereof. This can be addressed by the development and implementation of quality improvement programmes that will serve to bridge this gap, and ultimately educate and equip clinicians with adequate knowledge and skills to provide patients with safe, evidence-based care that will improve their functional status and quality of life.

The Namibian public healthcare sector crisis (lack of physiotherapy and specialist services) mentioned in Chapter 1, severely affects access to healthcare services for those that cannot afford private healthcare. Without any physiotherapists to work at the public health facilities, patients in ICU and the wards may not receive any rehabilitation or mobilisation at all, and this would require urgent attention. Research that only includes one or two private facilities is not a true reflection of what is happening in Namibia as a whole. As mentioned in the limitations, service delivery and process vary in the public and private sectors, that will need to be explored so that recommendations for improvement can be made, and so that solutions for access to various services not available in the public sector can be proposed and implemented. A public-private partnership desperately needs to be established, with inclusion of public hospitals in future research and quality improvement programmes, so that the ailing public hospitals in Windhoek can receive much-needed assistance in the management of their patients.

Chapter 6 Summary and Conclusion

The aims and objectives of this study were to describe: the profile of patients admitted to ICUs in Windhoek; mobility practices of physiotherapists working in Windhoek ICUs; and nurse, doctor, and physiotherapist attitudes and perceptions on EM of critically ill patients in Namibian ICUs.

The record review results were mostly from one hospital, which is also the student researcher's place of employment, which may have introduced substantial selection bias. The record review results may therefore not be a true reflection of the broader practice in Namibia. Nonetheless, the records suggest there was very good compliance with EM, as most patients were mobilised within 48 hours of admission to ICU. Patients were mostly male and were a mean age of 56 years. Most admissions were for cardiac-related management. ICU LOS was an average 3.41 days, and average duration of mechanical ventilation was less than one day. Patients received once daily physiotherapy, and a variety of respiratory and rehabilitation techniques were used during treatment. The adverse event rate during physiotherapy was low, as well as the overall mortality rate. Delirium is not being monitored or managed. Moreover, illness severity, which is linked to mortality [103], is not recorded on admission. It will therefore be important to include this on admission, using the APACHE II score.

The survey results included participants from both consenting hospitals and other institutions, which is a better representation of practice than that reported in the record review. It suggests that although participants recognise the importance of early mobilisation, they do not always implement it. Moreover, participants reported self-perceived knowledge gaps on the early mobilisation literature and a lack of confidence in providing mobilisation to patients. The incidence of ICUAW was underestimated by many participants, which support the self-perceived knowledge gaps. Many barriers to EM were identified, most of which are amenable to change.

Although there seem to be mobility protocols in place, those for delirium and sedation management appear to be absent. It is crucial that protocols for delirium and sedation management be included in the patients' daily care routine, which will influence the patient's ability to participate in their mobilisation activities and affect their physical outcomes [107]. Referral from a doctor is required for initial mobilisation of patients. Participants reported that they see patients once to twice daily in ICU and employ a variety of respiratory and rehabilitation techniques that are progressed as the patient improves. Patients are referred to physiotherapists and step-down facilities for long-term rehabilitation after hospital discharge. However, participants seem to limit the level of activity deemed safe for patients receiving mechanical ventilation via an ETT or tracheostomy. Moreover, the patients are mobilised by a team that includes a physiotherapist, nurse, and a porter without much family engagement. The implementation of quality improvement programmes, that include both private and public institutions, would serve to bridge the gap between knowledge and implementation of EM, address mobility practice and delirium and sedation management.

This study was the first of its kind in Namibia. However, future prospective studies should include larger sample sizes and should include all ICUs from both the private and public sectors to increase the generalisability of results. Survey studies need to be adequately detailed, whilst remaining succinct to minimise the possibility of participant fatigue. Future mobility practice studies need to account for a larger range of mobility practice, and researchers involved in data collection/analysis would ideally need to be blinded.

6.1 Recommendations for Research and Practice

The record review was performed retrospectively, while the survey was conducted at one point in time (cross-sectional). The mismatch observed between actual practice and self-reported practice could be attributed to the fact that mobility practice may have changed from the selected year for the record review (2016) to the year that the survey was conducted (2018). We recommend that a point prevalence study be conducted in all private and public ICUs, where a prospective record review and survey can be conducted simultaneously, to eliminate the possibility of discrepancy in observed practice.

Many perceived barriers to early mobility practice that are amenable to change were identified in this study. Moreover, the study showed that patients in ICU receive physiotherapy once daily, and that mobilisation is delivered by a team that includes little family engagement. Another important point is that delirium is not being assessed and monitored, and sedation protocols are seldom followed, both of which influence the patient's ability to participate in their rehabilitation/mobilisation [107]. Illness severity, that is associated with mortality and ICU LOS, and may influence the likelihood of rehabilitation/mobilisation [65, 72], is also not assessed on admission. However, the use of a variety of physiotherapy techniques and progressive rehabilitation/mobilisation have been reported. It is suggested that a quality improvement programme be implemented at the participating hospital to target these problem areas in mobility practice, using the Plan-Do-Study-Act framework. This framework can also be used by other hospitals in Namibia to design and implement their own quality improvement programmes.

Plan

Identification of Areas Needing Improvement

The perceived barriers to early mobilisation identified that are amenable to change include:

- Requiring a referral (written or verbal) for initial mobilisation
- Lack of written protocols or guidelines
- Routine bedrest orders on admission
- No mobility champion in the ICU
- Oversedation of patients
- Conflicting perceptions regarding suitability for early mobilisation
- Safety concerns
- Not recognising when commencement of mobilisation is appropriate
- Inadequate knowledge, training, and skills on early mobilisation
- Limited staffing

Once daily physiotherapy in ICU may not be enough for some patients, and the inclusion of family engagement in the patient's rehabilitation are recommended. Moreover, the absence of delirium monitoring and the seldom use of standardised sedation protocols also need to be addressed. The absence of illness severity scoring on admission, that is associated with mortality and ICU LOS, and the likelihood of rehabilitation/mobilisation, is also an important aspect that needs to be included.

Proposed Interventions to Address the Areas Needing Improvement

It is recommended that a multidisciplinary mobilisation team consisting of clinicians from physiotherapy, occupational therapy, nursing, and medicine be established, led by a mobility champion. The mobility champion may be from any discipline. Buy-in from stakeholders i.e., doctors working in ICU and hospital management relating to automatic assessment of ICU patients for commencement of early mobilisation is crucial in the success of the QIP. This is where the mobility champion should advocate for and rally support from the doctors and hospital management to abolish the reliance on referrals for physiotherapy/mobilisation.

It is recommended that the mobilisation team design a standardised mobility protocol for mechanically ventilated and non-ventilated patients. Any existing mobility protocols may need to be revised.

On admission to ICU, it is recommended that the nurse responsible for the patient assess illness severity using the APACHE II score that will give a prognosis of ICU outcomes and influence the likelihood of rehabilitation/mobilisation, if at all. We recommend that the mobility champion put systems in place to ensure that all patients admitted to ICU are assessed within 48 hours to determine readiness for mobilisation. This will enable physiotherapy/mobilisation to commence at the earliest time possible.

It is recommended that the mobility champion improve and expand on their own knowledge of early mobilisation and educate the multidisciplinary team on its various aspects through information sessions, workshops, presentations, staff newsletters, and reports on the latest EM literature. The establishment of ICU MDT ward rounds may also serve as a platform for the promotion of EM. Members of the MDT may be invited to weekly physiotherapy staff meetings where the progress and treatment plans of patients are discussed.

For targeted improvement in mobility practice, the ACBDEF bundle of care, with emphasis on the "E", can be used to co-ordinate patient care in ICU and to improve their functional outcomes, that include [51]:

- **A**ssessment, prevention, and management of pain (the Behavioural Pain Scale or Critical Care Pain Observation Tool can be used to assess pain)
- **B**oth spontaneous awakening trials (SATs) and spontaneous breathing trials (SBTs) can be utilised
- **C**hoice of analgesia and sedation (analgesia-first medication, use of non-benzodiazepines is encouraged)
- **D**elirium monitoring and management (CAM-ICU and the ICDSC are the best recommended delirium screening tools)
- **E**arly mobility and **e**xercise (the only known non-pharmacological intervention to reduce the duration of delirium)
- **F**amily engagement (family participation in the patient's care i.e., getting a patient history; providing feedback on patient progress to the family; education to the family; active participation in mobilisation activities)

The other elements in this bundle may also be addressed as part of the quality improvement project.

Do

This will involve the implementation and testing of the above-proposed interventions. It is recommended that an improved version of the record review and survey used in this study be conducted at 6 months and 1 year after implementation of the QIP.

Study

Review the Results

The record review and survey results should be compared to the baseline data to determine if a change in the perceived barriers to early mobilisation, and if a change in mobility and sedation practice occurred. Whether the monitoring and management of delirium has been incorporated into practice should also be reviewed.

Act

If the desired change in perception of early mobilisation barriers, mobility and sedation practice has occurred, we recommend that the above-proposed interventions continue, with the mobility and sedation protocols, and delirium monitoring and management tools added to the patients' daily care routine. It is also recommended that the APACHE II score to assess illness severity be added to the ICU admission forms.

Successful implementation of the above-suggested quality improvement programme will direct mobility practice in ICU at the participating hospitals, as well as other hospitals (private or public) if they implement it too.

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Appendices

Appendix I: MVA Fund Act of 1990

GOVERNMENT GAZETTE

OF THE

REPUBLIC OF NAMIBIA

R0,60 WINDHOEK – 31 December 1990 No. 132

CONTENTS

Government Notice

OFFICE OF THE PRIME MINISTER

No. 99 1990

PROMULGATION OF ACT OF THE NATIONAL ASSEMBLY

The following Act which has been passed by the National Assembly and signed by the President in terms of the Namibian Constitution is hereby published in terms of Article 56 of that Constitution.

No. 30 of 1990: Motor Vehicle Accidents Act, 1990

"lift club" means any club of which -

(a) every member shall have a turn to convey or cause to be conveyed by means of a motor car the members of such club or other persons designated by such members to or from or to and from specified places for a specified purpose; or

(b) every member is the owner of a motor car and of which one or some of its members shall by means of a motor car of which he or she is the owner, or they are the owners, as the case may be, convey or cause to be conveyed the members of such lift club or other persons designated by such members to or from a specific place for a specific purpose;

"Minister" means the Minister of Finance;

"motor car" means a motor vehicle designed or adapted for the conveyance of not more than 11 persons, including the driver;

"motor vehicle" means any vehicle designed or adapted for propulsion or haulage on a road by means of fuel, gas or electricity and includes a trailer, a caravan, an agricultural or any other implement designed or adapted to be drawn by such other vehicle;

"owner", in relation to -

(a) a motor vehicle which a motor dealer has in his or her possession during the course of his or her business and which may in terms of any law on the licensing of motor vehicles not be driven or used on a public road except under the authority of a motor dealer's licence of which the motor dealer concerned is the holder, means that motor dealer;

(b) a motor vehicle which has been received for delivery by a motor transport licence holder in the course of his or her business of delivering new motor vehicles and which has not yet been delivered by him or her, means that motor transport licence holder;

(3) The financial year of the Fund shall run from 1 April of any year to 31 March of the following year: Provided that the first financial year of the Fund shall run from 21 March 1990 to 31 March 1991.

(4) The income of the Fund shall be exempt from income tax.

Levy on fuel for the benefit of the Fund for utilization for purposes of payment of claims for damages in consequence of motor vehicle accidents.

3. (1) The Minister of Mines and Energy, in consultation with the Minister of Finance, may by notice in the *Gazette* impose a levy for the benefit of the Fund on every litre fuel, distillate fuel or residual oil sold in Namibia.

(2) The notice referred to in subsection (1) -

(a) shall state the amount of the levy;

(b) shall specify the person who shall be responsible for the payment of the levy;

(c) shall specify the product referred to in subsection (1) in respect of which the levy shall be payable;

(d) shall specify the person charged with the collection of the levy;

(e) shall state the times when and the manner in which the levy shall be payable to the person charged with the collection of the levy, and by that person to the Fund;

(f) may prescribe that interest shall be payable, at the rate specified in the notice, on any levy received after the date on which such levy was payable.

(3) The notice referred to in subsection (1) may exempt, in part or in full, any person from any provision thereof: Provided that any such notice shall not contain any exemption from the payment of the levy, except to the extent and on such conditions as the Minister of Mines and Energy, in consultation with the Minister of Finance, may determine in respect of -

(a) petroleum products manufactured from raw materials produced in Namibia;

(d) shall, within 60 days after each audit, submit to the Minister audited balance sheets and the report of the auditor in respect of such audit together with a report on the Fund's activities during the financial year to which the audit relates; and

(e) shall exercise or perform the other powers, duties and functions conferred or imposed upon the Director or the Fund in terms of this Act and do all such other things as are incidental or conducive thereto.

(2) The accounts of the Fund shall be audited annually by a person registered as an accountant and auditor under the provisions of the Public Accountants' and Auditors' Act, 1951 (Act 51 of 1951), who shall annually be nominated by the Minister.

(3) The Director shall be assisted by officers in the Ministry of Finance designated by the Permanent Secretary for that purpose.

(4) The Fund shall reimburse the Government for services rendered to the Fund by persons in the service of the Government.

(5) The Minister shall lay upon the Table of the National Assembly a copy of the report referred to in paragraph (d) of subsection (1) within 30 days after the receipt thereof if the National Assembly is then in session or, if the National Assembly is not then in session, within 30 days after the commencement of its next ensuing session.

(6) Notwithstanding the provisions of subsection (1) and section 5(1), the Director may refer any claim contemplated in subsection (1) to any appointed agent to handle such claim subject to such general or special directions as the Director may give.

Appointment of agents.

5. (1) The Director shall, subject to the approval of the Minister, appoint as many agents as may apply for appointment, on such conditions as may be determined by mutual agreement, to investigate or settle, subject to the provisions of this Act, on behalf of the Fund claims

referred to in section 6 arising from the driving of a motor vehicle in the case where the identity of either the owner or the driver thereof has been established or to commence, conduct, defend or abandon legal proceedings in connection with such claims.

(2) The Director shall, upon approval by the Minister, cause the names of the said agents and the claims in respect of which those agents shall be liable, to be published in the *Gazette*.

Liability of Fund and appointed agent in respect of loss or damage inflicted by the driving of motor vehicles.

6. (1) The Fund or its appointed agent, as the case may be, shall, subject to the provisions of this Act and on the prescribed conditions, be obliged to compensate any person for any loss or damage which he or she has suffered as a result of -

(a) any bodily injury to himself or herself;

(b) the death of or any bodily injury to any person,

in either case caused by or arising out of the driving of a motor vehicle by any person whomsoever on or after the commencement of this Act at any place within Namibia, if the injury or death is due to the negligence or other unlawful act of the person who drove the motor vehicle or the owner of the motor vehicle or his or her servant in the execution of his or her duties as such a servant.

(2) The provisions of subsection (1) shall not apply in respect of any loss or damage -

(a) for which neither the driver nor the owner of the motor vehicle in question would have been liable if section 8 had not been enacted; or

(b) suffered as a result of bodily injury to or the death of any person who, at the time of the occurrence which caused that injury or death -

(i) was being conveyed for reward on a motor vehicle which is a motor cycle; or

(ii) is a person referred to in section 7(1)(b) and a member of the household, or responsible in law for the maintenance, of the driver of

the motor vehicle in question, and was being conveyed in or upon the motor vehicle in question; or

(c) if the claim in question has not been instituted and prosecuted by the claimant, or on behalf of the claimant by any person entitled to practise as an attorney in Namibia; or

(d) where the claimant has entered into an agreement with any person other than the one referred to in paragraph (c) in accordance with which the claimant has undertaken to pay such person after settlement of the claim -

(i) a portion of the compensation of the claim; or

(ii) any amount in respect of an investigation or of a service rendered in respect of the handling of the claim otherwise than on instruction from a person mentioned in paragraph (c); or

(e) suffered as a result of bodily injury to any person who -

(i) unreasonably refuses or fails to subject himself or herself, at the request of the appointed agent and at the cost of that agent to any medical examination or examinations by medical practitioners designated by the said agent; or

(ii) refuses or fails to furnish the appointed agent, at the agent's request and cost, with copies of all medical reports in his or her possession that relate to the relevant claim for compensation; or

(iii) refuses or fails to allow the appointed agent, at the agent's request, to inspect all records relating to himself or herself that are in the possession of any hospital or his or her medical practitioner; or

(f) if the claimant concerned refuses or fails -

(i) to submit to the appointed agent together with the prescribed claim form, or within a reasonable period thereafter and if he or she is in a position to do so, an affidavit in which particulars of the accident that gave rise to the claim in question are fully set out; or

(ii) to furnish the appointed agent with copies of all statements and documents relating to the accident that gave rise to the claim in question within a reasonable period after having come into possession thereof.

(3) The provisions of paragraph (a) of subsection (2) shall not be construed so as to exclude the liability of an appointed agent under subsection (1) in a case where the driver or owner of the vehicle is exonerated from liability merely by virtue of the provisions of section 7(a) of the Workmen's Compensation Act, 1941 (Act 30 of 1941).

(4) Where a claim for compensation under subsection (1) -

undertaking

(a) includes a claim for the costs of the future accommodation of any person in a hospital or nursing home or treatment of or rendering of a service or supplying of goods to such person, the Fund or the appointed agent, as the case may be, shall be entitled, after furnishing the third party concerned with an undertaking to that effect or a competent court has directed the Fund or the appointed agent, as the case may be, to furnish such undertaking, to compensate the third party in respect of the said costs after the costs have been incurred and on proof thereof; and

(b) includes a claim for future loss of income or support, the Fund or the appointed agent, as the case may be, shall be entitled, after furnishing the third party concerned with an undertaking to that effect or a competent court has directed the Fund or the appointed agent to furnish such an undertaking, to pay the amount payable in respect of the said loss, by instalments as agreed or ordered by such court.

(5) Where a third party is entitled to compensation in terms of this section and has incurred costs in respect of accommodation of himself or herself or any other person in a hospital or nursing home or the treatment of or any service rendered or goods supplied to himself or herself or any other person, the person who provided the accommodation or treatment or rendered the service or supplied the goods may claim the amount direct from the Fund or the appointed agent, as the case may be, on a prescribed form, and such claim shall be subject, *mutatis mutandis*, to the provisions applicable to the claim of the third party concerned, and may not exceed the amount which the third party could, but for the provisions of this subsection, have recovered.

(6) The Fund or, with the Permanent Secretary's approval, the appointed agent, as the case may be, may make an advance payment to the claimant out of the amount to be awarded in terms of subsection (1) to the claimant in respect of medical costs, loss of income and loss of support.

Limitation of liability.

7. (1) The liability of the Fund or the appointed agent, as the case may be, in connection with any one occurrence to compensate a third party for any loss or damage contemplated in section 6(1) which is the result of any bodily injury to or the death of any person who, at the time of the occurrence which caused that injury or death, was being conveyed in or on the motor vehicle concerned, shall be limited -

(a) to the sum of R25 000 in respect of any bodily injury to or death of any one such person who, at the time of the occurrence which caused that injury or death, was being conveyed in the motor vehicle in question -

(i) for reward; or

(ii) in the course of the business of the owner of that motor vehicle; or

(iii) in the case of an employee of the driver or owner of that motor vehicle, in respect of whom the provisions of subsection (2) do not apply, in the course of his or her employment as such an employee; or

(iv) for the purposes of a lift club where that motor vehicle is a motor car; or

(b) in the case of a person who was being conveyed in the motor vehicle concerned under circumstances other than the circumstances referred to in pragraph (a), to the sum of R25 000 in respect of loss of income or of support and the costs of accommodation in a hospital or nursing home, treatment, the rendering of a service and the supplying of goods resulting from bodily injury to or the death of one such person, excluding the payment of compensation in respect of any other loss or damage,

but exclusive of the cost of recovering the said compensation.

(2) (a) Where the loss or damage contemplated in section 6(1) is suffered as a result of the bodily injury to or the death of an employee of the driver or owner of the motor vehicle in question and the third party is entitled to compensation under the Workmen's Compensation Act, 1941 (Act 30 of 1941), in respect of such bodily injury or death, the liability of the Fund or the appointed agent, as the case may be, in respect of the bodily injury to or the death of any one such employee shall be limited in total to the sum representing the difference between the amount which that third party could, but for the provisions of this paragraph, have claimed from the appointed agent or the amount of R25 000, whichever is the lesser, and any lesser amount to which that third party is entitled by way of compensation in terms of the said Workmen's Compensation Act, 1941.

(b) The provisions of paragraph (a) shall not be so construed -

(i) that the right of a person who is entitled to damages in terms of section 6 to recover any costs awarded to him or her in any judicial proceedings is affected;

(ii) that the Fund or its appointed agent is responsible in terms of the Workmen's Com-

pensation Act, 1941, for the amount of the compensation to which any such person is entitled thereunder.

Claim lies against Fund or appointed agent only.

8. When a third party is entitled under section 6 to claim from the Fund or its appointed agent any compensation in respect of any loss or damage resulting from any bodily injury to or the death of any person caused by or arising out of the driving of a motor vehicle by the owner thereof or by any other person with the consent of the owner, that third party shall not be entitled to claim compensation in respect of that loss or damage from the owner or from the person who so drove the vehicle, or if that person drove the vehicle as a servant in the execution of his or her duty, from his or her employer, unless the Fund or its appointed agent is unable to pay the compensation.

Submission of information regarding motor accidents by owner or driver of motor vehicle.

9. (1) When, as the result of the driving of a motor vehicle, any person other than the driver of that motor vehicle has been killed or injured, the owner and the driver, if he or she is not the owner, of the motor vehicle shall (if reasonably possible, within 14 days after the occurrence) furnish the Director or an appointed agent on the prescribed form with particulars of the occurrence and also the prescribed statements.

(2) Any person who fails to comply with any provision of subsection (1) shall be guilty of an offence and liable on conviction to a fine not exceeding R2 000 or, in default of payment, to imprisonment not exceeding 6 months, unless such person is unable to comply with that provision and his or her inability is not due to his or her own action or default.

(3) The appointed agent shall within 14 days after the third party has complied with the provisions of section 6(2)(f)(i), furnish that person or the representative of that person with a copy of the information and statements which the said owner or driver furnished in terms of subsection (1), as well as all statements which were obtained from witnesses to the occurrence.

Presumptions regarding driving of motor vehicles.

10. (1) For the purposes of this Act -

(a) a motor vehicle which is being propelled by any mechanical, animal or human power or by gravity or momentum shall be deemed to be driven by the person in control of the vehicle;

(b) a person who has placed or left a motor vehicle at any place shall be deemed to be driving that motor vehicle while it moves from that place as a result of gravity, or while it is stationary at that place or at a place to which it moved from the first-mentioned place as a result of gravity;

(2) Whenever any motor vehicle has been placed or left at any place, it shall, for the purposes of this Act, be presumed, until the contrary is proved, that such vehicle was placed or left at such place by the owner of such vehicle.

Prescription of claims.

11. (1) Notwithstanding the provisions of any other law relating to prescription, but subject to the provisions of subsections (2) and (3), the right to claim compensation under section 6 from an appointed agent in respect of claims referred to in section 5(1) shall become prescribed upon the expiration of three years from the date upon which the claim arose.

(2) If a claim has been lodged in terms of section 12 before the expiry of the period referred to in subsection (1), such claim shall not become prescribed before the expiry of a period of five years from the date upon which the claim arose.

(3) Prescription of a claim instituted under sections 5(1) and 6 shall not run against -

(a) a minor;

(b) any person detained as a patient in terms of the provisions of the Mental Health Act, 1973 (Act 18 of 1973);

(c) a person under curatorship.

(4) Notwithstanding the provisions of section 8 of the Workmen's Compensation Act, 1941 (Act 30 of 1941), any right under subsection (1)(b) of that section to recover an amount which under that Act is required to be paid to a third party in circumstances other than those mentioned in section 7(2) of this Act, shall for the purpose of subsections (1) and (2) be deemed to be a right to claim compensation under section 6 arising on the same date as the claim of such third party under the said section 6: Provided that if the recovery of any such amount has been debarred under

this section, any compensation thereafter awarded to the third party under this Act shall be reduced by the amount concerned.

Procedure

12. (1) A claim for compensation and accompanying medical report under section 6 shall -

(a) be set out in the prescribed manner on a prescribed form which shall be completed in all its particulars;

(b) be sent by registered post to or delivered by hand at the registered office or local branch office of the appointed agent who in terms of section 5(2) must handle the claim, and who shall, in the case of delivery by hand, at the time of the delivery acknowledge receipt thereof and the date of such receipt in writing.

(2) (a) The medical report on a prescribed form shall be completed by the medical practitioner who treated the deceased or injured person for the bodily injuries that he or she sustained in the accident from which the claim arises, or by the superintendent (or his or her representative) of the hospital where the deceased or injured person was treated for such bodily injuries: Provided that if the medical practitioner or superintendent (or his or her representative) concerned fails to complete the medical report on request within a reasonable time and it appears that as a result of the passage of time the claim in question may become prescribed, the medical report may be completed by another medical practitioner who has fully satisfied himself or herself regarding the cause of death or the nature and treatment of the bodily injuries in respect of which the claim is made.

(b) Where the claim relates to a person who was killed instantaneously in a motor accident or has died before treatment by a medical practitioner for the bodily injuries that he or she sustained in such an accident, the completion of the said medical report shall not be a requirement, but in such an event the prescribed form in terms of paragraph (a) shall be accompanied by a copy of the inquest record or, in the case of a prosecution of the person who allegedly caused the deceased's

death, a copy of the relevant charge-sheet in which it is clearly indicated that such person's death resulted from the accident to which the claim relates.

(3) A claim by a supplier for the payment of incidental expenses in terms of section 6(5) shall be in the prescribed form, and the provisions of this section shall *mutatis mutandis* apply in connection with the completion of that form.

(4) (a) Subject to the provisions of subsection (5) any form provided for in this section and not completed in all its particulars shall not be acceptable as a claim under this Act.

(b) A clear reply shall be given to each question contained in the prescribed form referred to in subsection (2) and if a question is not applicable the words "not applicable" shall be inserted.

(c) A form on which ticks, dashes, deletions and alterations have been made that are not confirmed by a signature shall not be regarded as properly completed.

(d) Precise details shall be given in respect of each item under the heading "Compensation claimed" and shall, where applicable, be accompanied by supporting vouchers.

(5) Unless the appointed agent with whom a claim has been lodged in accordance with the provisions of subsection (1)(b), by written notice, sent by registered post or delivered by hand to the claimant or the claimant's representative within 60 days from the date upon which the claim was so lodged, objects to the validity of the claim, such claim shall for all purposes be deemed to have been properly lodged in accordance with the provisions of this section.

