IMPLEMENTATION AND EVALUATION OF A VALIDATED EVIDENCE-BASED PHYSIOTHERAPY PROTOCOL IN A SURGICAL ICU: A CONTROLLED BEFORE AND AFTER STUDY

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Declaration

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third-party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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Abstract

Overall Aim: to implement and evaluate a tailored best-practice multifaceted implementation strategy (intervention) for the effective uptake of a validated evidence-based physiotherapy protocol for the management of patients in a surgical intensive care unit (ICU) in the Western Cape, South Africa (SA).

Method: A phased, multipronged design. Phase 1 (survey): described i) the profile of the public sector physiotherapists and their department organisation and structure and ii) the profile and current practices of the public ICU physiotherapists and ICU organisation and structure in which they work. Phase 2 (systematic review): identified best-practice implementation strategies for the effective uptake of evidence-based clinical practice guidelines (CPGs) and protocols. Phase 3a) Nominal Group Technique (NGT): tailored the implementation strategies to the targeted physiotherapists; and b) controlled before and after (CBA) trial: implemented and evaluated the intervention for the uptake of the ICU physiotherapy protocol in a surgical ICU.

Results: The physiotherapy survey received a 70% (n=46/66) response. 429 young, early-career physiotherapists with mainly Bachelor degrees, in production ('junior') level posts, in departments organised and structured on a departmental model with a hierarchal ranking of posts and physiotherapy to hospital bed ratio of 1:69 was identified. The ICU physiotherapy survey received a 34% (n=58/170) response. ICU physiotherapists had no ICU post-graduate training, 1-5years of ICU work experience, ICU services and practices that varied. Education, audit and feedback, reminders, support, multidisciplinary implementation team and plan, communication and case discussion including telemedicine strategies were identified. Multifaceted implementation strategies are four times more effective (OR: 4.07, 95%CI: 2.93-5.65; p<0.00001, I=89%) than single strategies in improving process of care measures in the ICU. The tailored intervention included an educational handbook, workshop series, grand rounds/bedside teaching sessions and reminders (pocket cards and posters). 1509 patients were included in the 16month CBA trial analysis. Experimental Unit A had a higher TISS-28unit day score [2.3units, p=0.004] in the implementation phase compared to the baseline (pre-implementation phase) in Unit A and all phases in control Unit B. Time to first physiotherapy contact after ICU admission in the implementation phase was longer [adj. OR 1.2, 95%CI:1-1.4, p=0.02] in Unit A than the pre-implementation phase and pre-and implementation phase in Unit B. There was no change in time to first physiotherapy [adj. OR 0.9, 95%CI:0.7-1.1,

p=0.19] and first nurse [adj. OR 1, 95%CI: 0.7-1.6, p=0.84] mobilisation into a chair after ICU admission and time to physiotherapy post-extubation [adj. OR 1, 95%CI: 0.9-1.2, p=0.83] in the implementation phase regardless of unit and phase. Patients in unit A were more likely to receive the physiotherapy process of care than patients in unit B at baseline. There was no difference in hospital mortality [adj. OR 1.1, 95%CI: 0.6 - 2, p = 0.78], ICU mortality [adj. OR 1.22, 95%CI: 0.59 - 2.52, p=0.59], intubation [adj. OR 1.1, 95%CI: 0.8 - 1.5, p=0.68] nor proportion of failed extubations [adj. OR 1.2, 95%CI: 0.8 – 2, p=0.39] in the implementation phase between Unit A and B.

Conclusion: A tailored best-practice multifaceted implementation strategy and implementation fidelity alone did not facilitate effective uptake of and adherence to the protocol. ICU physiotherapy profile, organisation and structure and practice variation, high baseline process of care adoption rates, healthcare professional behaviour, attitude, knowledge and self-efficacy influenced protocol adherence. The use of a framework to guide ICU implementation initiatives and contextualize the implementation process in a resource limited setting is supported.

Keywords: controlled before and after trial, implementation, intensive care, physiotherapy, tailoring, South Africa

Word Count: 556 words including abstract headings.

Opsomming

Oorhoofse doelwit: Implementering en evalueering van 'n pasgemaakte, beste-praktyk, veelvlakkige implementeringstrategie (intervensie) vir die effektiewe opname van 'n gevalideerde bewysgebaseerde fisioterapieprotokol vir die bestuur van pasiënte in 'n chirurgiese intensiewe sorgeenheid (ICU) in die Wes-Kaap, Suid Afrika (SA).

Metode: 'N Fase, veelvoudige ontwerp. Fase 1 (opname): beskryf i) die profiel van die openbare sektor fisioterapeute en hul departement organisasie en struktuur en ii) die profiel en huidige praktyke van die openbare ICU fisioterapeute en ICU organisasie en struktuur waarin hulle werk. Fase 2 (sistematiese oorsig): bestepraktyk implementeringstrategieë vir die effektiewe opname van bewysgebaseerde kliniese praktyk riglyne (GPG's) en protokolle was geïdentifiseer. Fase 3a) Nominale Groeptegniek (NGT): Die implementeringstrategieë vir die geteikende fisioterapeute is aangepas; en b) beheer voor en na (CBA) verhoor: die intervensie vir die opname van die intensiewe sorg fisioterapie protokol in 'n chirurgiese intensiewe sorgeenheid was geïmplementeer en geëvalueer.

Resultate: Die fisioterapie opname vraelys het 'n 70% (n = 46/66) reaksie ontvang. 429 jong, vroeë loopbaanfisioterapeute met hoofsaaklik Baccalaureusgrade, in produksie ('junior') vlakposte, in afdelings georganiseer en gestruktureer op 'n departementele model met 'n hiërargiese rangorde van poste en fisioterapie tot hospitaalbedverhouding van 1:69, is geïdentifiseer. Die intensiewe sorgeenheid fisioterapie opname vraelys het 'n 34% (n = 58/170) reaksie ontvang. Intensiewe sorgeenheid fisioterapeute het geen intensiewe sorg nagraadse opleiding gehad nie, 1-5jaar van intensiewe sorg werkservaring, intensiewe sorgeenheid dienste en praktyke wat wissel. Onderwys, oudit en terugvoer, herinnerings, ondersteuning, multi-dissiplinêre implementeringspan en plan, kommunikasie en gevallestudie, insluitend telemedisynstrategieë, is geïdentifiseer. Veelvlakkige implementeringstrategieë is vier keer meer effektief (OR: 4.07, 95% CI: 2.93-5.65; p <0.