(6) Upon acceptance of an amount offered as compensation in terms of section 6(1) the third party shall be entitled to the agreed party and party costs or taxed party and party costs in respect of the claim concerned.

Enforcement of claims.

13. (1) No claim shall be enforceable by legal proceedings commenced by a summons served on the appointed agent -

(a) before the expiry of a period of 120 days as from the date on which the claim was sent or delivered by hand, as the case may be, to the appointed agent as provided for in section 12(1)(b); and

(b) before all requirements contemplated in section 6(2)(f) have been complied with:

Provided that if the appointed agent repudiates in writing liability for the claim before the expiry of the said period the claimant may at any time after such repudiation cause summons to be served on the appointed agent.

(2) No interest calculated on the amount of any compensation which a court awards to any third party by virtue of the provisions of section 6(1) shall be payable, unless 14 days have elapsed from the date of the court's relevant order.

(3) In issuing any order as to costs on making such award, the court may take into consideration any written offer in settlement, including a written offer without prejudice in the course of settlement negotiations of the claim concerned, made by the Fund or its appointed agent before the relevant summons was served on the Fund or the appointed agent, as the case may be.

Appointed agent's right of recourse

14. (1) When an appointed agent has paid any compensation under section 6 such agent may without having obtained a formal cession of the right of action, recover from the owner of the motor vehicle concerned or from any person whose negligence or other unlawful act caused the loss or damage concerned, so much of the amount paid by way of compensation as the third party concerned could, but for the provisions of section 8, have recovered from the owner or from the person whose negligence or other unlawful act caused the loss or damage, as the case may be, if the appointed agent had not paid any such compensation.

(2) An appointed agent's right of recourse against the owner of a motor vehicle under subsection (1) shall only be applicable -

(a) in any case where the motor vehicle was being driven at the time of the accident which gave rise to the payment of compensation by a person other than the owner and -

(i) the said person was under the influence of intoxicating liquor or of a drug to such a degree that his or her condition was the sole cause of such accident and the owner allowed him or her to drive the motor vehicle knowing that he or she was under the influence of intoxicating liquor or of a drug; or

(ii) the said person was driving the motor vehicle without holding a licence issued under any law relating to the licensing of drivers of motor vehicles, which he or she was required to hold, or the said person, being the holder of a learner's or other restricted licence issued under such law, failed, while he or she was driving the motor vehicle, to comply with the requirements or conditions of such learner's or restricted licence, and the owner allowed him or her to drive the motor vehicle knowing that he or she did not hold such a licence or that he or she failed to comply with the requirements or conditions of a learner's or restricted licence, as the case may be; or

(b) in any case where, at the time of such accident, the motor vehicle was being driven by the owner and -

(i) he or she was under the influence of intoxicating liquor or of a drug to such a degree that his or her condition was the sole cause of such accident; or

(ii) he or she was driving the motor vehicle without holding a licence issued under any law relating to the licensing of drivers of motor vehicles, which he or she was required to hold, or being the holder of a learner's or other restricted licence issued under such law, failed, while he or she was driving the motor vehicle, to comply with the requirements or conditions of such learner's or restricted licence; or

(iii) in the event of such owner having failed to comply with the requirements of section 9(1), he or she failed, at the request of the

Fund or the appointed agent, as the case may be, to furnish to the Fund or such appointed agent, the particulars referred to in section 9(1) with reference to the said accident within 14 days after such request or knowingly furnished the Fund or the appointed agent with false information relating to such accident and the Fund or the appointed agent was materially prejudiced by such failure or by the furnishing of such false information, as the case may be.

(3) The provisions of subsection (2)(b)(i), (ii) and (iii) shall *mutatis mutandis* apply in respect of any right of recourse by the appointed agent against any person who at the time of the accident which gave rise to the payment of the compensation, was driving the motor vehicle with or without the consent of its owner.

Regulations.

15. (1) The Minister may make regulations in relation to -

(a) matters in respect of which statistics are to be kept by appointed agents, the manner in which such statistics shall be compiled and the furnishing of information in connection therewith;

(b) any matter which in terms of this Act is required or permitted to be prescribed;

(c) in general any matter which the Minister may consider necessary or expedient to prescribe in order to attain or promote the objects of this Act.

(2) A regulation made under subsection (1) may provide for penalties not exceeding a fine of R1 000 or not exceeding imprisonment for a period of three months for any contravention of or failure to comply with its provisions.

State bound.

16. This Act binds the State.

Commencement of period of prescription in respect of certain claims.

17. In the application of the provisions of section 11 in respect of any claim which arose on or after 21 March 1990, but before the date of publication of this Act in the *Gazette* as a law, such claim shall be deemed to have arisen on the said date of publication.

Repeal and amendment of laws, and savings.

18. The provisions of the Motor Vehicle Accidents Act, 1986 (Act 84 of 1986), and the Multilateral Motor Vehicle Accidents Fund Act, 1989 (Act 93 of 1989), are hereby repealed.

Short title and commencement

19. This Act shall be called the Motor Vehicle Accidents Act, 1990 and shall come into operation on a date to be fixed by the President by proclamation in the *Gazette*.

Appendix II: MVA Fund Act of 2007

GOVERNMENT GAZETTE

OF THE

REPUBLIC OF NAMIBIA

N$6.40 WINDHOEK - 28 December 2007 No. 3970

CONTENTS

Government Notice

OFFICE OF THE PRIME MINISTER

No. 235 2007

PROMULGATION OF ACT
OF PARLIAMENT

The following Act which has been passed by the Parliament and signed by the President in terms of the Namibian Constitution is hereby published in terms of Article 56 of that Constitution.

No. 10 of 2007: Motor Vehicle Accident Fund Act, 2007.

Act No. 10, 2007 MOTOR VEHICLE ACCIDENT FUND ACT, 2007

ACT

To provide for the establishment, administration and management of the Motor Vehicle Accident Fund as an administrative body to provide assistance and benefits to persons injured in motor vehicle accidents and to dependents of persons killed in such accidents; and to provide for incidental matters.

(Signed by the President on 21 December 2007)

ARRANGEMENT OF SECTIONS

Section

Act No. 10, 2007 MOTOR VEHICLE ACCIDENT FUND ACT, 2007

BE IT ENACTED by the Parliament of the Republic of Namibia as follows:

Act No. 10, 2007 MOTOR VEHICLE ACCIDENT FUND ACT, 2007

PART I

PRELIMINARY PROVISIONS

Definitions

1. In this Act unless the context otherwise indicates -

"Board" means the Board established by section 10;

"Chief Executive Officer" means the Chief Executive Officer appointed in terms of section 20;

"claimant" means a person who, under sections 24 and 25, is entitled to claim for benefits from the Fund;

"committee" means a committee established under section 17;

"defect", when related to a vehicle, means a fault in a tyre, steering, brakes or a seat belt rendering the use of the vehicle unsafe or in breach of any law regulating road traffic and transportation, and "defective" has that meaning;

"dependent", in relation to a person involved in a motor vehicle accident, means any person being a spouse or a minor child of such person or a disabled or indigent person legally entitled, other than in terms of contract, to monetary maintenance from such person and includes a spouse in a customary law union and child of such union;

"driver" means the person who was driving the motor vehicle;

"financial year" means the financial year referred to in section 5;

"Fund" means the Motor Vehicle Accident Fund established by section 2;

"Immigration Control Act" means the Immigration Control Act, 1993 (Act No. 7 of 1993);

"injury" means injury to a natural person, and includes all forms of physical, emotional, psychological and behavioural abnormality and all forms of impairment caused or induced by a motor vehicle accident;

"injury management", includes any treatment or program, scheme, course, or process intended to restore and relieve physical, mental, emotional, behavioural health and function and redress all forms of impairment;

"life enhancement assistance" means home alteration and the provision of care giving, transport and artificial aids;

"medical treatment", includes any treatment or program, scheme, course, or process intended to restore physical, mental, emotional, behavioural health and function, infirmity of mind and body and redress all forms of impairment and includes hospitalization;

"member" means a member of the Board;

"Minister" means the Minister responsible for transport;

"motor vehicle" means a vehicle which is designed or adapted for propulsion or haulage on a road by means of fuel, gas or electricity and includes a trailer, caravan, an agricultural or other implement designed or adapted to be drawn by that vehicle and any other vehicle that may be prescribed;

"motor vehicle accident" means an event in which injury or death of a person occurs on account of the involvement of a motor vehicle being driven and includes an event where an unoccupied vehicle moves from one place to another, other than falling, on account of gravity;

"Namibia Refugees (Recognition and Control) Act" means the Namibia Refugees (Recognition and Control) Act, 1999 (Act No. 2 of 1999);

"prescribe" means prescribe by regulation made under section 35;

"rehabilitation", includes the restoration of bodily function, any treatment or program, scheme, course, schooling, training, or process intended to improve or restore physical, mental, emotional and behavioural health and function and restore all forms of infirmity of mind and body, and includes hospitalization;

"repealed law" means the Motor Vehicle Accidents Fund Act repealed by section 37;

"State-owned Enterprises Governance Act" means the State-owned Enterprises Governance Act, 2006 (Act No. 2 of 2006); and

"this Act," includes regulations made under section 35.

PART II

MOTOR VEHICLE ACCIDENT FUND

Establishment, purpose and functions of Fund

2. (1) There is established a fund to be known as the Motor Vehicle Accident Fund, and which for all purposes is a juristic person.

(2) The purpose and functions of the Fund are to -

(a) design, develop, promote and implement motor vehicle accident and injury prevention measures;

(b) fairly and reasonably provide assistance and benefits to a person who is injured in a motor vehicle accident;

(c) fairly and reasonably provide assistance and benefits to a person who suffers loss as a dependent of a person killed in a motor vehicle accident;

(d) reasonably indemnify the driver and owner of a vehicle involved in motor vehicle accident from claims for loss or damage arising on account of injury or death caused by the motor vehicle accident; and

(e) attend to any matter that is incidental to any function mentioned in this section.

Powers of Fund

3. In order to fulfil the functions imposed on the Fund by section 2, the Fund, where applicable subject to section 27 of the State-owned Enterprises Governance Act, may -

(a) conduct or invest in research, design, development, promotion and implementation of motor vehicle accident and injury prevention measures;

(b) conduct or invest in research, programs and projects designed to address issues of motor vehicle accident response, medical treatment, management of injury, rehabilitation and life enhancement assistance to persons injured in motor vehicle accidents;

(c) stipulate the terms and conditions on which claims for benefits made under this Act are made;

(d) stipulate the terms and conditions on which assistance and benefits provided under this Act are made and administered;

(e) investigate claims made on the Fund and any matter incidental to the exercise of its functions;

(f) acquire movable or immovable property, shares, debentures, stocks or other securities;

(g) sell, mortgage, lease, exchange, encumber in any way, or develop property of the Fund;

(h) borrow money from any person or institution and provide where required security for repayment of the loan;

(i) invest money of the Fund which is not immediately required for use by the Fund;

(j) do any act which can be done in relation to a negotiable or transferable instrument;

(k) give a study loan or bursary to any person for the purpose of pursuing studies or research in connection with the discharge of its functions, conducting operations or ensuring development;

(l) provide training for the purposes of better discharge of its functions, conducting operations or ensuring its development;

(m) enter into a contract or partnership for the purpose of providing indemnity not provided herein to the drivers and owners of motor vehicles as may be reasonably required;

(n) enter into a contract or partnership for the purposes of the discharge of its functions, conducting operations or ensuring its development;

(o) receive a donation or funding for the fulfilment of any purpose under this Act;

(p) procure reinsurance for any risk or liability undertaken by the Fund; or

(q) do any other act that is necessary in order to achieve the purpose of this Act.

Moneys of Fund

4. The moneys of the Fund consists of -

(a) money derived from the fund established under the Petroleum Products and Energy Act, 1990 (Act No. 13 of 1990) and made available to the Fund under that Act as agreed between the Minister and the Minister of Mines and Energy;

(b) money derived from an investment under section 3(1)(i) and money borrowed under section 3(1)(h);

(c) money derived in terms of any law;

(d) money appropriated by Parliament for the purpose of the Fund; and

(e) any money that accrues to the Fund.

Financial year and evaluation of liability of Fund

5. (1) The financial year of the Fund ends on 31 March of each year.

(2) The Fund's liability is established annually by actuarial evaluation and revenue must be set to match such liability.

Exemption from tax

6. The income or money of the Fund is exempt from any form of taxation or duty under any law governing tax or duty and such exemption extends to all transactions conducted by the Fund.

Accounts and audit

7. (1) The Fund must, in accordance with generally accepted accounting practice and procedure, cause proper books and records of accounts to be kept of all financial transactions, assets and liabilities of the Fund.

(2) As soon as possible after the end of each financial year, the Fund must have financial statements prepared for that year, consisting of a statement of income and expenditure and a balance sheet which must reflect the Fund's financial position as at the end of the financial year.

(3) The Fund must, not later than three months after the end of each financial year, submit records of accounts and financial statements to the Auditor-General for audit.

(4) The Auditor-General must submit the audited accounts, his or her certificate and a report in connection with any investigation, examination and auditing carried out by him or her under this Act and the State Finance Act to the Minister for tabling in accordance with section 8(3) and furnish a copy thereof to the Fund.

Annual report of Fund

8. (1) The Fund must at the end of each financial year compile an annual report that includes -

(a) a response to a report of the Auditor-General issued in terms of section 7(4);

(b) a report on the activities of the Fund and the performance of the Chief Executive Officer during the year to which the audit relates; and

(c) a summary of the actuarial evaluation of liability as required in terms of section 5(2) and whether or not income has been matched to liability.

(2) The Fund must, within six months after the end of each financial year, submit the annual report referred to in subsection (1) to the Minister.

(3) On receipt of the annual report referred to in subsection (2) the Minister must table the report together with the report of the Auditor-General referred to in section 7(4) in the National Assembly within 30 days of receipt, or if the National Assembly is not in session, within 30 days after the commencement of the next session.

PART III

ADMINISTRATION OF FUND

Powers of Minister

9. (1) The powers of the Minister in regard to the administration of the Fund are as set out in this Act.

(2) The Minister may, if he or she considers it necessary, by notice in writing, give direction to the Board on any matter regarding -

(a) substantive and operational policy;

(b) functional and operational objectives; or

(c) reporting on the Fund activities.

Establishment of Board

10. For the purposes of administering the affairs of the Fund there is established a Board of the Fund.

Powers and functions of Board

11. (1) The powers and functions of the Board are -

(a) to exercise and perform the powers and functions of the Fund;

(b) subject to section 9, to formulate the policy of the Fund; and

(c) to manage the financial and administrative affairs of the Fund.

(2) The Board -

(a) having due regard to principles of corporate governance, may in writing delegate any power or assign any functions referred to in subsection (1) to the Chief Executive Officer, its committee or any staff member of the Fund;

(b) is not divested of any power or functions delegated or assigned under paragraph (a), and it may, without prejudice of a right, change or rescind any decision made under a power so delegated;

(c) having due regard to speciality, expertise and skills required, may appoint or engage any person to advise it on any matter that is relevant to the exercise of its powers or performance of its functions under this Act.

Constitution of Board

12. (1) The Board consists of five members, who are persons with appropriate knowledge, skills and personal attributes to properly ensure the functional integrity of the Fund, appointed by the Minister, subject to section 15 of the State-owned Enterprises Governance Act, as follows -

(a) a person from the Ministry administering transport affairs;

(b) a person nominated by the Minister responsible for finance;

(c) a medical practitioner from the medical fraternity who, the Minister appoints after consultation with the association or associations which represents or represent medical practitioners in Namibia;

(d) a legal practitioner who, the Minister appoints after consultation with the association or associations which represent legal practitioners in Namibia; or

(e) a person who, the Minister appoints after consultation with the association or associations which represents or represent persons who are engaged in the business of transportation of persons.

(2) The Minister must appoint two members as chairperson and deputy chairperson of the Board, respectively.

Governance and performance agreements

13. (1) The Minister must, within one month of the Board being constituted, and with due regard to any directives laid down by the Council under section 4 of the State-owned Enterprises Governance Act, enter into a written governance agreement with the Board in compliance with section 17 of that Act.

(2) The Minister, within one month of appointing a person as a member, and with due regard to any directives laid down by the Council under section 4 of the State - owned Enterprises Governance Act, must enter into a performance agreement with such member in compliance with section 18 of that Act.

Term of office of member

14. Subject to section 16, a member holds office for a term of three years, and is eligible for reappointment at the end of that term.

Disqualification for appointment as member

15. (1) A person is not eligible for appointment as member, if such person -

(a) is not a Namibian citizen or lawfully admitted to Namibia for permanent residence and resident in Namibia;

(b) has been at any time convicted of an offence and sentenced to a term of imprisonment without the option of a fine;

(c) is an unrehabilitated insolvent;

(d) has been removed from an office of trust on account of misconduct;

(e) has been disqualified from being a director by an order made under the Companies Act, 1973 (Act No. 61 of 1973); or

(f) is certified as mentally disordered.

Vacation of office and filling of vacancies

16. (1) The office of a member becomes vacant if he or she -

(a) becomes subject to a disqualification mentioned in section 15;

(b) resigns by notice in writing to the Minister;

(c) is absent from two consecutive Board meetings without permission of the Board; or

(d) is removed from office under subsection (2).

(2) The Minister, by notice in writing, may remove a member from office if the Minister, after affording the member an opportunity to be heard, is satisfied that the member -

(a) is incapacitated by physical or mental illness; or

(b) is, for any valid reason, unable or unfit to properly, efficiently and effectively discharge the functions of a member.

(3) Whenever the Minister acts under subsection (2), the Minister may first suspend the member concerned from his or her office pending a final decision on whether or not the member should be removed.

(4) If a member dies or vacates office before the expiration of his or her term of office, the Minister must, as soon as reasonable possibly after receiving notice of the vacancy, appoint a person in accordance with section 12 to fill the vacancy for the remaining portion of that member's term of office.

Committees of Board

17. (1) The Board may establish committees -

(a) to advise the Board on any matter which the Board refers to it; or

(b) to exercise any of the powers or perform any of the functions of the Board which the Board delegates or assigns to it.

(2) A committee established under subsection (1) -

(a) consists of at least one member of the Board and such other members of the Board or other persons as the Board may appoint as members of the committee on such terms and conditions as the Board may determine; and

(b) meets at the time and place and on such terms and conditions as the Board may determine.

(3) The Board must establish a Medical Review Committee in accordance with subsection (1) consisting of three persons with knowledge, skills, understanding and experience in medical treatment, injury management, rehabilitation and long term care of injured persons.

(4) A member of the Board or a committee, a person appointed under section 11(2)(c) or any person who has done anything which, under this Act, is required to be done on behalf of the Fund, is entitled -

(a) to be paid for services rendered to the Fund at a level that is commensurate with the responsibilities involved in the discharge of his or her functions; and

(b) to be refunded for expenses incurred whilst doing work on behalf of the Fund,

unless the person has been or is entitled to be paid for rendering those services or to be refunded for the incurred expenses by any other person or entity.

(5) The money payable under subsection (4) is paid from the Fund.

Disclosure of interests by members

18. (1) A member must at all times act in the interest of the Fund.

(2) If a member or his or her spouse, or any company, close corporation or partnership of which the member or his or her spouse is a director, shareholder, member or partner, is in any way directly or indirectly interested in a matter which is the subject of consideration by the Board or a committee, and which may cause a conflict of interests in the performance of his or her functions as member, the member must -

(a) forthwith fully disclose the nature of such interest at the meeting of the Board or committee at which such matter is the subject of consideration; and

(b) withdraw from the meeting so as to enable the remaining members to discuss the matter and determine whether the member is precluded from participating in such meeting by reason of a conflict of interests.

(3) A disclosure by a member in accordance with subsection (2), and the decision taken by the remaining members in connection with the disclosure, must be recorded in the minutes of the meeting.

(4) A member who refuses or fails to comply with subsection (2) commits an offence and is liable to a fine not exceeding N$8 000 or to imprisonment not exceeding a period of two years, or to both such fine and such imprisonment.

Meetings and decisions of Board

19. (1) The Minister must convene the first meeting of the Board and thereafter, subject to subsection (2), meetings are held at such times and places as the Board determines.

(2) The chairperson may at any time, and must if so requested in writing by the Minister or by at least three members, convene a special meeting of the Board.

(3) The chairperson presides at meetings of the Board, but -

(a) in his or her absence the deputy chairperson presides; or

(b) in the absence of both, the chairperson and deputy chairperson, the members present at a meeting must elect a member from amongst their number to act as chairperson.

(4) The majority of all members forms a quorum at a meeting of the Board.

(5) The Board must hold meetings as often as the business of the Board requires, but it must meet at least four times during each financial year.

(6) A decision of the majority of the members present at a meeting constitutes the decision of the Board and in the event of an equality of votes the member presiding at the meeting has a casting vote in addition to his or her deliberative vote.

(7) A decision of the Board or an act performed on authority of the Board is not invalid -

(a) by reason of a vacancy on the Board;

(b) by reason of the fact that a person who is not entitled to be present as a member was present when the decision was taken or the act was authorized,

if that decision was taken or the act was authorized, by a majority of the members who were present and entitled to vote at the meeting.

(8) The Board must cause proper minutes of proceedings of its meetings to be kept.

(9) The Board may make rules governing the manner in which its meetings are held and the procedures at its meetings.

Chief Executive Officer

20. (1) The Board, with the concurrence of the Minister, must appoint a person who has the knowledge and experience relevant to the functions of the Fund to be the Chief Executive Officer of the Fund.

(2) A person is not eligible for appointment to the post of Chief Executive Officer if he or she -

(a) is a minor;

(b) has been convicted of an offence and sentenced to a term of imprisonment without the option of a fine;

(c) is an unrehabilitated insolvent;

(d) has been removed from an office of trust on account of misconduct;

(e) has been disqualified from being a director by an order made under the Companies Act, 1973 (Act No. 61 of 1973); or

(f) has been certified as mentally disordered.

(3) The Chief Executive Officer ceases to hold office if he or she -

(a) becomes disqualified for appointment in terms of subsection (2); or

(b) resigns from office; or

(c) is removed from office on account of misconduct.

(4) Subject to subsection (3), the Chief Executive Officer -

(a) is appointed for a term of five years;

(b) is eligible for reappointment at the end of his or her term, but this may not be construed to mean that -

(i) his or her term is automatically extended after the expiry thereof; or

(ii) his or her reappointment is guaranteed.

(5) The Chief Executive Officer, by virtue of his or her office, may attend meetings of the Board and participate in deliberations of the Board, but has no right to vote.

(6) Subject to the directions and control of the Board, the Chief Executive Officer -

(a) is responsible for conducting the day to day business and administrative affairs of the Fund, including the exercise or performance of any power or function the Board delegates or assigns to him or her;

(b) may appoint such employees as are necessary to enable the Fund to properly carry out its functions.

(7) Whenever the office of the Chief Executive Officer is vacant, or the Chief Executive Officer is for any reason unable to perform the functions of the office, the Board, may appoint -

(a) a staff member of the Fund; or

(b) any other eligible person,

to act as Chief Executive Officer during the vacancy or during the period that the Chief Executive Officer is unable to perform those functions.

Performance agreements of management staff of Fund

21. (1) The Board must require the Chief Executive Officer, and such other senior management staff of the Fund as the Board may determine, to enter into a performance agreement with the Board, with due regard to any directive laid down by the Council under section 4 of the State-owned Enterprises Governance Act, setting out, among others -

(a) the terms and conditions of appointment;

(b) objectives to be achieved and the time frame for achievement thereof; and

(c) measures necessary to evidence such achievement.

(2) Failure on the part of the Chief Executive Officer or other senior management staff member to comply with any provision of a performance agreement which he or she entered into with the Board, constitutes a ground for his or her dismissal from the service of the Fund, subject to the rules of natural justice.

Remuneration of management and other staff of Fund

22. Subject to section 22(3) of the State-owned Enterprises Governance Act, the Board -

(a) with the concurrence of the Minister, determines the conditions of service, remuneration and other benefits of the Chief Executive Officer and other management staff of the Fund; and

(b) determines the conditions of service, remuneration and other benefits of other staff members of the Fund below management level.

PART IV

ACCIDENT RESPONSE

Accident response

23. (1) Even though the Fund has not received a claim in respect of injury or death suffered in a motor vehicle accident, the Fund may take reasonable steps to ensure that -

(a) a motor vehicle accident is attended without avoidable delay; and

(b) an injured person requiring medical treatment is conveyed to a hospital and, if a hospital is not accessible, to such other medical treatment facility as is accessible;

(c) an injured person's condition is stabilized before it makes a determination of liability in terms of sections 24 and 25; or

(d) the body of a person killed is conveyed to a mortuary.

(2) In discharging its responsibilities in terms of this section the Fund is entitled to incur fair and reasonable costs and to contract with relevant service providers accordingly.

PART V

LIABILITY AND LIMITATIONS

Liability and limitations of liability of Fund

24. (1) A person who has suffered loss or damage as a result of injury to himself or herself, or as a result of the death or injury of any person, in either case caused by or arising out of the driving of a motor vehicle by any person, including the person himself or herself, in Namibia, is, subject to the conditions, limitations and exclusions imposed by this Act, entitled to the benefits prescribed by this Act.

(2) Subject to this Act, the Fund, in the case of a claim for benefits under this section, must award the benefits prescribed in section 25 to a person who has suffered loss or damage -

(a) as a result of injury to himself or herself; or

(b) as a result of the death or injury of any person,

caused by or arising out of the driving of a motor vehicle by any person, including the person himself or herself, in Namibia.

(3) A person or entity providing services and goods to a person who is entitled to benefits in terms of subsection (1) read with section 25 may claim payment directly from the Fund for such services and goods and in such event the provision of such services and goods, and their value, is included as being part of an award made to such person in terms of section 25.

(4) The liability of the Fund may not exceed -

(a) a value of N$1 500 000 as regards medical treatment, injury management, rehabilitation and life enhancement as specified in section 25(1)(d), (e), (f) (g) and (i) in respect of any one injured person regardless of whether or not such person receives one or a combination of the benefits;

(b) a value of N$100 000 regarding the cash grant as compensation for injury as specified in section 25 (1)(c) in respect of any one injured person;

(c) a value of N$100 000 per annum -

(i) in the case of loss of income as specified in section 25 (1)(a) in respect of any one injured person where there is proof that the person paid tax on income for the tax year preceding the injury or for most of a five year period immediately preceding the injury; and

(ii) in all other cases the value is the amount per annum specified in laws relating to income tax as the maximum amount at which income is non taxable;

(d) where the benefit is for loss of support in terms of section 25 (1)(b) such amount as a dependent is otherwise entitled to in law is limited -

(i) in the case where there is proof that the deceased paid tax on income for the tax year preceding the injury or for most of a five year period immediately preceding death, to a share calculated on income assumed to be no more than N$100 000 per annum; and

(ii) in all other cases, to a share calculated on income assumed to be no more than the amount per annum specified in laws relating to income tax as the maximum amount at which income is non taxable;

(e) a value of N$7 000 as regards the funeral benefit as specified in section 25(1)(h) in respect of any one person killed in a motor vehicle accident;

(f) such value as is prescribed regarding any other benefits contemplated in section 25(1)(j).

(5) For the purposes of applying the limitations set out in subsection (4) -

(a) the value of the award is calculated at the date of determination thereof;

(b) interest accrues to any unpaid or unexpended portion thereof at the rate applying to unpaid judgement debts of the High Court of Namibia;

(c) the limitation applies only to the capital sum as at date of determination and does not apply to an aggregate of such sum and any interest accruing thereafter.

(6) An award in terms of section 25 -

(a) to any person who is in Namibia in accordance with -

(i) a visitors permit under the Immigration Control Act;

(ii) section 14 of the Namibia Refugees (Recognition and Control) Act,

is limited to providing medical treatment and injury management for the period such person is in Namibia; or

(b) in respect of a person killed in a motor vehicle accident and who -

(i) is not granted right of residence in Namibia;

(ii) has the right to remain in Namibia in accordance with section 14 of the Namibia Refugees (Recognition and Control) Act,

is limited to providing the funeral benefit as specified in section 25(1)(h).

(7) The liability of the Fund where an accident involves a motor vehicle and an aircraft, locomotive or carriages being drawn by such locomotive is limited to awarding benefits to occupants of the motor vehicle involved.

(8) The Minister, by regulation, may amend any of the limitations of liability of the Fund prescribed by this section.

PART VI

BENEFITS

Benefits

25. (1) The benefits to be provided by the Fund are confined to the following categories -

(a) reimbursement of income lost as a result of being unable to secure employment or generate income on account of injuries sustained in a motor vehicle accident which benefit is the aggregate of a capital sum, together with interest accruing on any unpaid portion and where the benefit is to reimburse future income loss it is payable by instalments -

(i) subject to periodic assessment in terms of subsection (6), until the injured person attains the age of 60 years or dies, whichever occurs first;

(ii) which is calculated and paid as such portion of the benefit as can be paid over the period over which the injured party attains the age of 60 years and escalated annually by the rate of inflation as set by the Consumer Price Index at the time of the accident;

(iii) in the event of the injured person dying before attaining the age of 60 years payment by instalment ceases and the Fund is not liable to make any further payments in respect of the benefit;

(b) reimbursement of financial support lost by a dependent as a result of the death of a person caused by a motor vehicle accident which benefit is an aggregate of a capital sum, together with interest accruing on any unpaid portion, and if -

(i) the dependent is a spouse and the benefit is to reimburse future support lost, it is payable by instalments until the dependent attains the age of 60 years or dies, whichever occurs first, which instalments are -

(aa) calculated and paid as such portion of the benefit as can be paid over the period over which the dependent attains the age of 60 years; and

(bb) escalated annually by the rate of inflation as set by the Consumer Price Index at the time of the accident;

(ii) the dependent is a minor and the benefit is to reimburse future support lost, it is payable by instalments until the dependent attains the age of majority or completes his or her course of education after attainment of the age of majority, becomes financially self sufficient or dies, whichever occurs first, which instalments are -

(aa) calculated and paid as such portion of the benefit as can be paid over the period over which the dependent attains the age of majority; and

(bb) escalated annually by the rate of inflation as set by the Consumer Price Index at the time of the accident;

(iii) the dependent dies before attaining the stipulated age of majority, payment by instalment ceases and the Fund is not liable to make any further payments in respect of the benefit;

(c) a cash grant as compensation for injury, including loss of earning capacity, as a result of physical injury suffered in a motor vehicle accident, which is determined in accordance with the prescribed procedure;

(d) reimbursement of the costs of medical treatment for physical injury suffered in a motor vehicle accident, calculated in accordance with the prescribed tariff;

(e) an undertaking to pay for medical treatment or injury management in accordance with a treatment plan as prescribed subject to periodic assessment in terms of subsection (6);

(f) an undertaking to pay for rehabilitation of a person injured in a motor vehicle accident in accordance with a rehabilitation plan as prescribed subject to periodic assessment in terms of subsection (6);

(g) an undertaking to pay for life enhancement assistance in accordance with a life enhancement plan as prescribed where the injured person has suffered permanent physical or mental incapacity subject to periodic assessment in terms of subsection (6);

(h) a cash grant for funeral benefit in respect of the burial of a person killed in a motor vehicle accident as specified by section 24(4)(e);

(i) reimbursement of any costs reasonably incurred in the provision of a service to a person entitled to an award of a benefit other than costs that may be reimbursed in terms of the other subsections hereof; and

(j) such other benefits as the Minister, on the recommendation of the Board, may prescribe.

(2) Subject to the limits prescribed by this Act, monetary awards in terms of subsection (1) (a) and (b) must reasonably equate to the loss suffered or to be sufferred taking into account the employment history and situation of the injured party or deceased as the case may be;

(3) For the purposes of determining loss under subsection (1)(a) or (b) the income of the person or the deceased, as the case may be, is considered exclusive of tax payable on such income.

(4) The negligence of the driver or owner is not considered for the purposes of determining an award under subsection (1) (b).

(5) If an award of a benefit is made, any costs incurred in respect of the claimant under section 24 are deducted.

(6) If any undertaking has been awarded as a benefit in terms of either or all of subsection (1)(a), (e), (f), (g) or (i) -

(a) the condition of the person is thereafter assessed at least once annually by a medical practitioner or practitioners appointed by the Fund having relevant expertise regarding the person's condition; and

(b) after having received written reports from such medical practitioners under paragraph (a), the Fund must review the appropriateness of continuing the benefit, and must determine whether to -

(i) continue provide the benefit with or without changes; or

(ii) discontinue providing the benefit,

and inform the person of such determination in terms of a notice as prescribed.

(7) When an undertaking to pay for a benefit in terms of a plan is provided as an award and where a claimant accepts such medical treatment, injury management or rehabilitation that requires changes thereto, which changes may not be unreasonably refused, further expenses not included in the award must be paid by the claimant.

(8) If a person is dissatisfied with a plan offered as an award in terms of subsection (1)(e), (f) or (g), or with a determination to change or discontinue a benefit made in terms of subsection (6), the person may, within 30 days of receiving the offer or notice of the determination, deliver a written notice to the Fund setting out reasons for such dissatisfaction, and -

(a) the Fund, within 21 days of receiving the notice, may -

(i) deliver an amended offer of an award or determination to the person; or

(ii) refer the matter to the Medical Review Committee for its consideration and, in writing, inform the person of the date, time and venue set for the matter to be considered by the Committee,

but the Fund may, at its own cost, require the person to undergo further examination by a medical practitioner before making such decision.

(b) the Medical Review Committee, after having afforded the person and the Fund opportunity to make representations, if any, must consider the matter, and may -

(i) uphold the award or determination and give reasons in summary;

(ii) remit the matter to the Fund with a directive for action to be taken; or

(iii) amend the award or determination and give reasons in summary,

and, within 21 days, inform the person of its decision by notice as prescribed.

(9) A decision by the Medical Review Committee -

(a) is subject to the exclusions and limitations provided in this Act; and

(b) is binding on the Fund and section 32(4), (5) and (6) apply thereto with the necessary changes.

PART VII

EXCLUSIONS AND LIMITATIONS

Exclusions

26. The Fund may not award benefits to a person injured in a motor vehicle accident or claiming under section 25 -

(a) if the person unreasonably refuses or fails -

(i) to submit a duly completed claim to the Fund in the prescribed form;

(ii) on request by the Fund, to give particulars of the occurrence that are required in order for the Fund to make a determination in terms of section 24(1) or (2);

(iii) on request by the Fund, to furnish a document or information relevant to the claim;

(b) if the person who was injured unreasonably refuses or fails -

(i) to furnish the Fund with any medical report in his or her possession that is relevant to the claim;

(ii) permit the Fund, or a person authorised in writing by the Fund, to inspect medical records relating to the person; or

(iii) at the cost of the Fund, to undergo medical examination or assessment by a medical practitioner or expert appointed by the Fund regarding the injury and condition of the person;

(c) if the person is guilty of driving the motor vehicle involved in the accident in contravention of section 82(1) of the Road Traffic and Transport Act, 1999 (Act No. 22 of 1999);

(d) if the person did not hold a license issued under the law governing the licensing of drivers of motor vehicles or he or she being the holder of a learner's license or other restricted license issued under that law, failed to comply with conditions or requirements of that learner's licence or restricted licence;

(e) if the person is the owner of a motor vehicle involved in an accident being driven by a person who is not the holder of a licence issued under any law governing the licensing of drivers of motor vehicles or not in compliance with the terms and conditions of such licence;

(f) if the person has wilfully driven the motor vehicle involved in the motor vehicle accident knowing that it has been stolen;

(g) if the person has driven the motor vehicle or is being conveyed in the motor vehicle during the course of the commission of, or in furtherance of, a serious criminal offence referred to in Schedule 1 of the Criminal Procedure Act, 2004 (Act No. 25 of 2004), unless such person -

(i) has driven the vehicle or is being conveyed in the vehicle against his or her will; and

(ii) did not take part in the commission of such offence, or did take part in the commission of such offence by coercion;

(h) if the person is in Namibia in contravention of the Immigration Control Act, unless the person -

(i) wishes to remain in Namibia as a refugee in compliance with section 13 of the Namibia Refugees (Recognition and Control) Act, 1999 (Act No. 2 of 1999); or

(ii) is the person contemplated in section 14 of the Namibia Refugees (Recognition and Control) Act, 1999 (Act No. 2 of 1999);

(i) in respect of a claim for shock, nervous, emotional, psychological, neurological or other form or condition induced by that person witnessing, hearing or becoming aware of a motor vehicle accident;

(j) if the claim in question has not been instituted or prosecuted -

(i) by the claimant;

(ii) on behalf of the claimant, by a person who is entitled to practise as legal practitioner in Namibia; or

(iii) on behalf of the claimant, by the claimant's legal representative if the claimant is under a legal disability,

before the claim becomes prescribed in terms of section 34;

(k) if the claimant in making the claim provides false information, or withholds information, calculated to mislead the Fund in making a determination on the claim;

(l) if the claimant and another person who is not a legal practitioner referred to in paragraph (j) have entered into an agreement wherein that other person -

(i) receives payment for providing advice or assistance in making a claim; or

(ii) receives any money in respect of investigation of the claim or any expenses incurred in the handling of the claim.

Limitation of awards

27. (1) If a person claiming benefits under section 25 -

(a) is wholly responsible for the accident giving rise to the claim, the benefits awarded are limited to reimbursement, medical treatment, rehabilitation, life enhancement or injury management in terms of section 25(1)(d), (e), (f), (g) and (i) as may be required;

(b) has contributed to the accident, injury or death giving rise to the claim, any monetary award in terms of section 25(1)(a) and (c) otherwise payable is reduced in proportion to such contribution;

(c) was a driver of a motor vehicle involved in the accident in contravention of section 82(2) of the Road Traffic and Transport Act, 1999 (Act No. 22 of 1999), the benefits awarded are limited to reimbursement, medical treatment, rehabilitation, life enhancement or injury management in terms of section 25(1)(d), (e), (f), (g) and (i) as may be required;

(d) was injured when he or she was not, at the time of the accident, utilising a seat belt fitted to the motor vehicle for use by a person in the position of the claimant, the monetary benefits in terms of section 25(1)(a) and (c) otherwise payable is reduced by 25%;

(e) was injured when he or she was being conveyed otherwise than in or on a seat properly constructed and affixed to the motor vehicle for the purpose of the conveyance of persons, the monetary benefits in terms of section 25(1)(a) and (c) otherwise payable is reduced by up to 50%;

(f) not being a minor was injured when he or she was being conveyed in a motor vehicle which was, to the knowledge of such person, unlawfully conveying passengers or goods, and such person had a reasonable option to disembark from the vehicle, the monetary benefits in terms of section 25(1)(a) and (c) otherwise payable is reduced by up to 50%;

(g) is entitled to an award in terms of section 25(1)(a) or (c) monetary benefits or payment, other than as a funeral benefit, under a public social security scheme, pension fund, workmans compensation or benefits, the award is limited to such sum as represents the difference as a loss between the amount payable in terms of such entitlement and the amount otherwise payable in terms of this Act;

(h) has suffered an injury to the neck and there is no evidence of a fracture to, or displacement of the vertebrae of the spinal column, the benefits awarded

are limited to reimbursement and medical treatment or injury management in terms of section 25(1)(d), (e) and (i) as may be required;

(i) suffers post traumatic stress disorder or other problem or disorder primarily evidenced by statements by the person without proof of physical injury, the benefits awarded are limited to reimbursement and medical treatment or injury management in terms of section 25(1)(d), (e) and (i) as may be required;

(j) claims in terms of section 25(1) the award does not reimburse any loss comprising or involving loss of profits, outlay, investment or expense, including expense involving the recruitment, hiring or replacement of any member of staff; or

(k) was the owner or driver of the motor vehicle involved in the accident giving rise to the claim and at the time of driving, the vehicle was defective, and such defect -

(i) contributed to the cause of the accident; or

(ii) contributed to the death or injury of any person,

unless such person is able to show that the defect became manifest without knowledge of such person during the course of travel in which the accident giving rise to the claim occurred, the benefits awarded are limited to reimbursement, medical treatment, rehabilitation, life enhancement or injury management in terms of section 25(1)(d), (e), (f), (g) or (i) as may be required.

(2) The liability of the Fund to the driver of a motor vehicle in terms of this Act must, in respect of claims arising out of a motor vehicle accident in which cause is ascribed to the negligence of the driver of an unidentified motor vehicle, exclude the award of benefits in terms of section 25(1)(a), (c) or (i), unless there is -

(a) proof, involving physical evidence, of a collision between the unidentified motor vehicle and the injured party or the deceased, or the vehicle in which either was travelling or being conveyed at the time of the accident;

(b) proof of reasonable steps taken to identify the motor vehicle in question; or

(c) proof that the motor vehicle accident in question was reported to the police as soon as was reasonably possible.

PART VIII

CLAIM PROCEDURE

Procedure for making claims

28. (1) A claimant for benefits and a person or entity claiming in terms of section 24(3) must do so in the manner and on the form, as prescribed.

(2) If the Fund, within 60 days of receipt of a claim which was sent or delivered to it as prescribed, does not object to the validity of the claim, the claim is, for all purposes, deemed to be valid in law.

(3) If the Fund becomes aware that a person is injured as a result of a motor vehicle accident, it is entitled to serve on such person a notice to submit a claim within 30 days of receipt of the notice, whereupon section 34(4) applies, but the notice -

(a) is served on the injured person personally by the Fund investigator, subject to paragraph (b); and

(b) may not be served on an injured person who, on account of injury or mental incapacity, is unable to understand the contents thereof.

(4) Despite any provision of any other law to the contrary, the Fund is entitled -

(a) to request that the claimant give further particulars of the occurrence in order to make a determination in terms of this Act;

(b) to request that the claimant furnish a document in his or her possession or further information known by the claimant and relevant to the claim; or

(c) where the claim is to compensate for lost income, to have access to, and copies of, all records relating to the claimant or deceased as maintained under the Income Tax Act.

(5) If a claim relates to injury, the Fund may require the claimant to -

(a) furnish the Fund with any medical report in his or her possession that is relevant to the claim;

(b) permit the Fund, or a person authorised in writing by the Fund, to inspect medical and medical aid or insurance records relating to the claimant; or

(c) undergo medical examination or assessment by a medical practitioner or expert appointed by the Fund regarding the injury and condition of the claimant, at the cost of the Fund.

(6) When making a claim, a person who provides information knowing it to be false or withholds information required in terms of this Act commits an offence and is liable to a fine not exceeding N$5 000 or to imprisonment for a period not exceeding six months, or to both such fine and such imprisonment.

PART IX

INVESTIGATIONS AND FURNISHING OF INFORMATION

Investigations

29. (1) The Fund may appoint investigators to investigate -

(a) the causes of accidents giving rise to claims made on the Fund;

(b) the causes of motor vehicle accidents generally;

(c) matters of fact arising in claims made on the Fund;

(d) matters relevant to the detection of and prevention of fraud perpetrated in claims on the Fund;

(e) matters relevant to the prevention of motor vehicle accidents; or

(f) matters relevant to the promotion of motor vehicle accident and injury prevention.

(2) The Fund must issue each appointed investigator with a certificate confirming the appointment and a card identifying such person as a Fund investigator.

(3) The Fund may suspend or withdraw an appointment made in terms of subsection (1).

(4) When conducting investigations an investigator must carry the card identifying him or her as a Fund investigator, and on production thereof must -

(a) be accorded full access to any motor vehicle accident scene;

(b) be granted access to any person injured in a motor vehicle accident;

(c) be granted access to any person who witnessed a motor vehicle accident; and

(d) on request, be provided with a written statement and other relevant information and documentation by any person who has made a claim on the Fund.

(5) If asked by any person reasonably requiring such information, a Fund investigator must produce to such person the identity card contemplated in subsection (2).

(6) A person commits an offence, if such person -

(a) hinders, obstructs, handicaps or disturbs an investigator in the conduct of investigation under this section;

(b) refuses or fails without just excuse to answer to the best of his or her ability any question put to him or her by an investigator in terms of this section;

(c) refuses or fails to provide any book, document, data or object requested in terms of this section;

(d) refuses to give information or intentionally gives false and misleading information to an investigator;

(e) refuses or fails to allow an investigator to enter any premises for investigation in terms of this section; or

(f) falsely claims or pretends to be an investigator appointed under this section.

(7) A person convicted of an offence referred to in subsection (6) is liable to a fine not exceeding N$10 000 or to imprisonment for a period not exceeding 12 months, or to both such fine and such imprisonment.

Furnishing of information by owner and driver of motor vehicle

30. (1) If a person, other than the driver, has been injured or has died as a result of the driving of a motor vehicle, the driver and the owner of the motor vehicle, if the driver is not the owner, must, on the prescribed form and within 14 days after the occurrence, furnish the Fund with particulars of the occurrence and any prescribed information.

(2) A person who refuses or fails to comply with subsection (1) commits an offence and is liable to a fine not exceeding N$5 000 or to imprisonment for a period not exceeding six months, or to both such fine and such imprisonment.

(3) The Fund, within 21 days after a claimant has complied with section 28(1), must furnish the claimant or his or her representative with a copy of the particulars and information supplied by the owner or driver under subsection (1) and statements taken from witnesses to the occurrence that it may have in its possession.

PART X

RIGHTS, LEGAL REMEDIES AND PRESCRIPTION

Claimant's other rights preserved

31. (1) An award of a benefit in terms of this Act is without prejudice to a claim that may lie against any other party, provided that a claim must first be made against the Fund and a court adjudicating a claim against another party in a cause of action arising out of the same facts must take into account the award or offer made by the Fund in terms hereof.

(2) If because of any limitation imposed under this Act on the liability of the Fund, the value of benefits awarded under this Act for the damage or loss sustained is less than the actual amount due for the loss or damage sustained, the claimant may claim for the difference from the owner of the motor vehicle or from the person whose negligence or other unlawful act caused the loss or damage.

(3) The value of an injury grant awarded under this Act is deducted from an award of general damages in any action arising out of the same accident as that giving rise to the grant and brought by the person to whom such injury grant was made.

(4) If a person claims against another person in terms hereof, the Fund must assist the claimant by providing copies, on payment of costs of reproduction, of all documentation it has in its possession that relate to the matter.

Legal Proceedings

32. (1) A person may not commence legal proceedings against the Fund for the purposes of obtaining benefits under this Act, unless he or she has fully complied with section 28 and a period of 90 days has expired from the date of such compliance.

(2) Despite subsection (1), if the Fund, in writing, repudiates liability for the claim before the 90 days' period referred to in that subsection expired, the claimant may at any time after the repudiation, commence legal proceedings against the Fund.

(3) Despite any law to the contrary, where the cause of action is founded on a repudiation of liability or a dispute regarding the claimant's contribution to the accident, injury or death giving rise to the claim, proceedings may be instituted in a court of competent jurisdiction.

(4) In any action brought against the Fund, the court may -

(a) order absolution from the instance;

(b) dismiss the action;

(c) grant an order that the Fund is liable and that the Fund must proceed to make a determination to award benefits in accordance with section 25; or

(d) grant an order that the Fund is liable and that the Fund must proceed to make a determination to award benefits in accordance with section 25 at such reduced level as accords with the court's determination of the claimant's contribution to the accident, injury or death,

and make such award as regards costs as it thinks appropriate.

(5) Despite any provision to the contrary in any law, if the Fund has not repudiated the claim, or if there is no dispute about the claimant's contribution to the accident, injury or death, but the claimant -

(a) disputes the award of benefits made by the Fund; or

(b) is concerned with locus standi, procedure, treatment or any aspect as regards administering the provisions of this Act,

the proceedings are by way of review to the High Court which must make such order under administrative law as it thinks appropriate.

(6) Review proceedings may not be commenced, unless the claimant has first served a notice as prescribed on the Fund setting out the grounds on which he or she is dissatisfied to which notice the Fund must respond in writing within 21 days of receipt thereof setting out the reasons for the award, its decision or action complained of and attach any reports on which reliance was placed.

(7) The Minister, on recommendation of the Board, may prescribe -

(a) that all legal proceedings in terms of subsection (3) are to be referred to and determined by way of arbitration; or

(b) the rules of procedure to be followed in such arbitration proceedings referred to in paragraph (a), and such rules may be amended from time to time.

(8) Except where the Fund requests that an agreement or undertaking be made

an order of court, no agreement or undertaking by the Fund to award benefits in respect of any claim is enforceable in any court, unless in addition thereto liability has actually accrued to the Fund in terms of this Act.

(9) If legal proceedings brought under this Act are settled before a court determines the matter, the claimant or the Fund is entitled to party and party costs in respect of that claim and, failing agreement, is entitled to have a bill of costs taxed.

(10) In any legal proceedings the Fund, as represented by its duly authorized employees who have right of appearance in the courts of law, may -

(a) act on its own behalf;

(b) appear in any court; or

(c) sue out, serve and receive service of process.

(11) Whilst performing any function or exercising a power under this Act -

(a) a member;

(b) a member of a committee established under section 17;

(c) a person appointed under section 11(2)(c);

(d) a staff member of the Fund; or

(e) any person who has performed a duty or exercised a power on behalf of the Fund,

is not personally liable for anything done or omitted in good faith, unless the commission or omission constitutes gross negligence.

(12) This section applies with the necessary changes to a claim for compensation made on the Fund in respect of loss or damage suffered as a result of a motor vehicle accident that occurred prior to commencement of this Act.

Fund's right of recourse

33. (1) If under section 25 benefits have been awarded by the Fund to any person, the Fund, subject to subsections (2) and (3), and without having obtained cession of the right of action from the claimant, may recover -

(a) from the owner of the motor vehicle; or

(b) the person whose negligence or other unlawful act caused the loss or damage,

an amount equating to the value of benefits awarded as equates in monetary value to the amount as the claimant could, but for sections 24 and 25, have recovered from the owner or the person whose negligence or other unlawful act caused the loss or damage, if the Fund had not paid the benefits.

(2) The Fund's right of recourse against the owner of a motor vehicle under subsection (1) may arise only if the motor vehicle at the time of the incident which gave

rise to the award of benefits, was being driven -

(a) by a person other than the owner of the vehicle and -

(i) the person was under the influence of intoxicating liquor or of a drug to such an extent as to be incapable of proper control of the vehicle; and

(ii) the owner of the vehicle allowed the person to drive the vehicle knowing that the driver was under the influence of intoxicating liquor or of a drug;

(b) by a person other than the owner of the vehicle and -

(i) the person did not hold a license issued under the law governing the licensing of drivers of motor vehicles; or

(ii) the person being the holder of a learner's license or other restricted license issued under the law governing the licensing of drivers of motor vehicle failed to comply with conditions or requirements of the learner's licence or restricted licence,

and the owner of the motor vehicle allowed the driver to drive the motor vehicle knowing that the driver did not hold a licence or that the driver was not complying with the conditions or requirements of a learner's or restricted licence;

(c) by the owner of the motor vehicle and he or she was under the influence of intoxicating liquor or of a drug to such an extent as to be incapable of proper control of the vehicle;

(d) by the owner of the motor vehicle and -

(i) he or she did not hold a license issued under the law governing the licensing of drivers of motor vehicles; or

(ii) he or she, being, the holder of a learner's license or other restricted license issued under the law governing the licensing of drivers of motor vehicles, failed to comply with the conditions or requirements of the learner's or restricted license;

(e) by the owner of the motor vehicle and -

(i) he or she failed to comply with section 30; or

(ii) he or she knowingly furnished the Fund with false information about the accident,

and the Fund is financially or materially prejudiced by the failure to comply with section 30 or the furnishing of false information;

(f) by the owner of the motor vehicle at a time when such vehicle was defective and such defect caused or contributed to the cause of the accident in which case the Fund is entitled to recover as provided for in subsection (1) other than the value of any benefit accruing in terms of section 27(1)(k).

(3) The Fund's right of recourse under subsection (1) against any person who with or without the owners consent was driving the motor vehicle at the time of the occurrence that gave rise to a claim may only arise if -

(a) the person drove the vehicle whilst he or she was under the influence of intoxicating liquor or of a drug to such an extent as to be incapable of proper control of the vehicle;

(b) the person drove the vehicle when -

(i) he or she did not hold a license issued under the law governing the licensing of drivers of motor vehicles; or

(ii) he or she being the holder of a learner's license or other restricted license issued under the law governing the licensing of drivers of motor vehicles failed to comply with the conditions or requirements of that learner's or restricted license; or

(c) the person failed to comply with section 30 or knowingly furnished the Fund with false information about the incident and the Fund is financially or materially prejudiced by the failure to comply with section 32 or the furnishing of false information.

(d) the person was driving a motor vehicle at a time when such vehicle was defective and such defect caused or contributed to the cause of the accident in which case the Fund is entitled to recover as provided for in subsection (1) other than the value of any benefit accruing in terms of section 27(1)(k).

Prescription of claims

34. (1) Despite any provision to the contrary in any law relating to prescription, and subject to subsections (2) and (3), the right to claim benefits under sections 24 and 25 becomes prescribed at the expiry of a period of one year from the date the claim arose.

(2) If within the period referred to in subsection (1), a person who is entitled to claim for benefits under this Act lodges a claim that complies with section 28(1), the claim becomes prescribed at the expiry of a period of two years from the date the claim arose.

(3) Prescription of a claim referred to in this section does not run against -

(a) a minor;

(b) any person detained as a patient in terms of any mental health legislation; or

(c) a person under curatorship.

(4) Despite subsections (1) and (2), a person who is entitled to claim for benefits under this Act and unreasonably fails to do so within 90 days of receiving a notice from the Fund in terms of section 28(3) to submit a claim as prescribed forfeits the right to claim.

PART XI

GENERAL PROVISIONS

Regulations

35. (1) The Minister, on the recommendation of the Board, may make regulations relating to -

(a) the procedure to be followed when making a claim under this Act;

(b) the conditions to be fulfilled before a claim is made in respect of injury or death caused by a motor vehicle whose driver or owner at the time of the incident cannot be identified;

(c) the administration of benefits that may be awarded under this Act;

(d) any matter which he or she is required or permitted to prescribe under this Act; or

(e) generally any matter which is necessary or expedient in order to achieve the objectives of this Act.

(2) A regulation made under subsection (1) may prescribe penalties for any contravention or failure to comply with it, not exceeding a fine of N$5 000 or imprisonment not exceeding a period of three months, or both such fine and such imprisonment.

Savings and transitional provisions

36. (1) This Act applies to cases where the occurrence which gave rise to the claim or obligation took place after the commencement of this Act, but -

(a) any claim or obligation that arose before the commencement of this Act is dealt with in accordance with the repealed law, subject to the procedural requirements of section 32; and

(b) any payment due to the claimant under the repealed law is paid out of the Fund.

(2) At the commencement of this Act -

(a) except as is otherwise provided herein, the assets, liabilities, rights and obligations existing in or accruing to the previous Fund established by the repealed law are transferred to the Fund; or

(b) except where the context indicates otherwise, a reference in any law to the previous Fund or an agreement with the previous Fund is construed as a reference to or an agreement with the Fund.

(3) To the extent that a provision of the Assessment of Damages Act, 1969 (Act No. 9 of 1969) or the Apportionment of Damages Act, 1956 (Act No. 34 of 1956) is in conflict with a provision of this Act, this Act prevails.

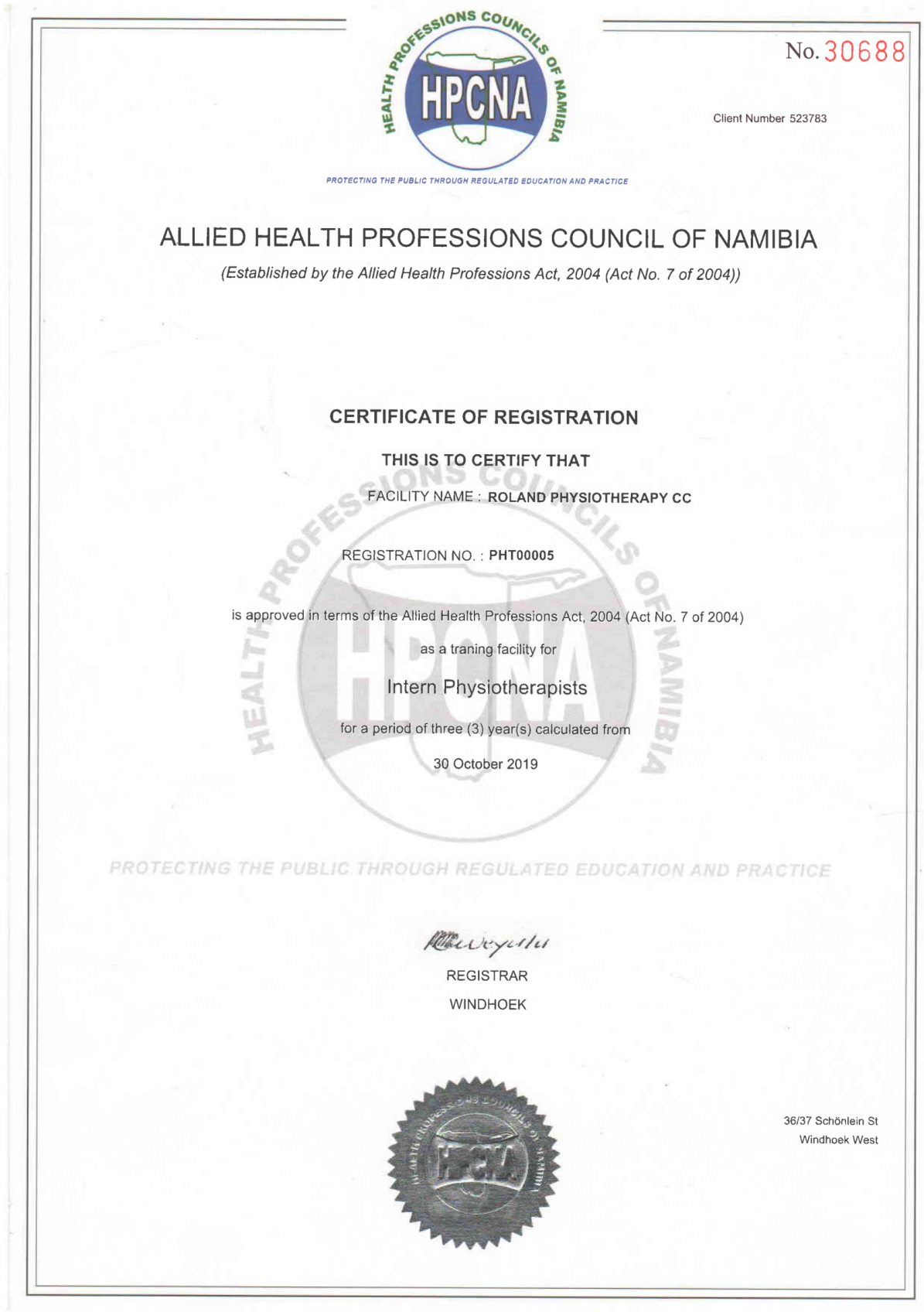
Repeal of laws

37. The Motor Vehicle Accidents Fund Act, 2001 (Act No. 4 of 2001) is repealed.

Short title and commencement

38. This Act is called the Motor Vehicle Accident Fund Act, 2007, and it commences on a date determined by the Minister by notice in the *Gazette*.

Appendix III: Intern Accreditation Certificate



No. 30688

Client Number 523783

HEALTH PROFESSIONS COUNCILS OF NAMIBIA

HPCNA

PROTECTING THE PUBLIC THROUGH REGULATED EDUCATION AND PRACTICE

ALLIED HEALTH PROFESSIONS COUNCIL OF NAMIBIA

(Established by the Allied Health Professions Act, 2004 (Act No. 7 of 2004))

CERTIFICATE OF REGISTRATION

THIS IS TO CERTIFY THAT

FACILITY NAME : **ROLAND PHYSIOTHERAPY CC**

REGISTRATION NO. : **PHT00005**

is approved in terms of the Allied Health Professions Act, 2004 (Act No. 7 of 2004)

as a traning facility for

Intern Physiotherapists

for a period of three (3) year(s) calculated from

30 October 2019

PROTECTING THE PUBLIC THROUGH REGULATED EDUCATION AND PRACTICE

REGISTRAR

WINDHOEK

36/37 Schönlein St
Windhoek West

Appendix IV: CPD Accreditation Certificate

Client Nr : 539518

SERVICE PROVIDER ACCREDITATION CERTIFICATE

Name of Accredited Service Provider

ROLAND PHYSIOTHERAPY

Accreditation Number

ORG00953

Period

26 February 2020 to 26 February 2021

REGISTRAR
WINDHOEK

23 March 2020

DATE

Appendix V: Request for Physiotherapists to Provides Services in Public Hospital

Namibian Society of Physiotherapy

P.O. Box 23321 • Windhoek • Namibia • www.namibiaphysio.com

25 June 2019

Dear Members

RE: REQUEST FOR PRIVATE PHYSIOTHERAPISTS TO CONSIDER PART-TIME CONTRACTS WITH WINDHOEKCENTRAL HOSPITAL

The above matter refers.

The Public Service sector is currently faced with CRITICAL SHORTAGES in staff, in mainly the scarce skills areas. Physiotherapy is the most affected. For the past ten years, the department has been operating with only three Physiotherapists. Two have now resigned, and currently the department is operating on skeleton staff as there is only one physiotherapist servicing the entire Windhoek Central Hospital (WCH).

A brief background of Windhoek Central Hospital

Windhoek Central Hospital is a specialised academic hospital, having critical departments with patients requiring daily physiotherapy. There have been challenges in recruiting and retaining Physiotherapists in the public sector due to unattractive remuneration packages and lack of supportive policy towards physiotherapy services.

The Chief Medical Superintendent of the hospital, Dr D.I. Uirab, has requested for physiotherapists in the private sector to come on board and assist the Ministry as a matter of urgency, whilst a permanent solution is worked on. The current proposal is for private Physiotherapists or physiotherapy practices to offer 10 hours per week, on a part time contract. The remuneration thereof is to be announced.

Members are also requested to assist with drafting a proposal which will offer temporary Physiotherapy services to state patients at Windhoek Central Hospital. The Proposal should also advice on the best recruitment and retention strategies of Physiotherapists . The proposal should also include strategies to get the physiotherapy department accredited by the Health Profession Council of Namibia. Accreditation will allow the department to train intern Physiotherapists.

Suggestions as to how the NSP can assist can be sent to Exco via Festa at secretary@namibiaphysio.com and Isa exco-secretary@namibiaphysio.com .

Exco would like to schedule a meeting to discuss the final draft before it is sent to the medical superintendent. The proposed date for the meeting is 1 July 2019, time and venue to be communicated.

Counting on your usual support.

Yours sincerely,

Isa Steenkamp
NSP Secretary

Appendix VI: Total Hip Replacement Physiotherapy Protocol

TOTAL HIP REPLACEMENT EXERCISE PROTOCOL FOR PHYSIOTHERAPISTS.

PREOPERATIVE

- Instruction on postoperative exercise program and expectations
- Instruction on total hip precautions
  - No hip flexion beyond 90 degrees
  - No hip adduction beyond neutral
  - No hip internal rotation past neutral
  - Keep pillow between legs for six (6) weeks
- Give exercise manual for Total Hip Replacement

NB. home environment

POSTOPERATIVE PHYSIOTHERAPY

Day 1

- Check medical notes, post operative X-rays and examine the patient before therapy
- Make sure that the patient has a physiotherapy exercise manual
- Explain to the patient the Dos and Don'ts, risk of DVT, pressure sores, chest infection, stiffness.
- Start with bed exercises
  - Deep Breathing Exercises
  - chest physio as needed
  - Foot pump exercises
  - Heel slides with terminal knee locking.
  - Quads, hams and gluts setting or isometrics
  - Hip flexion not more than 60 degrees.
- Initiation of bed mobility and transfer training-Bed to/from chair.
- Standing and walking can be done if patient is stable.
- Patient can sit out of bed for + or -15 minutes.
- Educate patient to do exercise programme in bed and to keep knee block between the legs.

Day 2

- Initiation of gait training with the use of assistive devices, such as walking frame and crutches
  - gait re education with hip and knee flexion//posture correction.
- Check operation site, swelling and drainage. Ivac may be removed
- Continuation of bed exercises
  - Foot pump exercises
  - Heel slides with terminal knee extension
  - Quads, hams and gluts isometric
- Progress with bed mobility and functional transfer training.
- Be cautious with mobility if patient is dizzy.

Days 3- 7

- Progression of R.O.M and strengthening exercises to the patient's tolerance
- Train sit to stand with minimum support or independently (safely).
- To sit for all meals.
- Progression of ambulation on level surfaces.
- Progress to stairs: Up: good leg /operated leg/ crutches.
  Down: crutches/operated leg/good leg
- The patient may be discharged.
- Arrange for follow up physiotherapy.

Week 1 – 2

- Progression of ambulation distance plus rest periods.
- Continuation of R.O.M and strengthening exercises.

  Supine. Quads strengthening
  .Heel slides
  .Hip abductors
  .Circulation exercises
  NB suspensions or Therabands can be used to assist active movements.

  Side lying (affected side on top)
  .Hip abduction
  .Hip flexion and extension
  .knee flexion and extension

  Standing
  .Hip abduction
  .Hip flexion and extension
  .Knee flexion
- Initiation of range of motion and strengthening exercises in prone
  .Knee flexion and extension
  .Hip extension
  .Hip abduction

Week 2-5

- Progression of ambulation – start one crutch indoors to one crutch outdoors.
- Strengthening exercises continue in supine, side lying and standing.
- Cycling- put seat as high as possible
- Side walking and balance training
- 3-5 weeks: Side step and forward step exercises.
  :Continue exercises with weights.

Week 6-8

- Wean crutches
- Strengthening exercises and stretches
  Hip abductors
  Hip flexors
  Step exercises
  Hip extensors
- Balance training and proprioception
  Wobble board

Standing on one leg eyes closed
Half lunges to full lunges

- Continue cycling increase time

Week 9-12

- Continue balance training
- Full lunges
- Strengthening
- Refer to Biokinetics

Appendix VII: Total Knee Replacement Physiotherapy Protocol

TOTAL KNEE REPLACEMENT EXERCISE PROTOCOL FOR PHYSIOTHERAPISTS.

Preoperative

- Assessment of joint range of motion, muscle strength, mobility and general function.
- Home assessment
- Cardio-vascular or respiratory assessment.
- Explanation of postoperative physiotherapy management
- Give physiotherapy exercise manual (handout)
- Preoperative muscle strengthening e.g quadriceps and hamstrings and cardio-vascular training.

Postoperative Day 1

- Check operation notes and mobility instructions.
- Make sure that the patient has Physiotherapy exercise manual.
- Assess respiratory status and treat if necessary.
- Bed exercises-ankle pumps
  -heel slides
  -quadriceps and gluteal sets
- Encourage bed mobility and proper alignment of knee joint
- No pillows under the knee.
- Sit at the edge of bed for few minutes.
- If not dizzy and BP well controlled, power and sensation adequate, may try few steps on walker/ crutches.
- Transfer training- bed to/from chair.

Postoperative Day 2

- Check chest.
- Exercises for active Range Of Motion and Active- assisted Range Of Motion
  -heel slides
  -ankle pumps
  -knee flexion and extension
- Strengthening exercises-quadriceps (terminal knee extension)
  -gluteal sets
  -straight leg raises
  -isometric hip adduction
- Progress with gait training on walking frame or on pair of crutches.
  -encourage knee flexion in swing phase.
- Progress with transfer training
  -bed mobility
  -sit to/from stand
  -toilet transfers
- Encourage patient to perform bed exercises independently 3 times per day.
- Sit in a chair for 30 min twice a day.

Postoperative Day 3-7

- Sit at edge of bed to perform exercises such as knee flexion and extension
- Begin hip flexion and knee flexion in standing.

1

- Continue bed exercises
- Progression of ambulation on level surfaces
- Progress to stair climbing
  -Up: good leg/ operated leg / crutches
  -Down: crutches /operated leg/ good leg
- The patient may be discharged.
- Book patient for follow up physiotherapy.

Postoperative week 1- 2

- Strengthening and range of motion exercises in supine.
  -Quadriceps (towel under knee) performed with ankle dorsiflexion
  -Straight leg raises- active assisted to active
  -Knee flexion and extension
  -Heel slides with terminal knee extensions.
  -Calf muscle strengthening -ankle plantar flexion with Theraband
- Side lying- knee flexion and extension (you may use suspension).
  - Hip abduction, hip extension
- Sitting -Straight leg raises (in long sitting)
  -knee flexion and extension (at edge of bed)
- Standing –Knee flexion and extension
  -Terminal knee extension against the wall.
- Sutures are taken out.

Postoperative week 2-5

- Initiation of exercises in prone- put cushion under the knee for comfort.
  -knee flexion and extension
  -Terminal knee extension.
  -Hip extension exercises
  -Hip abduction and adduction
- Progression of ambulation-start from one crutch indoors to one crutch outdoors.
- Begin stationary bicycle with supervision.
- Strengthening exercises continue in supine, side lying, sitting and standing (with weights).
- Balance training
- Side walking and knee flexion over a step.
- 4-5 weeks-Side step and forward step exercises.
  -Stretching of quadriceps and hamstring muscles.
  -Toe and heel walking.

Postoperative week 6-8

- Wean off crutches –start to ambulate indoors without crutches to without crutches outdoors.
- Continue strengthening exercises with weights of knee and hip muscles
- Focus on unilateral balance activities

-Forward step exercises
-Standing on one (leg eyes closed)
-Half lunges
-wobble board
-Heel and toe walking

- Increase time of cycling on stationary bicycle.

Postoperative Week 9-12

- Continue balance training
- Strengthening
- Full lunges
- You may refer patient for biokinetics.

Appendix VIII: Cardiac Surgery Physiotherapy Protocol

Heliane Roland
B Sc (Physio) Stell
Reg Physiotherapist
Prac.No 072 000 000 6874

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Windhoek
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Cell: 0811290180
rolandrc@africaonline.com.na

Protocol Cardio-thoracic surgery

Surgery days Dr du Toit: Monday pm
Wednesday pm
Thursday full day

All cardiothoracic patients must be seen pre-op by the physio,preferably on the eve before the operation.

Pre-operative:
1.Evaluate medical history
2.Auscultation
3.CXR
4.Results of lung function tests
5.Treat lungs if necessary
6..Demonstration/use of Bird
7..Pamphlet must be given/pre-op education

Post-operative
Patient will be extubated 6-8 hours post-op.

Day 1:
1.Assess post-op CXR
2.Auscultation
3.Arterial Blood gases- P02 kpa must be less than 10 if it must be safe to treat!
4.Presence of arrhythmias
5.Palpate for chest expansion,secretions

Treatment in semi-fowlers position /sitting in chair/over side of bed –usually 2x per day!

- IPPB with PEEP 30-60 breaths in intervals of 15-20 breaths.During IPPB encourage thoracic expansion
- DBE
- Vibs/shaking bilateral during expiration phase to assist mobilising secretions
- PEEP-bottle 20-30 breaths (patient is instructed to do so hourly)
- Instruction of coughing with wound support
- Mobilize to chair 1-2 x per day
- Treatment time varies,dependant on patient tolerance and stability,25-40 min!!

Post-op Day 2-4

Treatment in semi-fowlers position / sitting in chair /over side of bed –usually 2 x per day!

- IPPB with PEEP 30-60 breaths in intervals of 15-20 breaths
- DBE
- Vibs/shaking on expiration
- Percussion in positions tolerated by patients pain,usually in sitting(due to sternotomy no side-lying)
- PEEP –bottle 20-30 breaths
- Instruction of coughing with wound support
- Mobilise to chair 1-2 x per day.Doctor will instruct when to start walking few steps / around nurses station
- Treatment time varies,dependant on patients tolerance and stability,25-40 min!

Day 4 onwards

- Repeat above as necessary including lung treatment ,mobilising,stairs.(check that pulse does not exceed 130/min.Let patient rest when tired.
- Give advice on home walking program, precautions at home etc.

CONTRAINDICATIONS FOR IPPB

- **Pneumothorax**
- **Large Bullae on CXR**
- **Severe haemoptysis**
- **Post-op air leak (eg after lobectomy)**

CONTRAINDICATIONS FOR PERCUSSION

- **Severe osteoorosis**
- **Frank haemoptysis**
- **Metastasis in ribs,vertebral column**

CONTRAINDICATIONS TO PHYSIOTHERAPY TREATMENT

- **Acute bronchospasm**
- **Fast arterial fibrillation**

Prolonged ventilated patient post-surgery

Patient is assessed and factors such as physiological stability ,state of consciousness, secretions etc.influences treatment choice.

A Patient with an unstable respiratory system requiring high levels of oxygen (Fi O2 > 0.6) and/or high levels of PEEP (> 10 cm H20) should have an absolute indication for treatment before physio is undertaken.

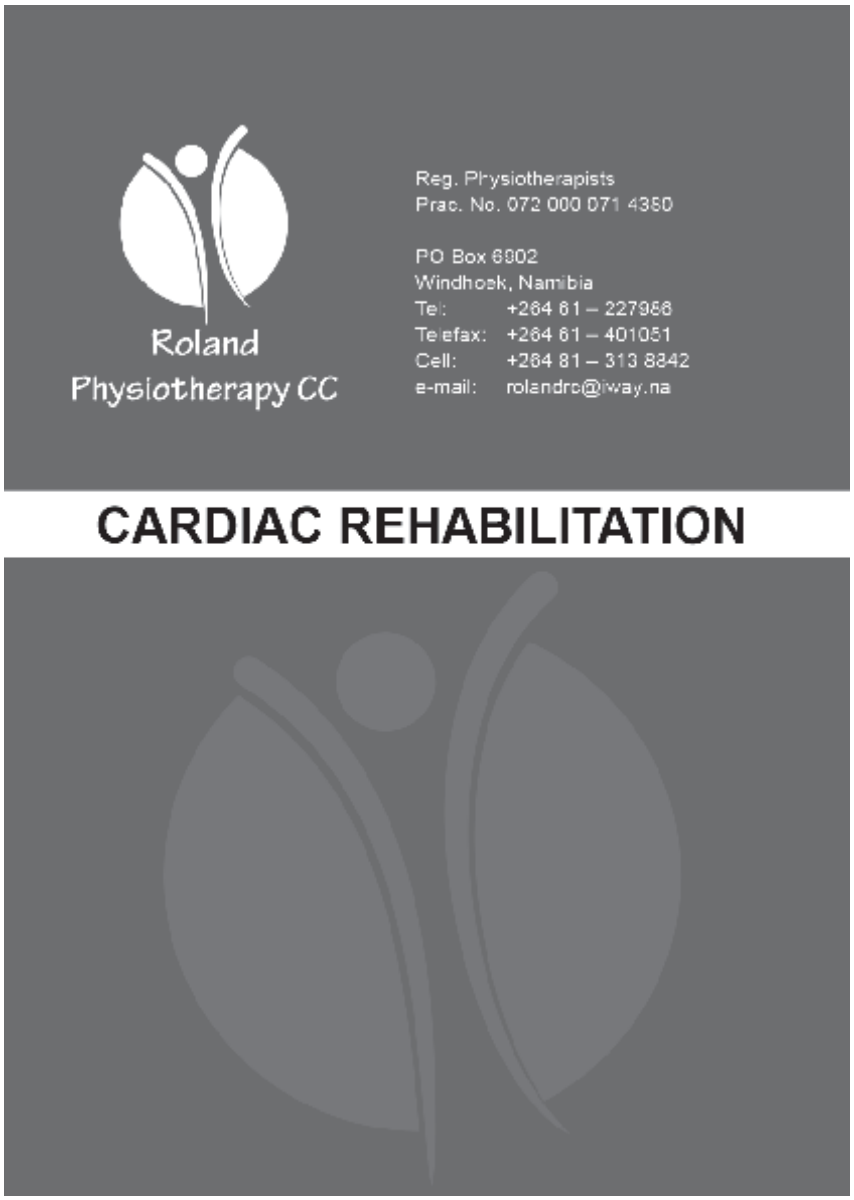
Treatment:

- Percussion/shaking/vibration in alternate sidelying –as tolerated by patient
- Suction and saline lavage of secretions via ET –tube/ trachi / mouth.
- Passive/active assisted movements
- Stretches ,especially Achilles tendon
- Transfer to chair if possible
- Mobilize to chair if possible
- Walk on the spot if possible
- Treatment time: 30-40 min as tolerated

Treatment times

- Treat 1st treatment between 7h30 – 09h30
  Treat 2nd treatment 13h30 – 16h30. Optimally at least 5 hours between treatments.
- If patient needs to be seen 3 times per day,allow at least 4 hours between individual treatments.
- 7h30 ,12h00 and then around 17h00

Appendix IX: Information Booklet Cardiac Rehabilitation



This information booklet has been prepared to help you and your relatives understand more about you heart operation. It also gives you general information about what to expect from the time of your admission to your discharge home from hospital, and some practical advice on what to do when you get home.

Date of operation:.....

Procedure performed:.....

Types of procedures performed

1. Heart valve replacement (mechanical or tissue type)
2. CABG(cabbage) – coronary artery bypass graft. A vein/s from your leg or arm is transplanted to your heart which is connected to the aorta to bypass the blockage in arteries of your heart
3. Co-arctation of aorta repair

Physiotherapy

Aim of physiotherapy

To restore full respiratory function post-operative.

To assist the patient to regain full mobility

Prepare patient for phase II cardiac rehabilitation

Your first session is done pre- operative (the day before your operation). In this session we will explain our involvement in the process, check your respiratory function. The daily treatment program will be explained. The physiotherapist will demonstrate how to use your PEP bottle / spiromter, the Bird machine and the breathing exercises. They will explain all precautions you have to take after the operation.

Your first treatment session post- operative takes place the first morning after your operation. We visit you twice a day for the duration of your stay in the hospital.

***Important notes*:**

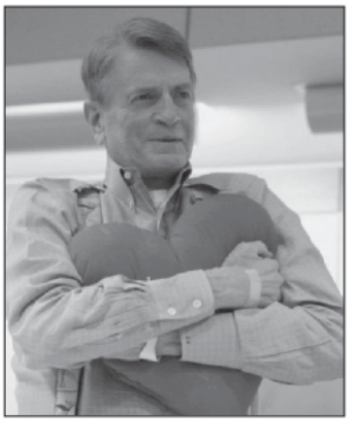
1. Your lungs are deflated during the operation to allow the surgeon to work on your heart. During this period the bypass machine takes care of your heart and lung function. This is the reason why it is normal to have chest complications like a partially collapsed lung or poor breathing effort, etc. after the surgery.
2. During the operation the surgeon makes a cut through your sternum (breast bone). This wound is painful and restricts your ability to move, breathe and cough normally.
3. ***DO NOT PULL, PUSH OR LIFT USING YOUR ARMS TO MOVE IN AND OUT OF BED FOR 6 WEEKS OR LIFT ANY HEAVY ITEMS.***

4. Always move/walk whilst hugging your heart pillow, especially in the first 2-4 weeks.

Coughing and moving

The wound on your sternum will be painful especially when you try to breathe deep, cough and move. Once you wake up the sisters in the ICU will provide you with a heart shaped pillow that you **must** use to support your chest when you do above mentioned things for the next **6 weeks**.

The 6 week watch!



Your sternum wound takes 6 weeks to heal and the bones takes about 3months to fuse properly. For that reason you are not allowed to pull or push anything heavy. Sleeping on your side is allowed as soon as pain permits. You will not be allowed to drive your car for 6 weeks.

Day 1 - Physiotherapy

We will check your vitals(blood pressure, heart rate etc.) and if the surgeon gives the all clear, then your physiotherapist will start with basic arm and leg movements to stimulate your blood circulation. If you are strong enough you will be moved out of bed. Then we will start with deep breathing exercises. Due to pain you will not be willing to breathe normally or cough. However for the lungs to fully expand and for the drains to be removed from your chest area your lungs must be fully expanded. The only way to achieve this is to do breathing exercises and to cough properly.

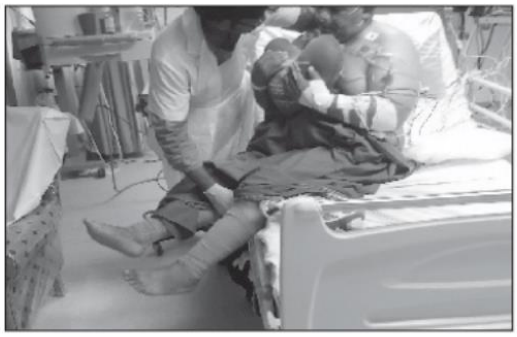
Activity 1

Your physiotherapist will ask you to take a deep breath, pushing out with your tummy, without lifting your shoulders or tensing your neck muscles and again blow out focusing on your tummy muscles. Do this 10 times.

Activity 2

The physiotherapist will place his/her hands on the side of your chest and ask you to breath in against his hands, pushing with your rib cage outwards as you do so. This is done 10 times

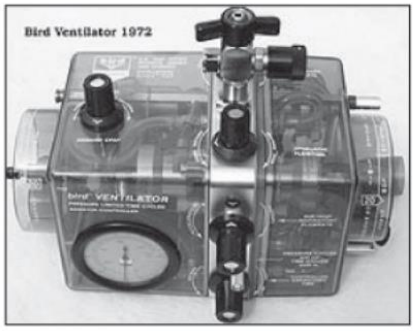
Sitting up

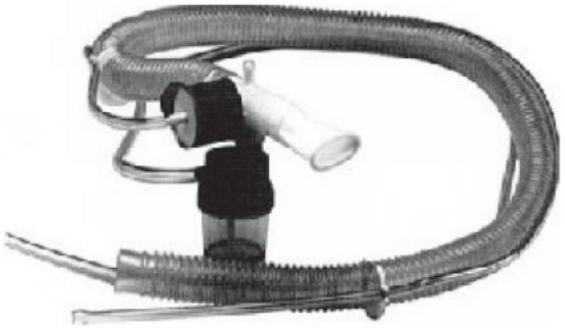


If all your vitals stay stable you will be assisted to sit on the edge of the bed *(see picture on top)*. Remember you are **not** allowed to use your arms or sit upright using your abdominal muscles. This will place strain on your chest wound. You must hug the heart pillow tightly while the physiotherapist and the nurse helps you to sit up.

Activity 3 – The bird and peep

We use a portable ventilator called bird. It's function is to help your lungs inflate fully.





You place the mouthpiece into your mouth, close your lips and take as deep a breath **in** as possible. You will then feel the machine starting and pushing air into your mouth/throat. The more you do it, the quicker your pain will become less and your breathing easier. This forced air helps the air sacs in the bases of your lungs to open and helps expel the residual fluid that is still in your chest cavity from the operation.

PEP - bottle / Spirometer

Next the physiotherapist will give you a plastic water filled bottle that is sealed at the top with a rubber tube through the cap. You have to blow long and slowly into the bottle. Blowing against water resistance helps with your lung sacks opening up and makes your breathing better. You should blow into the bottle at least 30 times per hour every time you are awake. Spirometer: Your physiotherapist will explain.

Moving out of bed

You will now be assisted out of bed by the physiotherapist and the nurse and helped to sit in a chair. REMEMBER WHEN YOU GET UP, DO NOT PULL OR PUSH WITH YOUR ARMS. USE YOUR LEGS ONLY TO PUSH YOURSELF UP INTO STANDING WHILE YOU HUG YOUR PILLOW. If you can tolerate it you will sit up in a chair for +/- 2hrs and then helped to bed. If you feel unwell ring the bell or tell the nurse so that we can help you back into bed.

This routine will be repeated twice daily. Once your drains are removed you will be moved to the ward normally on the afternoon of day 2.

Resting

For the first 6 weeks sleep on your back with a pillow under your head and under your knees. Wear shirts with buttons in front. Between therapy sessions get as much rest as possible. This will speed up your recovery, so limit visitors in the ICU. Sleeping on your side is permitted as soon as pain allows you to do that, probably after 2-4 weeks.

Alarms and monitors

When you wake up you will have lots of lines and tubes connected to you. This allows your body functions to be monitored. We know that the noise of the alarms is irritating but please understand that it is a necessity.

Day 2

This will be a repeat of Day 1. If your lines are removed we will start doing step exercises and walking small distance with you in the ICU. ALWAYS REMEMBER, IF YOU CAN TALK WHILE YOU WALK, WITHOUT GETTING OUT OF BREATH, THEN YOU ARE DOING OK. IF YOU CAN'T COMPLETE A SENTENCE OR FEEL ANY DISCOMFORT, INFORM YOUR THERAPIST AND STOP

Day 3 till discharge

The physiotherapists will continue with your breathing exercises and increase your walking distance daily until you can climb two flights of stairs (remember always to embrace your pillow when up). On your last day in hospital we will arrange a follow-up appointment and arrange for you to join the cardiac rehabilitation class. Here you will join other patients who had similar operations (classes are normally on Monday and Friday afternoons).

Phase II rehabilitation

The aim of this part of your rehabilitation is to get you fit enough to manage household activities. Please ensure that you have transport to bring and collect you as you are not allowed to drive for 6 weeks. If you still have chest problems you will be seen daily. If your chest is clear you will attend physiotherapy twice weekly (Monday and Fridays) till your surgeon refers you to biokinetics for end-phase rehabilitation (normally after 6 weeks).

Exercises

1. Stand and bring your hands up to your chest and stretch your arms away down from your body. Repeat 5 times.

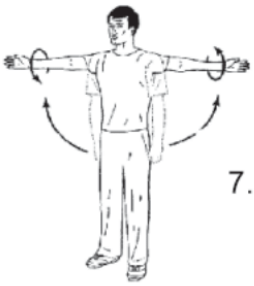
2. Repeat same exercise but lift your arms in front of your body to shoulder height and drop down. Repeat times 5

3. While standing stretch your arms forward and bend at the waist as if to greet. Repeat 5 times.

4. Stand up straight, hands on the hips. Now bend to the left, straighten up and bend to the right. Do 5 to each side.

5. Stand up, straight hands on the hips. Now swivel at your hips and make 5 circles

6. Stand up straight, hands on the hips. Now bend your knees and do a mini-squat. Repeat 5 times.



7. Stand up straight, arms stretched out, now make circles. Make 5 circles.

8. Stand up straight, arms at your sides. Now lift them up sideways and bring them down. Repeat 5 times

9. **Walking progression**

Week 1: 5-10 minutes at a time.
Week 2: 10-15 minutes at a time.
Week 3: 15-20 minutes at a time.
Week 4: 20-30 minutes at a time.
Week 5: Aim for 30-45 minutes walk daily 5 days per week.

9.1 Walking

Your target is to be able to walk 40 minutes daily without stopping by week 6. So add 5 minutes weekly to your walks until you reach your target. Remember if you feel discomfort, stop.

10. Testing

During your hospital stay and after discharge your vitals will always be taken before, during and after exercise to make sure it is safe for you to continue with exercise.

11. CAUTION

IF YOU FEEL ANY DISCOMFORT (shortness of breath, pain, dizziness) WHEN YOU EXERCISE, STOP! WAIT FOR THE FEELING TO DISAPPEAR. IF IT GOES AWAY, CONTINUE. IF IT DOES NOT GO AWAY, SIT DOWN AND TAKE YOUR PRESCRIBED (SUBLINGUAL) MEDICATION. OTHERWISE CALL YOUR DOCTOR IMMEDIATELY.

Our Contact numbers: 061 - 227 986 or 081 - 313 8842

Appendix X: Information Booklet Neck and Back Rehabilitation

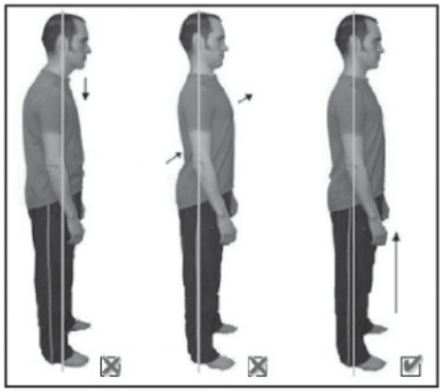
THE POST-OP NECK AND BACK BOOK

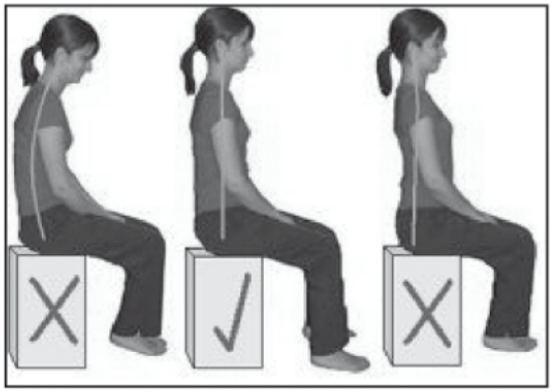
1. GETTING BACK ON YOUR FEET

A decision has been made by you, and your surgeon that an operation is required to correct your neck or back problem. This is the first step on your road to recovery. The next step is up to you. You can recover faster and stay healthier if you learn to take good care of your spine. That means maintaining good posture, moving safely, and exercising regularly to strengthen the muscles that help support your spine. Our physiotherapists will support you during this process. Feel free to ask questions.

GOOD POSTURE

Your spine has 3 curves(*cervical, thoracic, lumbar*) formed by the bony vertebrae and cushioning disks. Keeping the curves of your spine in a balanced (*S-shape*) position is the key to preventing pain and future problems. That means keeping your ears, shoulders and hips in line when you sit and stand.





Safe Movement

Bending, twisting, or arching your spine, especially as it heals, can cause pain and possibly lead to new injuries. In this booklet you will find tips throughout to help you move safely and protect your spine as you ease your back into your everyday activities.

Regular exercise

Your spine support is dependent on the strength and flexibility of the muscles of your back, abdomen, pelvis and legs. You will find simple flexibility and strength exercises throughout, that you can make part of your daily routine. *It is important to make exercises a good habit and not just a punishment imposed on you by your physiotherapist.*

When you exercise, remember to:

- Inhale as you start and exhale as you let go.
- No forced breathing or breath withholding
- Avoid twisting, bending movements
- Perform the exercises in a slow, controlled manner
- ***Stop if you feel any pain and report it to your physiotherapist***

YOU MAY HAVE HAD ONE OF THE FOLLOWING PROCEDURES

- Anterior Cervical Decompression and Fusion
- Posterior Cervical Laminectomy
- Posterior Cervical Decompression and Laminectomy
- Lumbar Laminectomy and Discectomy
- Decompressive Lumbar Laminectomy
- Lumbar Fusion

2. IN THE HOSPITAL

Your recovery begins as soon as you leave the operating room. Your physiotherapist will help you get on your feet within 24hrs. The physiotherapist will teach you how to brace yourself, turn ***(logroll)*** *and get in and out of bed safely. You may or may not have a brace for your neck or back to keep it stable as it heals. If so you will be given advice on when and how to use it. Never leave the bed without fitting it on first.*

Pain Control

Pain for up to one year after surgery is normal. Even simple movements can cause pain at first. In the hospital you will be given medication to reduce pain.

3. STARTING TO MOVE AFTER THE OPERATION

Learning to Brace Yourself

Your stomach muscles are a natural support for your spine. Bracing these muscles whenever you move helps prevent pain and re-injury.

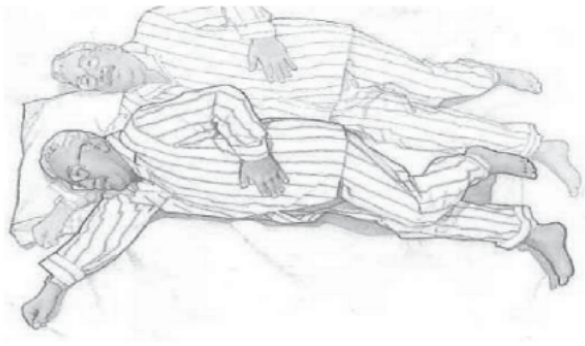
To brace your abdominal muscles:

- Put your hands on your stomach. Gently tighten your stomach muscles by pulling in your stomach. Breathe normally without relaxing your stomach muscles
- If you have difficulty you can tighten your stomach muscles by squeezing your buttock muscles.

Turning safely in bed(logrolling)

Twisting or bending your back after surgery is painful and can cause further injury. When you move think of your body as a *log,* from your shoulders to your hips.

To logroll in bed:
Brace your stomach muscles to help to support your spine. Bend your knees,slightly towards your chest. Roll to one side, keeping your ears,shoulders, and hips in line. Be carefull not to bend or twist at the waist.



4. LYING DOWN

Lying down puts the least pressure on your spine. To keep the 3 curves of your spine in their balanced position, lie on your back or on your side – not on your stomach. Choose only a firm matress or firm couch. Use soft pillows to support your neck and legs. You can also put a pillow, rolled- up towel or lumbar roll under your lower back.

BACK BASICS

To lie on your side:

- Bend your knees towards your chest. Place a pillow between your knees and under your head and neck

To lie on your back:

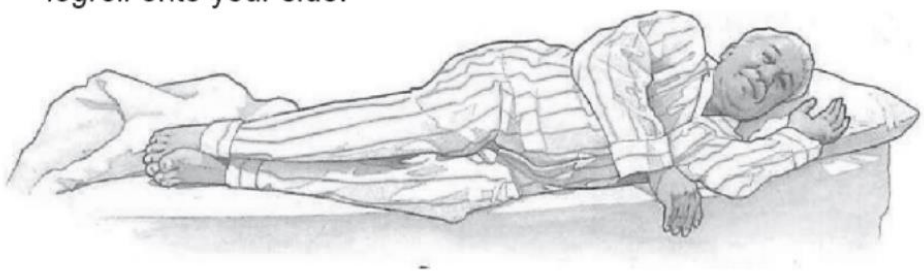
- Put a pillow under your neck and under your knees, or keep your knees bent.

When you change positions brace your abdominal muscles and logroll.

5. TO SIT UP

You are only allowed to sit up for meals and for using the bathroom. Try to limit sitting up to 20 minutes in the first 6 weeks

- *Brace* your abdominal muscles and *logroll* onto your side.



- Slowly scoot to the edge of the bed.
- Carefully push your body up with one elbow and the opposite hand. At the same time gently swing your legs to the floor. Keep your ears, shoulders, and hips in line and your abdominal muscles *braced*.

To lie down, do the reverse

6. DISCHARGE

Once you can *walk* safely on your own and climb steps you will be discharged home. The sooner you become active, the sooner you'll get back to normal. But you also need to protect your back so it can heal. Try to increase your activity level steadily but gradually.

Use the **Back basics** and the **Tips** in this booklet to help you keep your spine balanced. Begin walking as soon as you get home. Try walking for 10 minutes in the beginning and add 10 minutes daily till you can manage 40 minutes walking.

Walking

Week One to Six

Expect to feel weak and tired when you first get home. You should feel a little stronger each day. You will probably be sore around the incision. You may still have some pain, tingling, or numbness in your neck, back, arms or legs. This should decrease gradually as the nerves heal. Keep moving as much as you can without increased pain.

Preventing Setbacks

Increased pain for more than two hours after an activity usually means you've done too much too soon. Don't just reach for the pain pills. Take pain as a warning sign to slow down and pay attention to your posture and movements. Make sure you're bracing your stomach muscles and keeping your proper posture.

Week Six and After

By about the sixth week, your back is well on the way to healing. If you're using correct posture and movement and exercising regularly, you should feel better and be able to do more each week. Continue to let pain be a warning to slow down.

Your Walking Program

Walking is the best exercise after back surgery. It strengthens your back and leg muscles and increases your endurance. It also relieves stress, which can cause the muscles in your back to tighten. Begin walking around the house. Build up to taking several walks a day.

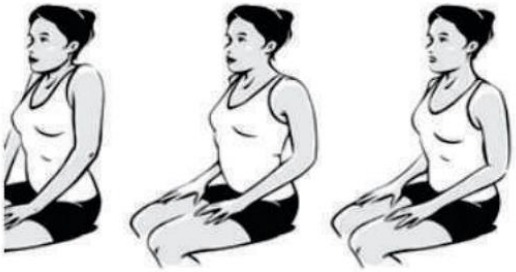
TIPS – Call your doctor if you . . .

Feel persistent or severe pain; weakness or numbness in your back or legs; notice drainage, swelling, or increased redness around your incision; have a fever, severe headache or extreme fatigue; have difficulty breathing or have problems controlling your bladder or bowels.

7. EXERCISES

Neck

1. *Shoulder rolls* – In a sitting position, roll your shoulders upwards, backwards, downwards, and forwards. Repeat 5-10 times.

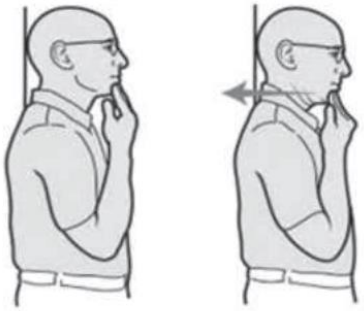


2. *Neck rotation* – In a sitting position, turn your neck from side to side. Repeat 5-10 times each side.

Active neck rotation

3. *Neck lateral flexion* – In a sitting position, move your neck sideways so that your ear moves towards your shoulder. Repeat 5-10 times each side.

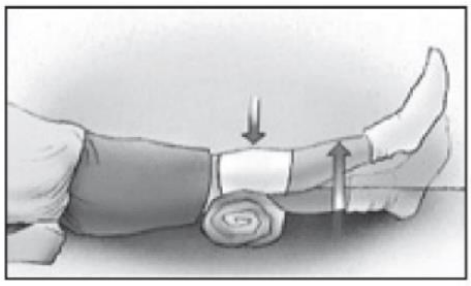
4. *Chin tuck* – Sit or stand with your back against a wall. Tuck your chin in towards your chest. You may assist this movement by pushing your chin inwards with your index and middle fingers. Repeat 5-10 times.



Back and Lower Extremities

1. *Circulatory drill* – After surgery there is always a risk of blood clots forming due to the long periods of inactivity and from the drugs used. Make sure you move your feet by pointing the toes and then pulling them up or moving your feet in circles. This assists the blood flow in your legs. Repeat 10-20 times.

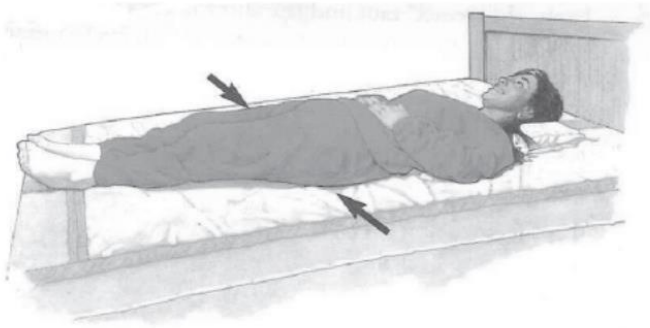
2. *Knee extension* – Push your knee into the bed or place a towel under your knee and lift your heels off the bed. Repeat 5-10 times.



3. *Pelvic tilt* – Lie on your back. As you inhale, pull your tummy in, push the hollow of your back into the bed and lift your buttocks up from the bed. Hold for 2-5 seconds. Repeat 5-10 times.

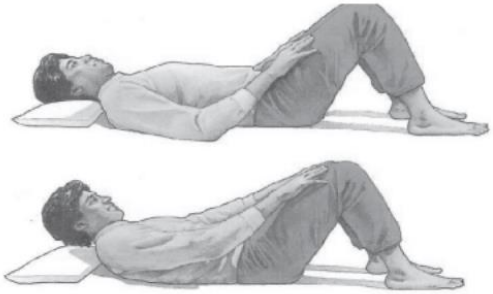
3.1 *Back muscle activation* – Lie on your back. Press your left arm and right leg into the bed. Hold for 5 seconds. Repeat with your other arm and leg. Repeat 5 times.

4. *Buttocks squeeze* – Lie on your back. Squeeze your buttock muscles together and hold for 5 seconds. Relax. Repeat several times per day.

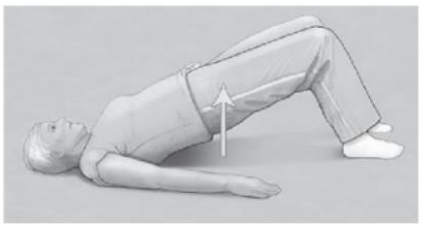


CAUTION: DO NOT DO THE FOLLOWING TWO EXERCISES UNTIL YOUR DOCTOR OR PHYSIOTHERAPIST SAYS YOU CAN:

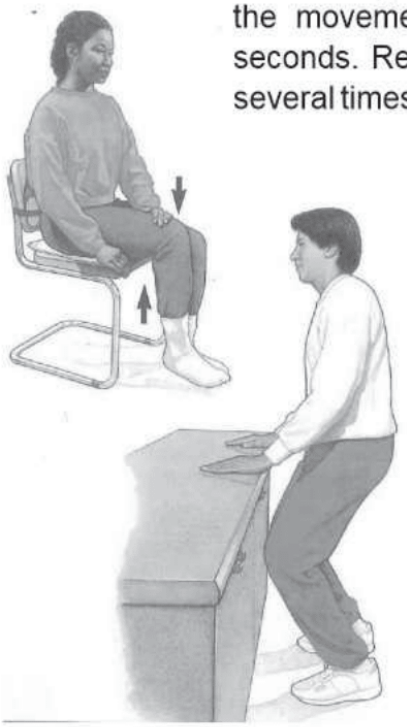
5. *Partial sit-up* – Lie on your back with your knees bent. Brace your stomach muscles and squeeze your buttock muscles together. Reach your hands towards your knees while lifting your head. Move back to starting position. Repeat up to 10 times.



6. *Bridge* – Lie on your back with your knees bent. Inhale, gently pull your tummy in and lift your buttocks off the bed. Repeat up to 10 times.



7. *Knee lifts* – While sitting upright in a chair, lift one knee up and resist the movement with your opposite hand. Hold for 5 seconds. Repeat with your other leg. Do 5 repetitions, several times per day.



8. *Mini-squats* – Hold onto a desk/ table with you maintain a good posture. Bend at your knees till you feel a gentle stretch in the front of your thighs. Let your buttocks stick out. Do not arch your back! Repeat several times per day.

TIPS

Eating

Slide your chair under the table as far as possible. Keep your plate close to you so you don't have to reach for your food. Sit up straight – don't lean forward or put your elbows on the table

Using the toilet

A raised toilet seat makes getting up and down easier on your spine.

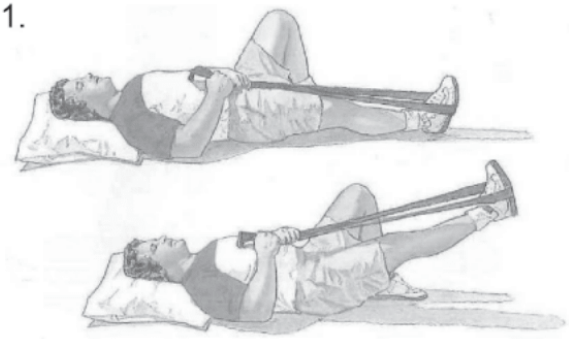
Driving

CAUTION – DO NOT DRIVE until your doctor says it is ok. When you sit make sure your hips are higher than your knees. Brace your back when getting in and out of the car. Use your leg muscles to stand up.

8. STRETCHING

1. *Hamstring stretch* – The easiest way to stretch your hamstrings if it is too painful to your leg is to tie a bandage or towel around your foot and pull your leg up. Go as far as you feel a gentle stretch in the back of your leg. Hold for 20 seconds. Repeat several times per day

1.



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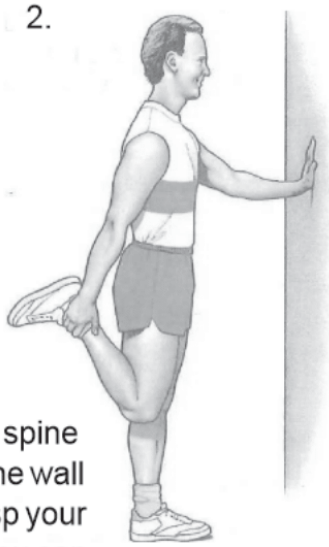


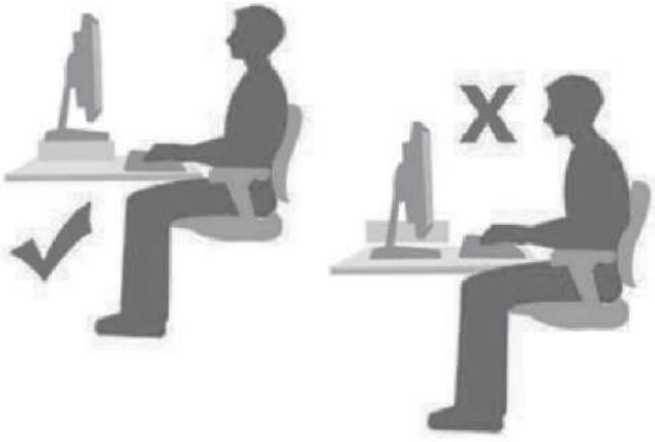
2. *Quadriceps stretch* – Stand with your spine balanced. Support yourself by holding onto the wall with your left hand. With your right hand, grasp your right ankle and bring your heel up as far as you can tolerate. Do not arch your back or lean sideways. Keep your ears, shoulders, and hips in line. Hold for 20 seconds. Repeat 5 times each leg.

3. *Calf muscle stretch* – Stand facing a wall. Move your one leg back. Now gently push your heel into the floor. Hold for 20 seconds. Repeat with your other leg.

4. *Pretzel stretch* – Lie on your back with your knees bent. Cross one leg over the other at your knee. Take a hold of your bent leg and pull both legs toward your chest. Hold for 20 seconds. Repeat with your other leg.

TIPS - *Dressing* – **DO NOT BEND FORWARD** when putting your socks or shoes on. Instead use braai tongs or lie on your back to put them on.

Doing desk work – Position your chair so you are sitting directly over your work. Arrange everything within easy reach. Put your computer screen at eye level. To avoid bending your neck forward, use a slant board or other raised surface for reading and writing/typing.



9. Home Activities

If you must sit

Keep your feet flat on the floor, your knees level with or slightly below your hips. Place a lumbar roll or small cushion behind your back. You may want to tape it to your chair. Keep your back straight while sitting up, for up to 20 min at a time.

Getting up

Make sure you sit in a sturdy chair with armrests. Use your arms to push up into standing. **Do not bend forward.** Keep your back straight, push your hips forward while getting up.

Watching TV

To bend over – Brace your stomach muscles and start with your feet shoulder-width apart. Bend at your hips and knees. Let your buttocks stick out, but do not arch your back!

To stand up – pull your buttocks in and push up with your leg muscles.

Resting – Lie on your side, on a firm couch with a pillow between your knees.

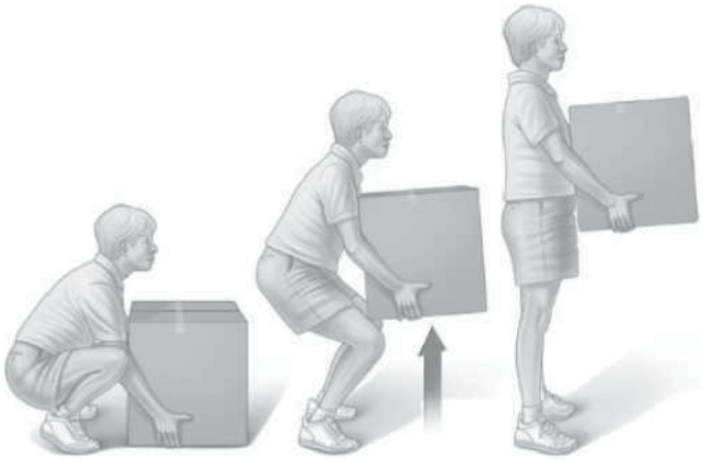
10. Taking care of yourself

Surgery may not make your spine like new, but it can relieve pain and let you get back to most, if not all of the activities you enjoy. How well your back recovers depends on the time and energy you put into protecting and strengthening your spine – now and for the rest of your life. Maintaining good posture, moving safely, and exercising regurlarly are the best care you can give your back. Think of them as daily investments.

1. Lifting and bending

After 6 weeks, you can lift items and drive a vehicle. However, it is still important that you remember and apply the advice given in this booklet.

BEND YOUR KNEES, NOT YOUR BACK! BRACE YOURSELF BEFORE LIFTING AND KEEP YOUR BACK STRAIGHT!



TIPS Always keep loads you lift close to your body, your feet shoulder-width apart, and one foot slightly in front of the other. Keep your back straight. Push up using your leg muscles. Do not bend your back. Bend your knees, even when tying your shoes or putting on socks or pants.

2. **If you must reach**

- Avoid reaching as much as possible.
- Ask someone to get things for you.
- Later in your recovery, if you must reach, climb just high enough to reach without lifting your elbows above your shoulders.
- Brace your stomach muscles.
- Do not arch or bend your back as you reach.
- Bring the object close to your body.
- Climb up and down slowly, keeping your ears, shoulders, and hips in line.

3. **To stand and turn**

- Place one foot slightly in front of the other, in a step position, or stand with your feet shoulder-width apart.
- Keep your knees relaxed and stomach muscles braced.
- Turn by stepping around with your feet.
- Keep your ears, shoulders, and hips in line.
- Be careful not to twist or bend at your waist.

4. **To push**

- Put one foot forward for better balance.
- Keep your knees relaxed and your ears, shoulders, and hips in line.
- Keep your elbows close to your body.
- Step and push with your entire body.
- Do not bend or arch your back.

5. **If you must pull**

- Get close to the object.
- Keep your ears, shoulders, and hips in line.
- Lock your elbows to your body and move back as you pull.
- Do not bend or arch your back.
- To pull while standing, put one foot slightly in front of the other and bend your knees slightly. Lock your elbows to your body and shift your weight onto your back foot as you pull.

6. Shopping

- Buy in small amounts at a time and bag lightly.
- Ask for bags with handles.
- Pushing places far less stress on your spine.
- Push your trolley. Remember to use the bending and lifting tips in this booklet.

7. *Other activities*

- There is no reason why you cannot resume sexual activities after surgery.
- It is wise to wait until your pain is minimal.
- In the first 6 weeks after your operation, the best position to assume is on your side. This way no stress is placed on your back. You could alternatively lie on your back. Remember to place pillows under your knees, lower back, and head.

11. REVIEW

Do's and Dont's

- *Brace* yourself, before you move.
- *Logroll* when you turn in bed, remember to brace your stomach muscles while turning.
- If you have a brace fit it **before** getting out of bed.
- Do not bend your hips more than 90 degrees when getting up.
- First 6 weeks sit only for meals and toileting.
- You may sit for up to 20 min at a time.
- No driving for first 6 weeks
- Avoid lifting heavy objects. If you lift any object keep it close to your body.
- **Bend your knees** when going down, **keep your back straight**
- Perform daily exercise. Increase your walks everyday**.**
- Increased pain, wound changes or loss of function must be reported to your doctor.

Appendix XI: Information Booklet Total Hip Replacement

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Physiotherapy

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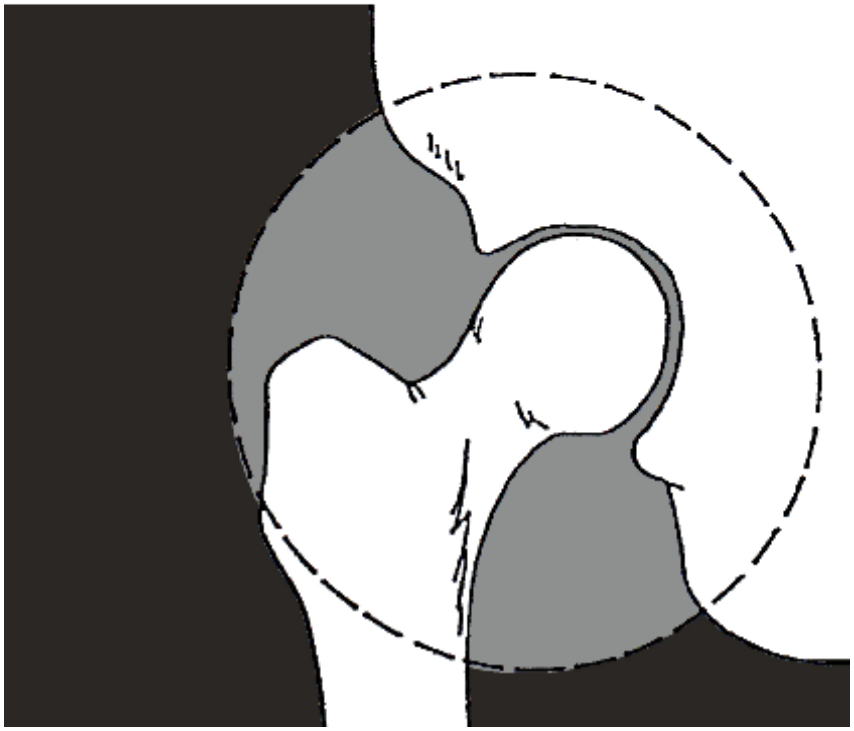
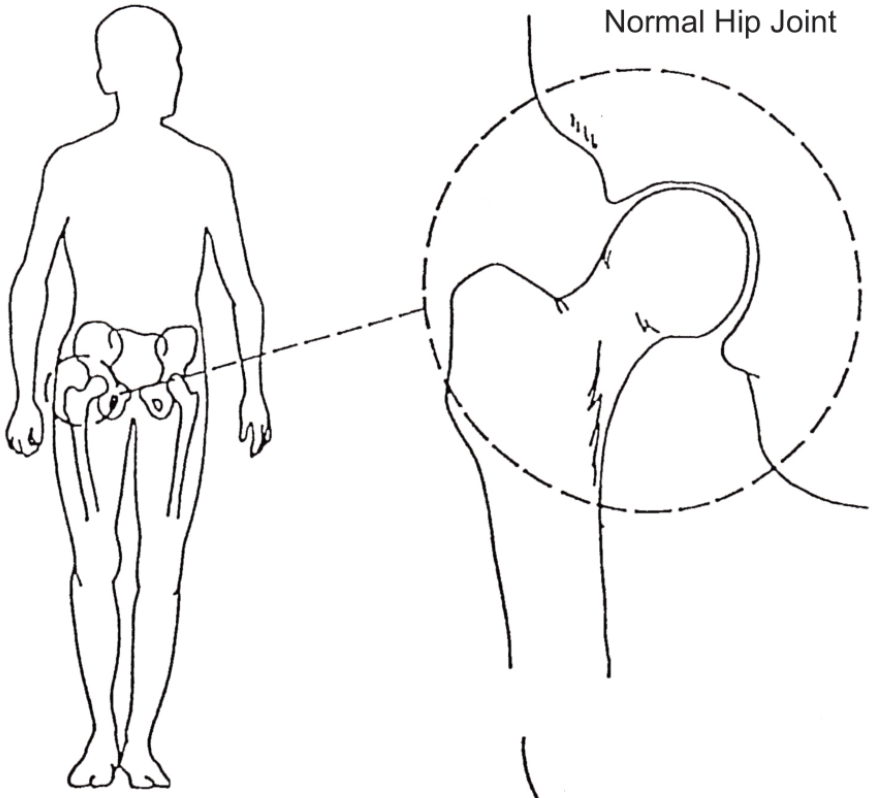
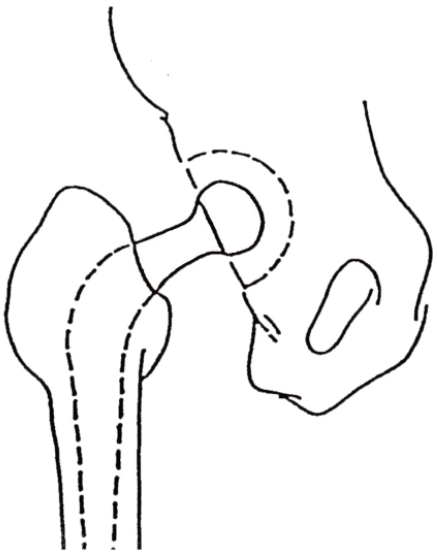
Total Hip Replacement



General Information



Degeneration of Articular Cartilage



Hip after Total Hip Replacement

Home Advice

At this stage you will have some pain due to the incision. Any wrong movement might dislocate the hip due to the weak buttock muscle.

Precautions

1. Never force your hip
2. Avoid sitting in a low chair for the first 3 months after your surgery.
3. Never cross your legs
4. Do not bend your hip above 90 degrees. (Knees below hip)
5. Do not get up from a chair by bending your body forwards. Always slide forward and stand up, pushing through the good leg and stretching the operated leg out in front.
6. Never go into the squatting position.
7. To pick up something: Bend forward with the operated leg stretched out at the back of your body. Never bend down on straight legs.
8. Do not stand with your toes turned in.
9. When sleeping on your back, place a pillow between your legs for 3 months after the operation
10. After 6 weeks you may sleep on your non-operated side, with 3 pillows between our legs.
11. After 3 months you may sleep on the operated side again, also with pillows between your legs, preferable continental pillows.
12. When getting in and out of bed, do it on the operated side as far as possible.
13. Raise your bed at home.
14. Remember to use the toilet seat raise.

Walking

1. For the first month after the operation, walk with both crutches.
2. After 1 month you may use one crutch, UNLESS advised differently. The crutch must be held on the hand opposite to the operated leg. When walking outside, use 2 crutches for safety purposes.

3. After 2 months you may use a walking stick in the hand opposite to the operated leg.

Steps

1. Doing Up: Non operated leg - operated leg - crutches
2. Going down: Crutches - operated leg - non operated leg

Remember all:

Good foot up to heaven, bad foot down to hell!

Driving and traveling

1. Do not drive a car yourself for 6 weeks after the operation.
2. When getting in and out of a car, take care not to cross your legs or bend your hip up too far.

Remember all:

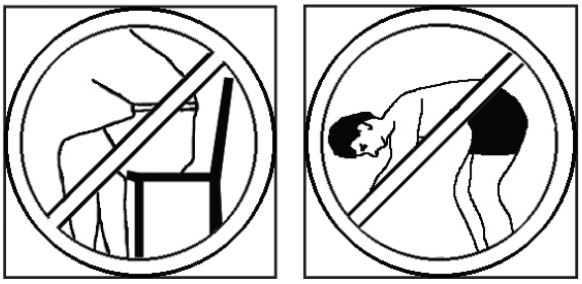
All these measures are taken in order to allow the operation site to heal and to prevent the prosthetic from popping out of the joint (which will cause severe damage to your new hip). It is important to attend your outpatient clinic for follow up appointments. If there are any problems:

1. Swelling and painful calf;
2. Painful, red wound; or
3. You are running a temperature.

Please consult your General Doctor immediately.

Three Basic Rules

1. Do not bend forward at your waist more than 90 degrees.



2. Do not cross the operated leg beyond the middle of your body at any time.

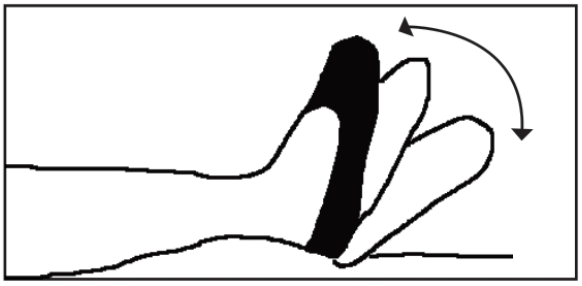
3. Do not rotate your operated leg inward.

Total Hip Replacement Exercise Guide

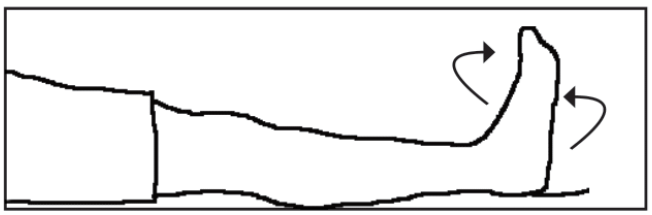
Regular exercises to restore your normal hip motion and strength and a gradual return to everyday activities are important for your full recovery. Your orthopaedic surgeon and physiotherapist may recommend that you exercise 2-3 times a day during your early recovery. They may suggest some of the following exercises.

Early Postoperative Exercises
These exercises are important for increasing circulation to your legs and feet to prevent blood clots. They also are important to strengthen muscles and to improve your hip movement. You may begin these exercises in the recovery room shortly after surgery. It may feel uncomfortable at first, but these exercises will speed your recovery and reduce your postoperative pain. These exercises should be done as you lie on your back with our legs spread slightly apart.

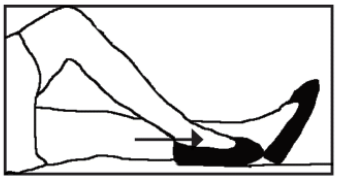
Ankle Pumps
Slowly push your foot up and down. Do this exercise several times as often as every 5 - 10 minutes. This exercise can begin immediately after surgery and continue until you are fully recovered.



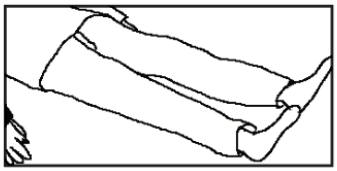
Ankle Rotations
Move your ankle inward toward your other foot and then outward away from your other foot. Repeat 5 times in each direction, 3-4 times a day.



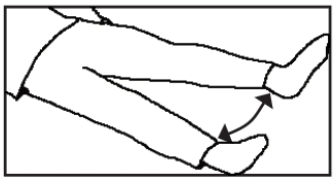
Bed-Supported Knee Bends
Slide your heel toward your buttocks, bending your knee and keeping your heel on the bed. Do not let your knee roll inward. Repeat 10 times, 3 or 4 times a day.



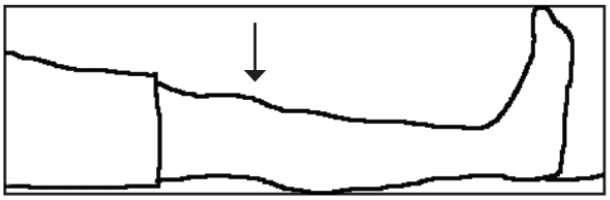
Buttock Contractions
Tighten buttock muscles and hold to a count of 5. Repeat 10 times, 3-4 times a day.



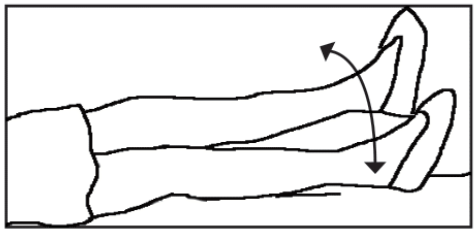
Abduction Exercise
Slide your leg out to the side as far as you can and then back. Repeat 10 times, 3-4 times a day.



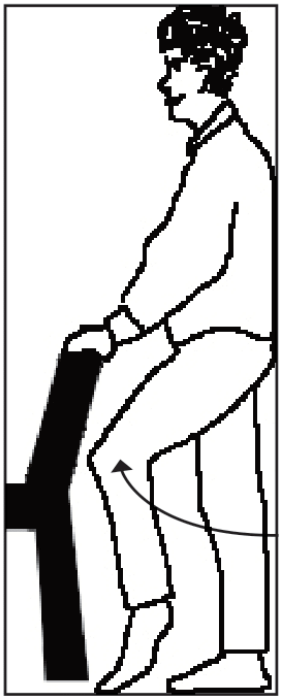
Quadriceps Set
Tighten your thigh muscle. Try to straighten your knee. Hold for 5 to 10 seconds. Repeat this exercise 10 times during a 10 minute period. Continue until your thigh feels fatigued.



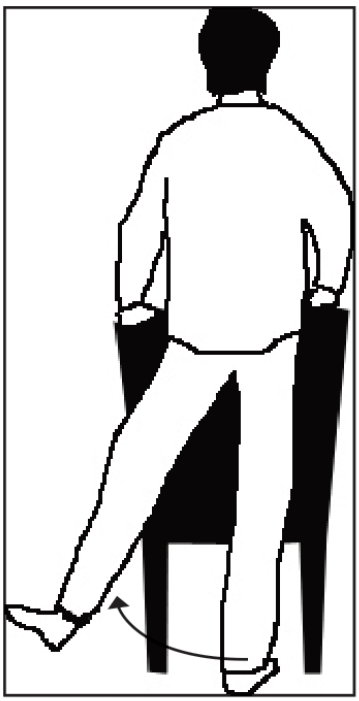
Straight Leg Raises
Tighten your thigh muscle with your knee fully straightened on the bed. As your thigh muscle tightens, lift your leg several inches off the bed. Hold for 5 to 10 seconds. Slowly lower. Repeat until your thigh feels fatigued.



Standing Exercises
Soon after your surgery, you will be out of bed and able to stand. You will require help since you may become dizzy the first several times you stand. As you regain your strength, you will be able to stand independently. While doing these standing exercises, make sure you are holding on to a firm surface such as a bar attached to your bed or a wall.

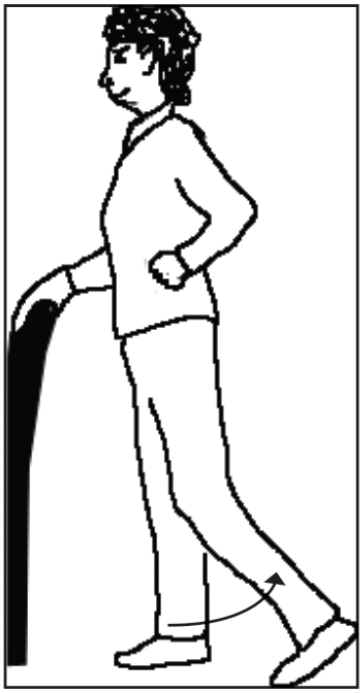


a) Standing Knee Raises
Lift your operated leg toward your chest. Do not lift your knee higher than your waist. Hold for 2 or 3 counts and put your leg down. Repeat 10 times, 3 or 4 times a day.



b) Standing Hip Abduction

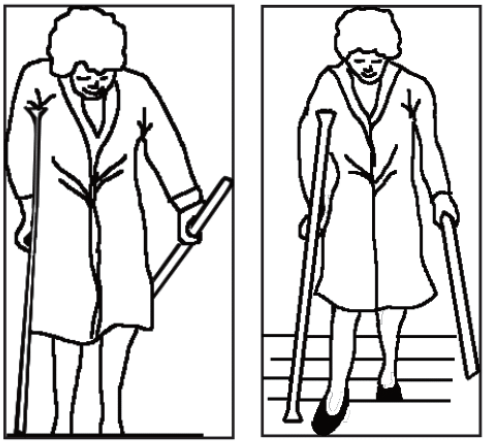
Be sure your hip, knee and foot are pointing straight forward. Keep your body straight. With your knee straight, lift your leg out to the side. Slowly lower your leg so your foot is back on the floor. Repeat 10 times, 3 or 4 times a day.



c) Standing Hip Extensions

Lift your operated leg backward slowly. Try to keep your back straight. Hold for 2 or 3 counts. Return your foot to the floor. Repeat 10 times, 3 or 4 times a day.

Walking and Early Activity
Soon after surgery, you will begin to walk short distances in your hospital room and perform light everyday activities. This early activities helps your recovery by helping your hip muscles regain strength and movement.



Walking with Walker, Full Weight bearing
Stand comfortably and erect with your weight evenly balanced on your walker or crutches. Move your walker or crutches forward a short distance. Then move forward, lifting your operated leg so that the heel of your foot will touch the floor first. As you move, your knee and ankle will bend and your entire foot will rest evenly on the floor. As you complete the step allow your toe to lift off the floor. Move the walker again and your knee and hip will again reach forward for your next step. Remember, touch your heel first, then flatten your foot, then lift your toes off the floor. Try to walk as smoothly as you can. Don't hurry. As your muscle strength and endurance improve, you may spend more time walking. Gradually, you will put more and more weight on your leg.

Walking with Cane or Crutch
A walker is often used for the first several weeks to help your balance and to avoid falls. A cane or a crutch is then used for several more weeks until your full strength and balance skills have returned. Use the cane or crutch in the hand opposite the operated hip. You are ready to use a cane or single crutch when you can stand and balance without your walker, when your weight is placed fully on both feet, and when your are no longer leaning on your hands while using your walker.

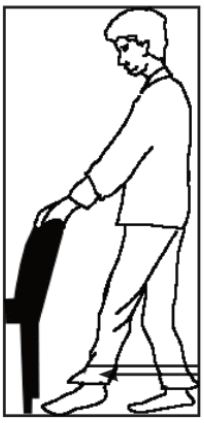
Stair Climbing and Descending
The ability to go up and down stairs requires both flexibility and strength. At first, you will need a handrail for support and you will only be able to go one step at a time. Always lead up the stairs with your good leg and down the stairs with your operated leg. Remember “up with the good” and “down with the bad”. You may want to have someone help you until you have regained most of your strength and mobility. Stair climbing is an excellent strengthening and endurance activity. Do not try to climb steps higher than those of the standard height of seven inches and always use the handrail for balance.

Advanced Exercises and Activities
A full recovery will take many months. The pain from your problem hip before your surgery and the pain and swelling after surgery have weakened your hip muscles. The following exercises and activities will help your hip muscles recover fully.

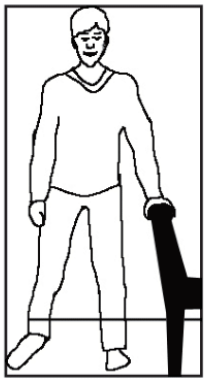
These exercises should be done in 10 repetitions four times a day with one end of the tubing around the ankle of your operated leg and the opposite end of the tubing attached to a stationary object such as a locked door or heavy furniture. Hold on to a chair or bar for balance.

Elastic Tube Exercises

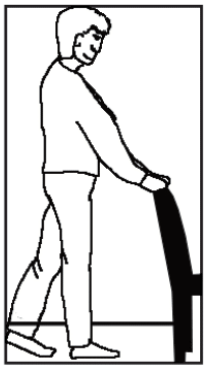
Resistive Hip Flexion
Stand with your feet slightly apart. Bring your operated leg forward keeping the knee straight. Allow your leg to return to its previous position.



Resistive Hip Abduction
Stand sideways from the door and extend your operated leg out to the side. Allow your leg to return to its previous position.



Resistive Hip Extensions
Face the door or heavy object to which the tubing is attached and pull your leg straight back. Allow your leg to return to its previous position.



Exercycling
Exercycling is and excellent activity to help you regain muscle strength and hip mobility. Adjust the seat height so that the bottom of your foot just touches the pedal with your knee almost straight. Pedal backwards at first. Pedal forward only after comfortable cycling motion is possible backwards. As you become stronger (at about 4 to 6 weeks) slowly increase the tension on the exercycle. Exercycle forward 10 to 15 minutes twice a day, gradually building up to 20 to 30 minutes 3 to 4 times a week.

Walking
Take a cane with you until you have regained your balance skills. In the beginning, walk 5 or 10 minutes 3 or 4 times a day. As your strength and endurance improves, you can walk for 20 or 30 minutes 2 or 3 times a day. Once you have fully recovered, regular walks, 20 or 30 minutes 3 or 4 times a week, will help maintain your strength.

Appendix XII: Information Booklet Total Knee Replacement

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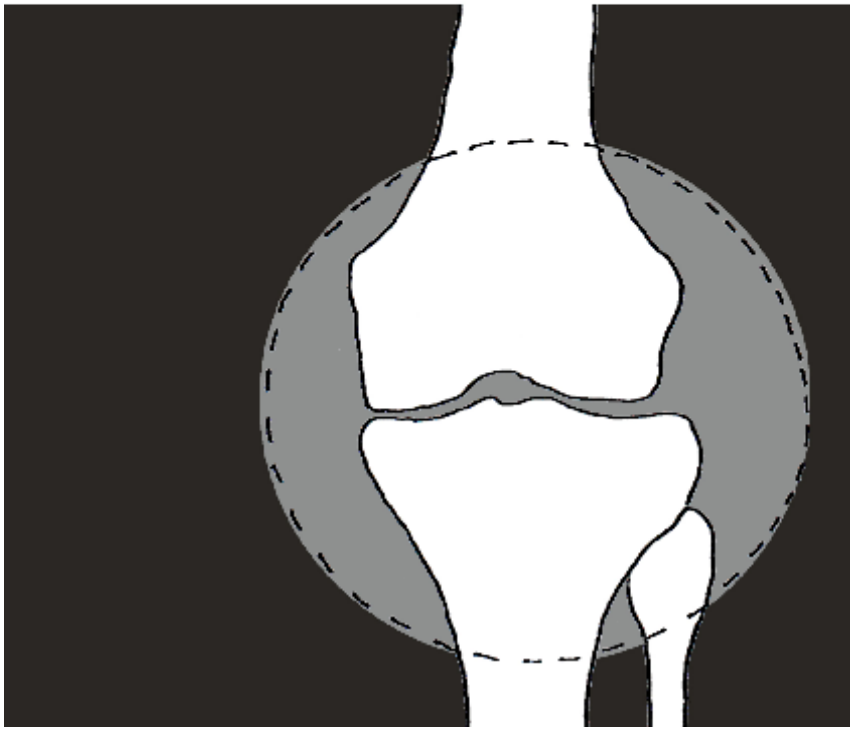
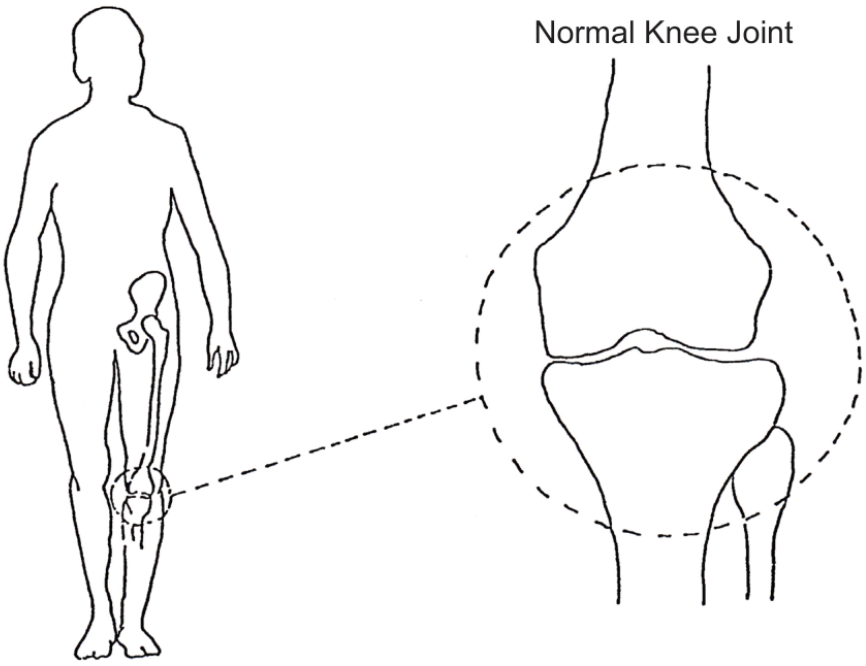
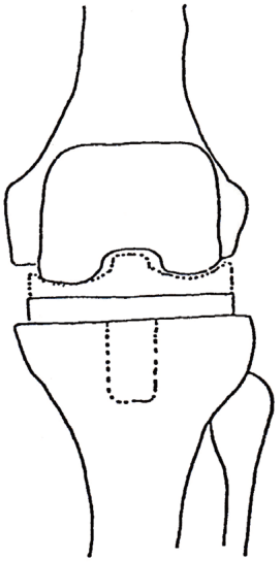
Total Knee Replacement



General Information



Degeneration of Articular Cartilage



Knee as with Total Knee Replacement

Osteo-Arthritis

Osteo-arthritis is:

1. a progressive degeneration of articular (joint) cartilage, ‘wear and tear’ and
2. the formation of osteophytes (bony growths) at the edges of the joint.

The pathology causes symptoms like pain, swelling, stiffness, deformity and loss of function. Treatment of the osteo-arthritic knee can be painkillers and exercise, or at the later stage, a Total Knee Replacement.

Total knee replacement

This operation is carried out to replace/resurface a joint damaged by arthritis. The new joint aims to relieve pain, reduce stiffness and hence improve function.

You knee will be quite stiff after the operation, with a thick bandage around and a small drain from the wound site. By starting some exercises early and regularly, you will increase the bending of your knee and strength of your muscles around the knee. It is important to gain your knee flexion and thigh muscle strength as soon as possible for the best results.

Immediate after the operation

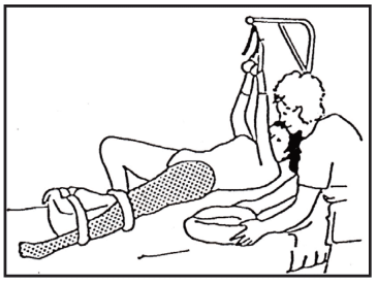
After the operation you need to start with gentle exercises to improve circulation and also deep breathing exercises.

1. Take 5 deep breaths every half an hour, especially the lower lobes, and cough.
2. Wiggle toes (1 minute)
3. Move ankles up and down, also big circles (30 times each)
4. With your leg out straight, push the back of your knees down into the bed while pulling toes and ankles up. This should tighten your thigh muscles (10x5 seconds)

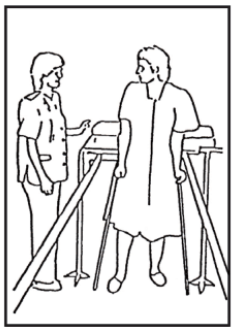
5. Tighten the buttock muscle, hold 5 seconds and relax (10x)

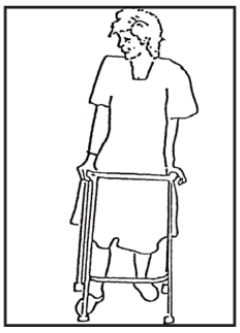
Day 1
If your leg is on a pillow, this should be removed, your drain might be taken out and the thick bandage replaced by a smaller dressing.

1. You will be encouraged to get the knee as straight as possible and will start to attempt to lift your leg off the bed (keeping it straight). Try to lift your leg 20cm off the bed and hold it there for a count of 3 seconds, lower leg slowly down and relax. Do these straight leg raises often.
2. At this stage you will also start to bend the new knee as far as possible with active exercises. You will get some help from the Physiotherapist.
3. You will also start strengthening the muscles around the knee. Do knee extensions over a pillow or towel roll.



Day 2/3 up to day 10
You will continue to progress with your exercises. By the 10th day you should be bending your knee 90 degrees and you should be walking with 1 or 2 crutches. Your stitches will be removed day 10 to 14. Make sure you have an appointment with your physiotherapist after discharge from the hospital.

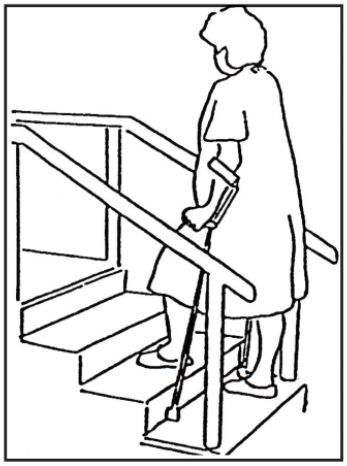




Walking
You will start walking day 1 or 2 with the aid of a walker, progressing to crutches. You will be guided as to how much weight to put through your knee.

The sequence is: Walking aid - operated leg - unoperated leg.

Stairs
Always use a handrail if available, one step at a time.
Going up: Good leg up first - operated leg - crutch(es) alongside.
Going down: Crutch(es) down first - operated leg - good leg.
Remember: Good leg up to heaven, bad leg down to hell.



Once Home
1. Exercise daily 2-3 times. This should be done 6-12 months. You will need to see your physiotherapist as an outpatient
2. Keep your leg elevated when at rest for several weeks to prevent swelling.
3. Your Specialist will normally review you at 6 weeks after surgery. Any queries should be asked then.
4. If you have any kind of infection, or any other problem, report to your GP, as soon as possible.
5. If your calf becomes painful, with or without swelling, or you can suddenly not take weight on the operated leg, go see your GP immediately!

Total Knee Replacement Exercise Guide

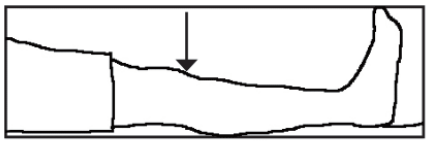
Regular exercise to restore your knee mobility and strength and a gradual return to everyday activities are important for your full recovery. Your orthopaedic surgeon and Physiotherapist may recommend that you exercise approximately 20-30 minutes two or three time a day and walk 30 minutes, two to three times a day during your later recovery.

Your orthopaedic surgeon may suggest some of the following exercises. The following guide can help you better understand your exercise/activity program, supervised by your therapist and orthopaedic surgeon.

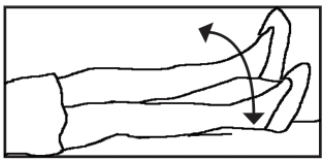
Early Postoperative Exercises

Start the following exercises as soon as you are able. You can begin these in the recovery room shortly after surgery. You may feel uncomfortable at first, but these exercises will speed your recovery and actually diminish your postoperative pain.

Quadriceps Sets
Tighten your thigh muscle. Try to straighten your knee. Hold for 5 to 10 seconds. Repeat this exercise approximately 10 times during a two minute period, rest one minute and repeat. Continue until your thigh feels fatigued.

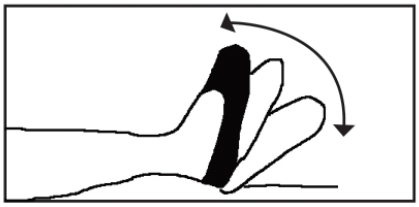


Straight Leg Raises
Tighten the thigh muscle with your knee fully straightened on the bed, as with the Quad set. Lift your leg several inches. Hold for five to 10 seconds. Slowly lower. Repeat until your thigh feels fatigued.

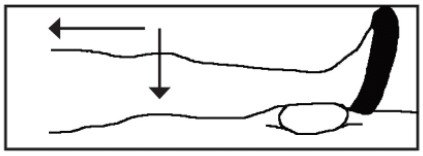


You also can do leg raises while sitting. Fully tighten your thigh muscle and hold your knee fully straightened with your leg unsupported. Repeat as above. Continue these exercises periodically until full strength returns to your thigh.

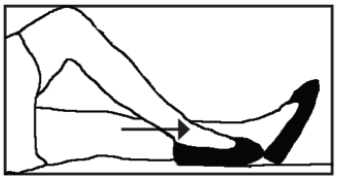
Ankle Pumps
Move your foot up and down rhythmically by contracting the calf and shin muscles. Perform this exercise periodically for two to three minutes, two or three times an hour in the recovery room. Continue this exercise until you are fully recovered and all ankle and lower-leg swelling has subsided.



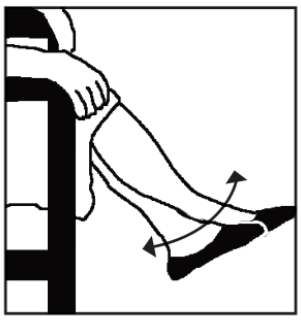
Knee Straightening Exercises
Place a small rolled towel just above your heel so that it is not touching the bed. Tighten your thigh. Try to fully straighten your knee and to touch the back of your knee to the bed. Hold fully straightened for 5 to 10 seconds. Repeat until your thigh feels fatigued.



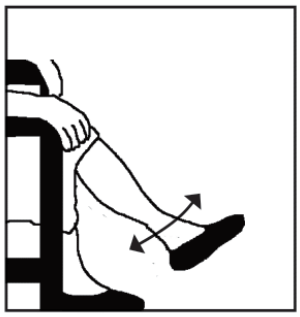
Bed-Supported Knee Bends
Bend your knee as much as possible while sliding your foot on the bed. Hold your knee in a maximally bent position for 5 to 10 seconds and then straighten. Repeat several times until your leg feels fatigued or until you can completely bend your knee.



Sitting Supported Knee Bends
While sitting at bedside or in a chair with your thigh supported, place your foot behind the heel of your operated knee for support. Slowly bend your knee as far as you can. Hold your knee in this position for 5 to 10 seconds. Repeat several times until your leg feels fatigued or until you can completely bend your knee.



Sitting Unsupported Knee Bends
While sitting at bedside or in a chair with your thigh supported, bend your knee as far as you can until your foot rests on the floor. With your foot lightly resting on the floor, slide your upper body forward in the chair to increase your knee bend. Hold for 5 to 10 seconds. Straighten your knee fully. Repeat several times until your leg feels fatigued or until you can completely bend your knee.

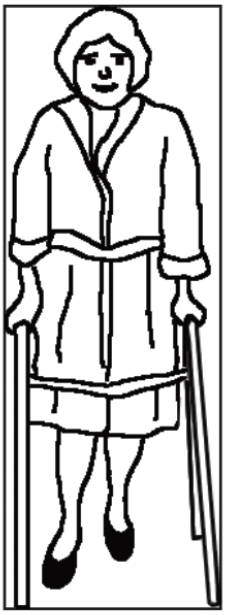


Early Activity

Soon after your surgery, you will begin to walk short distances in your hospital room and perform everyday activities. This early activity aids your recovery and helps your knee regain its strength and movement.

Walking

Proper walking is the best way to help your knee recover. At first, you will walk with a walker or crutches. Your surgeon or therapist will tell you how much weight to put on your leg.



Stand comfortably and erect with your weight evenly balanced on your walker or crutches. Advance your walker or crutches a short distance, then reach forward with your operated leg with your knee straightened so the heel of your foot touches the floor first. As you move forward, your knee and ankle will bend and your entire foot will rest evenly on the floor. As you complete the step, your toe will lift off the floor and your knee and hip will bend so that you can reach forward for your next step. Remember, touch your heel first, then flatten your foot, then lift your toes off the floor.

Walk as rhythmically and smooth as you can. Don’t hurry. Adjust the length of your step and speed as necessary to walk with an even pattern. As your muscle strength and endurance improve, you may spend more time walking. You will gradually put more weight on your leg. You may use a cane in the hand opposite your surgery and eventually walk without an aid.

When you can walk and stand for more than 10 minutes and your knee is strong enough so that you are not carrying any weight on your walker or crutches (often about two to three weeks after your surgery), you can begin using a single crutch or cane. Hold the aid in the hand opposite the side of your surgery. You should not limp or lean away from your operated knee.

Stair Climbing and Descending

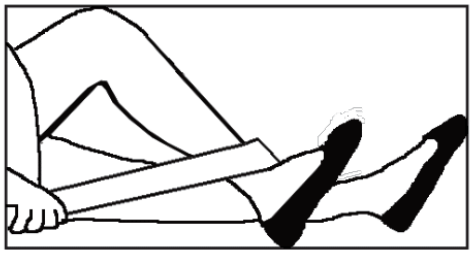
The ability to go up and down stairs requires strength and flexibility. At first, you will need a handrail for support and will be able to go only one step at a time. Always lead up the stairs with your good knee and down the stairs with your operated knee. Remember, “up with the good” and “down with the bad.” You may want to have someone help you until you have regained most of your strength and mobility.

Stair climbing is an excellent strengthening and endurance activity. Do not try to climb steps higher than the standard height (7 inches) and always use a handrail for balance. As you become stronger and more mobile, your can begin to climb stairs foot over foot.

Advanced Exercises and Activities
Once you have regained independence for short distances and a few steps, you may increase your activity. The pain of your knee problems before surgery and the pain and swelling after surgery have weakened your knee. A full recovery will take many months. The following exercises and activities will help you recover fully.

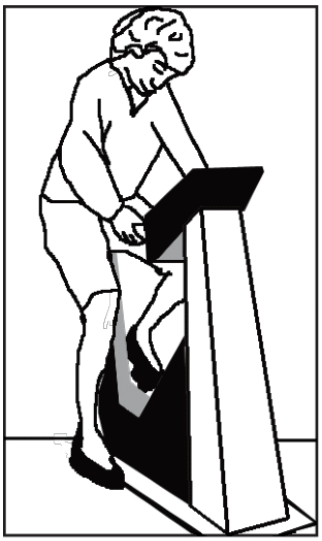
Standing Knee Bends
Standing erect with the aid of a walker or crutches, lift your thigh and bend your knee as much as you can. Hold for 5 to 10 seconds. Then straighten your knee, touching the floor with your heel first. Repeat several times until fatigued.

Assisted Knee Bends
Lying on your back, place a folded towel over your operated knee and drop the towel to your foot. Bend your knee and apply gentle pressure through the towel to increase the bend. Hold for 5 to 10 seconds; repeat several times until fatigued.



Knee Exercises with Resistance
You can place light weights around your ankle and repeat any of the above exercises. These resistance exercises usually can begin four to six weeks after your surgery. Use ½ to 1 kg weights at first; gradually increase the weight as your strength returns. (Inexpensive wrap-around ankle weights with Velcro straps can be purchased at most sporting goods stores.)

Exercycling



Exercycling is and excellent activity to help you regain muscle strength and knee mobility. At first, adjust the seat height so that the bottom of your foot just touches the pedal with your knee almost straight. Peddle backward at first. Ride forward only after a comfortable cycling motion is possible backwards.

As you become stronger (at about four to six weeks) slowly increase the tension on the exercycle. Exercycle for 10 to 15 minutes twice a day, gradually build up to 20 to 30 minutes, three or four times a week.

Pain or Swelling after Exercise. You may experience knee pain or swelling after exercise or activity. You can relieve this by elevating your leg and applying ice wrapped in a towel. Exercise and activity should consistently improve your strength and mobility. If you have any questions or problems, contact your orthopaedic surgeon or physiotherapist.

Appendix XIII: Koo and Colleagues Survey

Appendix 1 (as supplied by the authors): Survey document

Appendix to: Koo KKY, Choong K, Cook DJ, et al. Early mobilization of critically ill adults: a survey of knowledge, perceptions and practices of Canadian physicians and physiotherapists. CMAJ Open 2016. DOI:10.9778/cmajo.20160021. Copyright © 2016 Joule Inc. or its licensors

Canadian Critical Care Trials Group

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

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

Glossary of Terms

ICU: Intensive Care Unit

PCCU: Pediatric Critical Care Unit

ICU-acquired weakness: polyneuropathy, polyneuromyopathy or neuropathy acquired during critical illness.

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 ICU. Patients who receive EM will be progressively rehabilitated through a series of exercises that may begin while they are still receiveing 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), neuro-developmental 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

1. Please select ONE option below that best describes your view of early mobilization:

☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
crucial, should be top priority in the care of ICU patients	very important, should be a priority in the care of ICU patients	important, should be a priority in the care of ICU patients	somewhat important, should be considered in the care of ICU patients	not of great importance, but clinicians should bear it in mind	of minimal importance to the care of ICU patients	of no importance to the care of ICU patients

1.1 Barriers to Early Mobilization in the ICU

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

- routine bed rest orders on ICU admission
- physician orders required prior to mobilization
- insufficient equipment for early mobilization (e.g. ceiling lifts, chairs, walkers etc)
- no written guidelines or protocols for early mobilization
- not enough physical space
- no clinician champion/advocate to promote early mobilization in the ICU
- perceived to be an expensive intervention by administrators or unit leaders
- no institutional barriers
- other institutional barrier(s), please specify

_____

_____

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

- medical instability
- endotracheal intubation
- physical restraints
- risk of dislodgement of devices or lines
- cognitive impairment/cognitive age
- excessive sedation
- inadequate analgesia
- obesity
- frailty
- inadequate nutritional status
- no patient barriers
- other patient barrier(s), please specify

_____

_____

3. *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 ICU/PCCU? 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 in the ICU/PCCU is generally supported but it is not perceived as a priority in the care plan of a critically ill patient						
c) EM in the ICU/PCCU 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 hand-over 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						
l) other *provider* level barrier(s), please specify: _____ _____						

1.2 When to Initiate Mobilization in the ICU/PCCU

4. Generally speaking, when do YOU think mobilization should be initiated in the ICU/PCCU? Please select ALL that apply.

- ☐ as soon as possible following ICU/PCCU admission
- ☐ as soon as the patient's cardio-respiratory status has stabilized (i.e. no escalation in hemodynamic or ventilatory support)
- ☐ as soon as the patient is extubated
- ☐ as soon as the patient is off all vasoactive infusions
- ☐ as soon as the patient is conscious and can cooperate
- ☐ as soon as all sedative infusions are discontinued
- ☐ as soon as the patient is ready to be transferred out of the ICU
- ☐ other, please specify _____

1.3 Level of Activity

5. For each of the following scenarios, assume that the patients are previously ambulatory and are currently 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) thoracio-lumbar spinal injury							
e) within 24 hrs of treated myocardial infarction (cardiac enzymes persistently elevated)							
f) within 24 hrs of treated myocardial infarction (cardiac enzymes decreasing)							
g) coagulopathy (INR > 3)							
h) thrombocytopenia (platelet count < 20 x10^9/L)							
i) delirium (fluctuating level of consciousness, at times inattentive or agitated)							
j) within 24 hrs 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) 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 (i.v. heparin infusion, warfarin)							

6. Consider a patient admitted to the ICU/PCCU 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 Intensive Care Unit Acquired Weakness (ICU-AW)

7. What do YOU think is the approximate incidence of ICU-AW in the population of general medical-surgical ICU patients?

- < 5%
- 5-10%
- 11-20%
- 21-40%
- > 40%
- Don't know

2.2 Current Literature

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

- yes
- 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.

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

- I feel well trained and informed to mobilize mechanically ventilated patients.
- I feel somewhat trained and informed to mobilize mechanically ventilated patients.
- 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 ICU/PCCU without prompting or requests by other clinician groups?

- yes
- no
- unsure

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

- registered nurse
- physician
- physiotherapist
- occupational therapist
- respiratory therapist
- other, please specify _____

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

- technically, yes
- no
- unsure

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

- yes
- no
- unsure

15. Does YOUR ICU/PCCU have at least one clinician who serves as a champion for early mobilization?

- yes
- no
- unsure

16. If the ICU/PCCU you work in has at least one champion who promotes early mobilization, what discipline is she/he from?

- PT
- MD
- RN
- RT
- unsure

3.2 Intensity & Frequency of Mobilization

17. On average, what is the daily duration of mobilization performed by physiotherapists in YOUR ICU/PCCU 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 co-operative but can not ambulate yet							
d) a patient who is intubated, mechanically ventilated, alert, interactive/cooperative and can ambulate							

18. How frequently is mobilization performed by a physiotherapist in YOUR ICU 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 can not ambulate yet									
d) a patient who is intubated, mechanically ventilated, alert, interactive/cooperative and can ambulate									

3.3 Staffing in the ICU/PCCU

19. Who participates in the mobilization of patients in YOUR ICU/PCCU?
Please select ALL that apply.

- registered nurse
- physician
- physiotherapist
- occupational therapist
- respiratory therapist
- health care aide (i.e. physical therapy assistant, nurse aide etc)
- family member or home caregiver
- other, please specify _____

20. Is there a designated physiotherapist working in YOUR ICU/PCCU during the following times?

Time	available for full assessments & mobilization	available for limited assessments & mobilization	available only for cardio-respiratory/ chest physiotherapy	not available	unsure
regular weekday hours (Monday - Friday)					
weekday evenings (after 17:00, Monday-Friday)					
weekends (Saturday, Sunday) & holidays					

3.4 Types of Physiotherapy Techniques Performed

21. In general, how often are these physiotherapy techniques used in ICU/PCCU 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) transfers						
g) pre-gait activities						
h) gait training/ambulation						
i) treadmill						
j) neuromuscular electrical stimulation						
k) cycle ergometer						
l) dynamic tilt table						
m) other, please specify _____						

3.5 Workload of the Physiotherapist

22. Please answer the following questions about YOUR workload in the ICU/PCCU:

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

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

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

- full time
- part time

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

3.6 Sedation Practices

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

- routinely
- frequently
- sometimes
- infrequently
- never
- unsure

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

- routinely
- frequently
- sometimes
- infrequently
- never
- unsure

3.7 Rehabilitation following ICU/PCCU Discharge

25. Are patients with suspected ICU acquired weakness routinely referred to an outpatient clinic after ICU/PCCU discharge for long term rehabilitation?

- yes
- no
- unsure

26. To whom are the patients with suspected ICU acquired weakness referred?

- family physician
- general internist/paediatrician
- neurologist
- physiotherapist
- occupational therapist
- rehabilitation specialist
- intensivist
- other, please specify _____
- patients with ICU acquired weakness are not routinely referred to outpatient clinics
- unsure

4.1 Clinician Demographics

27. What type of clinician are you?

- physiotherapist
- physician
- registered nurse

28. What is your primary area of practice?

- adult
- paediatric

29. What type(s) of ICU(s) do you work in? Please select ALL that apply.

- medical-surgical ICU
- cardiovascular ICU
- neurological ICU
- trauma ICU
- burn ICU

Thank you very much for completing this survey!

Please return completed survey in the pre-addressed, pre-paid envelope provided.

Appendix XIV: HREC Approval

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E52-24 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 404 7682
Email: nosi.tsama@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

27 February 2018

HREC REF: 116/2018

Ms I du Plessis
Health & Rehab Sciences
Division of Physiotherapy
Old Main Building

Dear Ms du Plessis

PROJECT TITLE: MOBILITY PRACTICES, ATTITUDES AND PERCEPTIONS OF NURSES, DOCTORS AND PHYSIOTHERAPISTS REGARDING EARLY MOBILISATION OF CRITICALLY-ILL PATIENTS IN INTENSIVE CARE UNIT IN NAMIBIA. A RETROSPECTIVE RECORD REVIEW AND CROSS-SECTIONAL SURVEY. (MSc candidate- Ms S Francis)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study. This is subject to all local HREC and institutional approval.

Approval is granted for one year until the 28th February 2019.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student Miss Savarna Francis will be involved in this study.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval before the research may occur.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Yours sincerely

Signature removed

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.

Institutional Review Board (IRB) number: IRB00001938

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI),and Declaration of Helsinki (2013) guidelines.

The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Appendix XV: Study Deviation

HUMAN RESEARCH ETHICS COMMITTEE
18 NOV 2019
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

UNIVERSITY OF CAPE TOWN
FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

Form FHS011: Study deviation

HREC office use only (FWA00001637; IRB00001938)			
This serves as acknowledgement of a protocol deviation as described below.			
Chairperson of the HREC signature	Signature Removed	Date	18/11/2019

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	15/11/2019
HREC REF Number	116/2018
Project Title	Mobility practices, attitudes and perceptions of nurses, doctors and physiotherapists regarding early mobilisation of critically-ill patients in intensive care units in Namibia. A retrospective record review and cross-sectional survey.
Protocol number (if applicable)	
Principal Investigator	Ilse du Plessis
Department / Office Internal Mail Address	Ilse.duplessis@uct.ac.za

2. Protocol deviation description

Please describe the deviation below, including the reason why the deviation occurred.
Data collected within ethics approved date (28 February 2019) but still busy with data analysis and final write up.

3. Follow-up actions

3.1 Please describe any follow-up action(s) taken or planned as a result of this deviation e.g. DSMB reporting, report to sponsor, informing participants.
N/a, student only need extension to finalise write up, all data has been collected already
3.2 Please describe what action(s) have or will be taken to prevent similar deviations in future.
Ensure thesis is finalised within ethics approved timeframe

4. Principal Investigator's acknowledgement of responsibility

This signature indicates the PI has reviewed the deviation, taken appropriate follow-up action and implemented or plans to implement preventative steps where possible.			
Signature of PI	Signature Removed	Date	15/11/2019

Appendix XVI: Ethics Extension

UNIVERSITY OF CAPE TOWN

HUMAN RESEARCH ETHICS COMMITTEE
14 DEC 2020
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938) **This serves as notification of annual approval, including any documentation described below.**			
☑ Approved	Annual progress report	Approved until/next renewal date	30.11.21
☐ Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee	Signature Removed	Date Signed	14/12/20

Note: Please note that incomplete submissions will not be reviewed.
Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.
Please clarify your plan for research-related activities during COVID-19 lockdown

Comments to PI from the HREC

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	10 December 2020		
HREC REF Number	116/2018	Current Ethics Approval was granted until	30/11/2020
Protocol title	Mobility practices, attitudes and perceptions of nurses, doctors and physiotherapists regarding early mobilisation of critically-ill patients in intensive care units in Namibia. A retrospective record review and cross-sectional survey.		
Protocol number (If applicable)			
Are there any sub-studies linked to this study?	☐ Yes ✓☐ No		
If yes, could you please provide the HREC Ref's for all sub-studies? **Note:** A separate FHS016 must be submitted for each sub-study.			

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

Appendix XVII: Mediclinic Ethics Approval

MEDICLINIC

MEDICLINIC CORPORATE OFFICE
25 DU TOIT STREET
STELLENBOSCH
7600
SOUTH AFRICA

PO BOX 456
STELLENBOSCH
7599
SOUTH AFRICA

T +27 21 809 6500

www.mediclinic.co.za

11 May 2018

Ms S Francis
PO Box 6902
Windhoek
Namibia
9000

Savarna.Francis@gmail.com

Dear Ms Francis

PERMISSION TO CONDUCT RESEARCH AT MEDICLINIC MIDSTREAM

Your research proposal entitled "*Mobility practices, attitudes and perceptions of nurses, doctors and physiotherapists regarding early mobilisation of critically-ill patients in Intensive Care Units in Namibia. A retrospective record review and cross-sectional survey*" refers.

It is in order for you to conduct your research at Mediclinic Windhoek, and I wish you success with this project.

Yours sincerely

Signature Removed

Dr Chris du Plessis
General Manager Clinical Services
MEDICLINIC SOUTHERN AFRICA

ETHICS LINE +27 12 543 5332
TOLL-FREE 0800 005 316 (SOUTH AFRICA ONLY)

MEDICLINIC (PTY) LTD
REG. NO. 1969/009218/07

Appendix XVIII: Roman Catholic Hospital Research Permission

ROMAN CATHOLIC HOSPITAL
P.O. Box 157, TEL 2702004, FAX 2702034
WINDHOEK, NAMIBIA

15 August 2018

Miss Savarna Francis

PO Box 6902

Windhoek

Dear Miss Francis

PERMISSION TO CONDUCT RESEARCH AT ROMAN CATHOLIC HOSPITAL

Your research project titled: *"Mobility Practices, Attitudes and Perceptions of Nurses, Doctors and Physiotherapists Regarding Early Mobilisation of Critically-ill Patients in Intensive Care Units in Namibia. A Retrospective Record Review and Cross-Sectional Survey"* refers.

You are granted permission to conduct your research at Roman Catholic Hospital.

I wish you every success with this project

Yours sincerely

Signature Removed

Sr Sarah Gocela

Hospital Administrator

Roman Catholic Hospital

ROMAN CATHOLIC HOSPITAL
Practice No: 0560735
P.O. Box 157
Fax: 061-270 2033
Tel: 061-270 2004
WINDHOEK

Appendix XIX: Namibian Society of Physiotherapy Research Permission

Namibian Society of Physiotherapy

P.O. Box 23321 • Windhoek • Namibia •

30 January 2019

Miss Savarna Francis

PO Box 6902

Windhoek

Dear Miss Francis

PERMISSION TO CONDUCT ELECTRONIC SURVEY ON MEMBERS OF THE NAMIBIAN SOCIETY OF PHYSIOTHERAPY (NSP)

Your research project titled "Mobility practices, attitudes and perceptions of nurses, doctors and physiotherapists regarding early mobilisation of critically-ill patients in Intensive Care Units in Namibia. A retrospective record review and cross-sectional survey" refers.

You are granted permission to have the electronic version of your survey sent out to the members of the NSP

Please provide us with the fillable survey or survey link so that we can distribute it to the members

We wish you great success with this project

Yours sincerely

Signature Removed

Christine Nashenda
Chairperson
Namibian Society of Physiotherapy

Page 1 of 1

Appendix XX: Survey

Attitudes and Perceptions of Nurses, Doctors and Physiotherapists Regarding Early Mobilisation of Critically-ill Patients in Intensive Care Units in Namibia

Glossary

ICU: Intensive Care Unit

ICU-acquired weakness: Polyneuropathy, polyneuromyopathy, or neuropathy acquired during critical illness

Mobilisation: Physiotherapy involving active or assisted patient mobility. May include bed mobility, sitting, standing, ambulation or active exercises. Does not include passive range of motion

Early Mobilisation: Physiotherapy and acute rehabilitation started within 48 hours of admission to ICU. Patients who receive EM are progressively rehabilitated through a series of exercises that may begin while they are still on mechanical ventilation

Non-mobility Physiotherapy
Chest physiotherapy: techniques to improve ventilation-perfusion matching and respiratory mechanics including deep breathing exercises, airway secretion clearance, and percussion techniques **Passive Range of Motion:** passive movement performed by providers
Mobility Physiotherapy
Active Range of Motion: unassisted patient movement Strengthening Exercises: muscle strengthening (can include bedside ergometer) Bed Mobility: activities done in bed (e.g. active or assisted repositioning in bed or rolling from side to side) Transfers: trunk control, unsupported sitting, sitting at edge of bed, sit to stand, bed to chair or commode Pre-Gait: weight shifting, marching- on-the-spot, sideways stepping Ambulation: walking/gait training with or without walking aid and/or assistance

Do you have at least one year of experience working in ICU?

- ☐ Yes
- ☐ No

If yes, you may continue answering the questionnaire. Please state number of years of experience you have working in ICU: _____

Clinician Demographics

1. What type of clinician are you?

- ☐ Physiotherapist
- ☐ Doctor (state specialisation): _____
- ☐ Nurse

2. What is your primary area of practice?

- ☐ Adult
- ☐ Paediatric

3. What type/s of ICU/s do you work in? Please select ALL that apply

- ☐ Medical-surgical ICU
- ☐ Cardiovascular ICU
- ☐ Neurological ICU
- ☐ Trauma ICU
- ☐ Burn ICU
- ☐ General ICU

☐ Mixed ICU
☐ Spinal ICU

4. Did you specialise in ICU?

☐ Yes
☐ No
☐ Not Applicable

5. Do you have any postgraduate training in ICU?

☐ Yes
☐ No

6. Where did you receive your undergraduate training?

☐ University of Cape Town
☐ Stellenbosch University
☐ University of the Witwatersrand
☐ University of the Western Cape
☐ Rhodes University
☐ University of Fort Hare
☐ University of Johannesburg
☐ University of Kwa-Zulu Natal
☐ Northwest University
☐ University of Pretoria
☐ University of the Free State
☐ University of Limpopo
☐ University of South Africa
☐ University of Venda
☐ University of Namibia
☐ Nursing College (please specify) _____
☐ Other (please specify) _____

Perceptions

Personal View of Early Mobilisation in the ICU

1. Please select ONE option below that best describes your view of early mobilisation:

☐ Very Important, should be a priority in ICU	☐ Important, should be a priority in ICU	☐ Somewhat important, should be considered for ICU patients	☐ Not of great importance, but clinicians should bear it in mind	☐ Of no importance to the care of ICU patients

When to Initiate Mobilisation in the ICU

8. When do YOU think mobilisation should begin in ICU? Please select ALL that apply.

☐ As soon as possible after ICU admission
☐ As soon as the patient's cardio-respiratory status has stabilised (i.e. no escalation in haemodynamic or ventilator support)
☐ As soon as the patient is extubated

☐ As soon as the patient is off all vasoactive infusions
☐ As soon as the patient is conscious and can co-operate
☐ As soon as all sedative infusions are discontinued
☐ As soon as the patient is ready for discharge from ICU
☐ Other, PLEASE SPECIFY _____

Level of Activity

9. In the following scenarios, assume the patients are previously ambulatory, currently physiologically stable on mechanical ventilation, receiving no inotropes and minimally sedated. They have purposeful motor response and can obey verbal commands. What is the HIGHEST patient activity level you would allow in each scenario? Please select ONE response for each.

Diagnosis/Condition	Bed rest	Passive Range of Motion	Active Range of Motion	Standing	Transfers to Chair	Walking	Not Sure
Head trauma without increased intracranial pressure							
Head trauma with increased intracranial pressure							
Cervical spinal injury							
Thoraco-lumbar spinal injury							
Within 24 hrs of treated myocardial infarction (cardiac enzymes persistently elevated)							
Within 24 hrs of treated myocardial infarction (cardiac enzymes decreasing)							
Coagulopathy (INR > 3)							
Thrombocytopaenia (platelet count < 20 x 10 9/L)							
Delirium							
Within 24 hours of uncomplicated coronary bypass surgery							
Deep vein thrombosis (receiving therapeutic anti-coagulation)							
Obesity							
Frailty							
<u>Devices</u> Pulmonary artery catheter							
Intra-aortic balloon pump							
Femoral central venous catheter							
Radial arterial catheter							
Dialysis line inserted at subclavian site (during non-dialysis periods)							
Dialysis line inserted at femoral site (during non-dialysis periods)							
Continuous renal replacement therapy (during dialysis such as PRISMA)							
Extra corporeal membrane oxygenation							
High frequency oscillation							

Diagnosis/Condition	Bed rest	Passive Range of Motion	Active Range of Motion	Standing	Transfers to Chair	Walking	Not Sure
Conventional mechanical ventilation via endotracheal tube							
Conventional mechanical ventilation via tracheostomy							
Chest tube							
Non-invasive positive pressure ventilation							
Foley catheter							
<u>Drugs</u> Full anti-coagulation (i.v. heparin, warfarin)							

10. Consider a patient admitted to ICU, intubated and mechanically ventilated. What maximum patient activity level would you allow for each scenario? Please select ONE response for each.

High Dose Inotropes: *Dopamine (10-20 mcg/kg/min); Dobutamine (40mcg/kg/min); Epinephrine (>4mcg kg/min); Norepinephrine (>30mcg/kg/min); Phenylephrine (8-10mcg/kg/min)*

Low Dose Inotropes: *Dopamine (0-5 mcg/kg/min); Dobutamine (5mcg/kg/min); Epinephrine (0.04-1mcg/kg/min); Norepinephrine (0.01-2mcg/kg/min); Phenylephrine (0.5-1mcg/kg/min)*

Physiological Status	Bed rest	Passive Range of Motion	Active Range of Motion	Standing	Transfers to chair	Ambulation	Not Sure
<u>Cardiovascular</u> Three or more vasopressors or inotropic infusions							
Two vasopressors or inotropic infusions							
One high dose vasopressor or inotropic infusion							
One medium dose vasopressor or inotropic infusion							
One low dose vasopressor or inotropic infusion							
No vasopressors or inotropes							
<u>Respiratory</u> Minimal pressure support on conventional mode mechanical ventilation							
Moderate pressure support on conventional mode mechanical ventilation (e.g. FiO_2 0.5, PEEP 10)							
Advanced mode of mechanical ventilation (e.g. high frequency oscillation)							

Physiological Status	Bed rest	Passive Range of Motion	Active Range of Motion	Standing	Transfers to chair	Ambulation	Not Sure
Neurologic Unresponsive to verbal and motor stimulation							
Purposeful motor response, not obeying verbal commands							
Purposeful motor response, obeys verbal commands							

Knowledge

Intensive Care Unit Acquired Weakness

11. What do YOU think is the approximate incidence of ICUAW in the population of ICU patients?

- ☐ < 5%
- ☐ 5-10%
- ☐ 11-20%
- ☐ 21-40%
- ☐ > 40%
- ☐ Don't know

Current Literature

12. Are YOU familiar with any clinical trials or literature on early mobilisation of critically-ill patients?

- ☐ Yes
- ☐ No

13. What do the clinical studies on early mobilisation of critically-ill patients in ICU show? Select ALL true responses.

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

Practical and Technical Skills

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

- ☐ I feel well trained and informed to mobilise mechanically ventilated patients
- ☐ I feel somewhat trained and informed to mobilise mechanically ventilated patients
- ☐ I do not feel sufficiently trained or informed to mobilise mechanically ventilated patients

Practice

Assessment for Need of Rehabilitation

15. Are all patients automatically assessed for appropriateness to begin mobilisation by the physiotherapist in YOUR ICU without prompting or requests by other clinician groups?

- ☐ Yes
- ☐ No
- ☐ Unsure

16. Who is generally the first healthcare provider to identify if a patient is ready for mobilisation? Please select ONE response only.

- ☐ Registered nurse
- ☐ Physician
- ☐ Physiotherapist
- ☐ Occupational therapist
- ☐ Other, PLEASE SPECIFY _____

17. Does the initial physiotherapist assessment on each patient require a written or verbal order by a doctor?

- ☐ Yes
- ☐ No
- ☐ Unsure

18. Does YOUR ICU have documented protocols, policies or guidelines on when a patient should begin mobilisation?

- ☐ Yes
- ☐ No
- ☐ Unsure

19. Does YOUR ICU have at least one clinician serving as an early mobilisation champion?

- ☐ Yes
- ☐ No
- ☐ Unsure

20. If yes, what discipline is he/she from?

- ☐ Physiotherapy
- ☐ Medicine
- ☐ Nursing
- ☐ Unsure

Sedation Practices

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

- ☐ Routinely
- ☐ Frequently
- ☐ Sometimes
- ☐ Infrequently
- ☐ Never
- ☐ Unsure

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

DOCTORS ONLY TO ANSWER THIS QUESTION

- ☐ Routinely
- ☐ Frequently
- ☐ Sometimes
- ☐ Infrequently
- ☐ Never
- ☐ Unsure

Duration, Frequency and Intensity of Mobilisation

PHYSIOTHERAPISTS ONLY TO ANSWER Questions 23 to 25

23. What is the average daily duration of mobilisation in YOUR ICU of the following critically-ill patients? Please select ONE response for each condition

Condition	None	<15min	16-30min	31-45min	46-60min	>60min	Unsure
Intubated, mechanically ventilated, deeply sedated and unconscious							
Intubated, mechanically ventilated, inattentive and uncooperative							
Intubated, mechanically ventilated, alert, interactive and cooperative but cannot ambulate yet							
Intubated, mechanically ventilated, alert, interactive/cooperative and can ambulate							
Extubated, alert, interactive/cooperative and can ambulate							

24. How frequently do you mobilise the following critically-ill patients? Please select ONE response for each condition

Condition	None	Once/week	1-2/week	3-4/week	5-6/week	Once daily	Twice daily	>Twice daily	Unsure
Intubated, mechanically ventilated, deeply sedated. Unconscious									
Intubated, mechanically ventilated, inattentive. Uncooperative									
Intubated, mechanically ventilated, alert, interactive, cooperative. Cannot walk yet									
Intubated, mechanically ventilated, alert, cooperative. Can walk									
Extubated, alert, cooperative. Can walk									

25. With what intensity do you mobilise the following critically-ill patients? Please select all that apply

Condition	Passive Movements	Assisted bed-mobility (e.g. roll, bridge, move up in bed)	Assisted sitting at edge of bed	Independent sitting at edge of bed	Sit to stand with assistance	Assisted standing	Assisted standing transfer to chair	Assisted walking	Unassisted walking	Unsure
Intubated, mechanically ventilated, deeply sedated and unconscious										
Intubated, mechanically ventilated, inattentive and uncooperative										
Intubated, mechanically ventilated, alert, interactive and cooperative but cannot ambulate yet										
Intubated, mechanically ventilated, alert, interactive/cooperative and can ambulate										
Extubated, alert, interactive/cooperative and can ambulate										

As the patient improves, do you:

a) Decrease assistance (manual assistance and mobility aids)?
   - ☐ Yes
   - ☐ No

b) Increase the amount of time spent on an activity?
   - ☐ Yes
   - ☐ No

c) Add upper limb and lower limb exercises?
   - ☐ Yes
   - ☐ No

d) Progress assisted standing to marching-on-the-spot and taking a few steps?
   - ☐ Yes
   - ☐ No

e) During walking/gait training, do you add ADLs (activities of daily living), steps or stairs?
   - ☐ Yes
   - ☐ No

Staffing in the ICU

26. Who participates in the mobilisation of patients in YOUR ICU?

- ☐ Nurse
- ☐ Physician
- ☐ Physiotherapist
- ☐ Occupational therapist
- ☐ Health care aide (i.e. nurse aid, porter)
- ☐ Family member or home caregiver

☐ Other, PLEASE SPECIFY _____

27. Is there a designated physiotherapist working in YOUR ICU during the following times? Please select ONE option for each time-period.

Time-Period	Full assessments and mobilisation	Limited assessments and mobilisation	Chest physiotherapy only	Not available	Unsure
Regular weekday hours (Monday-Friday)					
Weekday evenings (after 17:00, Monday to Friday)					
Weekends (Saturday, Sunday and holidays)					

Physiotherapy Techniques Performed

PHYSIOTHERAPISTS ONLY TO ANSWER QUESTION 28 and 29

28. How often are these physiotherapy techniques used in ICU patients suitable for rehabilitation? Please select only ONE answer for each type of treatment.

Physiotherapy Technique	Never	Infrequently	Sometimes	Frequently	Routinely	unsure
Chest physiotherapy						
Passive range of motion						
Active range of motion						
Strengthening exercises						
Bed mobility						
Transfers						
Pre-gait activities						
Gait training/ambulation						
Treadmill						
Neuromuscular stimulation						
Cycle ergometer						
Dynamic tilt table						
Other, PLEASE SPECIFY						

Physiotherapist Workload

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

a) On average, how many ICU patients do you see 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 ICU?

☐ Full time
☐ Part time

d) What is the duration of your shift? _____hours

Rehabilitation After ICU Discharge

30. Are patients with suspected ICU-acquired weakness routinely referred to an outpatient clinic after ICU discharge for long term rehabilitation?

- ☐ Yes
- ☐ No
- ☐ Unsure

31. If yes, where are these patients referred? Please select all that apply.

- ☐ Family physician
- ☐ General internist
- ☐ Neurologist
- ☐ Physiotherapist
- ☐ Occupational therapist
- ☐ Rehabilitation specialist
- ☐ Intensivist
- ☐ Other, PLEASE SPECIFY
- ☐ Unsure

Barriers to Early Mobilisation in the ICU

32. What are the most important institutional barrier/s (customs and behaviour patterns in your work environment) to early mobilisation in YOUR ICU? Please select ALL that apply or "no institutional barriers" if there are none.

- ☐ Routine bed rest orders on admission
- ☐ Physician orders required prior to mobilisation
- ☐ Insufficient equipment for early mobilisation (e.g. hoists, chairs, walkers etc.)
- ☐ No written guidelines or protocols for mobilisation
- ☐ Not enough physical space
- ☐ No clinician champion to promote early mobilisation in ICU
- ☐ Perceived an expensive intervention by administrators or unit leaders
- ☐ No institutional barriers
- ☐ Other institutional barrier/s, PLEASE SPECIFY

_____

33. What are the most important patient level barriers to early mobilisation in YOUR ICU? Please select ALL that apply or "no patient barriers" if there are none.

- ☐ Medical instability
- ☐ Endotracheal intubation
- ☐ Physical restraints
- ☐ Risk of dislodgment of devices or lines
- ☐ Cognitive impairment/cognitive age
- ☐ Excessive sedation
- ☐ Delirium
- ☐ Inadequate analgesia
- ☐ Obesity
- ☐ Frailty
- ☐ Inadequate nutritional status
- ☐ No patient barriers

☐ Other patient barrier/s, PLEASE SPECIFY

_____

34. What are the most important provider level barriers to early mobilisation in YOUR ICU? Please select ALL providers that contribute to that barrier. If you believe the listed barrier is NOT important, select "None".

POTENTIAL PROVIDER BARRIER	Doctor	Nurse	Physiotherapist	NONE
Limited staffing to routinely mobilise patients				
EM in the ICU is generally supported but not perceived a priority				
EM in the ICU is generally perceived as important but is not supported by some individuals				
Lack of communication among clinician groups to facilitate EM during bedside rounds				
Lack of communication about rehabilitation during handover at shift change				
Lack of co-ordination among providers to facilitate EM				
Slow to recognise when patients should begin EM				
Lack of decision-making authority to initiate EM				
Conflicting perceptions of suitability of EM for patients				
Safety concerns about EM				
Inadequate training to facilitate EM				
Other provider level barrier/s. PLEASE SPECIFY: _____ _____				

Thank you for completing this survey!

Appendix XXI: Glossary of Data Elements in Record Review

Glossary of Data Elements in Record Review

Hospital Number	The number assigned to each of the two participating hospitals
ICU Type	The type of ICU (medical-surgical/cardiothoracic/neurological/trauma/burn/general/mixed/spinal) to which the patient was admitted
Date Recorded	The date expressed as DD-Month-YY when data from the chart was abstracted
Sex	Sex expressed as male or female
Age	A numeric value representing the patient's age in years
Admission Diagnosis	The diagnosis of the patient on day of admission
Source of Admission	Place that sent patient to the ICU (casualty/wards/theatre/other hospital/cathlab/unspecified)
Time of Admission was admitted to ICU	A numeric value representing the time at which the patient
Timing of Admission	Expressed as immediately or delayed
Type of Admission	Expressed as emergency or elective
Ventilated (ventilation status)	A tick-box to indicate if the patient was ventilated or not. Include both invasive and non-invasive ventilation
Type of Mechanical Ventilation (If ventilated)	The mode of mechanical ventilation the patient received: (assist-control/synchronized intermittent mechanical ventilation/pressure controlled/pressure support/pressure controlled inverse ratio/airway pressure release/pressure regulated volume control/proportional assist/neurally adjusted ventilatory assist/CPAP with pressure support/non-invasive CPAP)
Duration of Mechanical received Ventilation (days)	A numeric value representing the number of days the patient mechanical ventilation
Physiotherapy Techniques Performed	The various physiotherapy techniques used on the patient in ICU
Timing of Mobilisation	How soon after ICU admission the patient was mobilised (includes active or assisted patient mobility in or out of bed)

	Expressed in either less than 48 hours of ICU admission or number of days in ICU
Frequency of Mobilisation (If mobilised)	How many times daily the patient was mobilised by the physiotherapist
Presence of Delirium	Whether the presence of delirium was recorded for the patient
Length of Stay in ICU (days)	A numeric value representing the number of days the patient spent in ICU
Readmission Rate	A numeric value representing how many times the patient was re-admitted to ICU during their hospital stay
ICU Outcome	Whether the patient was transferred/discharged out of ICU or died
Adverse Events During Physiotherapy	An unexpected medical problem that happened to the patient during physiotherapy
In-ICU Mortality	Whether the patient survived or died in ICU

Appendix XXII: Informed Consent

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Divisions of Communication Sciences and Disorders,
Nursing and Midwifery, Occupational Therapy,
Physiotherapy; and Disability Studies

F45 Old Main Building, Groote Schuur
Hospital
Observatory, Cape Town, W Cape, 7925
Tel: +27 (0) 21 406 6628/ 6428/ 6534
Fax: +27 (0) 21 406 6323
www.dhrs.uct.ac.za

25 May 2017

Dear Colleagues (Nurse, Doctor, Physiotherapist)

My name is Savarna Olivia Francis and I am conducting a research project to obtain a Master of Science Degree at the University of Cape Town, supervised by Ilse Du Plessis and Brenda Morrow. The study is titled: Mobility Practices, Attitudes and Perceptions of Nurses, Intensivists and Physiotherapists Regarding Early Mobilisation of Critically-ill Patients in Namibian Intensive Care Units.

The purpose of this project is to determine what the perceptions amongst these groups of clinicians are around early mobilisation of critically ill patients, whether they are knowledgeable on the literature concerned with early mobilisation, what the actual mobility practices are, and the perceived barriers to provision of mobility. To achieve those aims, I invite you to participate in this study, which will be conducted in the form of a survey.

Why was this study started?

Many studies have been conducted in various countries on early mobilisation of critically ill patients. They all outline the benefits and barriers to early activity, current mobility practices, and the safety and feasibility of implementing early mobilisation programmes. Few studies looked at the knowledge, attitudes and perceptions of staff on early activity of patients. Many studies point out the need for more research on early mobilisation geared towards successful implementation of early mobilisation programmes. No research on this topic has been performed in Namibia, therefore I have chosen to investigate it. The results of this study will contribute to the body of knowledge on ICU rehabilitation practice in Southern Africa, identify further research needs and drive quality improvement initiatives.

What will be required of you in the study?

Should you consent to participate in the study, you will be asked to complete a survey, once-off, that will take about 20 minutes to finish. A venue at your workplace will be arranged for you take the survey in a group during your lunchbreak, so you do not incur any out of pocket expenses such as traveling

and parking costs, and loss of income from spending time away from your work duties. You will be given an opportunity to ask any questions you may have, all of which will be answered.

Where will the study take place?

The survey will take place at Roman Catholic, Mediclinic Windhoek, Rhino Park, Lady Pohamba, Katutura and Central hospitals. Exact venues at these hospitals will still be arranged.

What happens if you decide to withdraw from the survey?

You will not be coerced into taking the survey. Your participation in the study is entirely voluntary and may withdraw at any point without explanation nor penalty.

Are there any risks during your participation in the study?

Since this is a non-interventional study, the anticipated risk of harm or discomfort is minimal. The only foreseeable harm would be a breach of confidentiality. Steps to protect your anonymity will be taken to minimise this risk.

What are the benefits to completing this survey?

You may not directly benefit from participating in this research, however; we hope the results will contribute to the body of knowledge on ICU rehabilitation practice in Southern Africa, specifically in the Namibian context, identify further research needs and direct quality improvement initiatives.

Confidentiality

Your anonymity will be protected and will therefore not be asked to indicate your name, nor any other information that will reveal your identity. All information supplied on the survey will be kept strictly confidential.

Who do you contact for any further questions?

For any further questions that may arise, you may contact the following persons:

1. *Savarna Francis (Researcher)*
   Tel: +264814040470

   Email: savarna.francis@gmail.com

2. *Ilse du Plessis (Research Supervisor)*
   Email: ilse.duplessis@uct.ac.za

3. *Brenda Morrow (Research Supervisor)*
   Email: Brenda.morrow@uct.ac.za

If you have any questions concerning your rights as a research subject, you may contact the University of Cape Town Human Research Ethics Committee at: +27214066338

Statement of Consent

I…… have read …… the information letter. I understand the content of the letter and my role as participant in the study. I was given the opportunity to ask questions, which were all answered. I understand that my participation in this study is completely voluntary, and that I can withdraw from the survey at any point without any consequences in doing so.

Signed:

…….	…….
Participant	Date and Place
…….	…….
Researcher	Date and Place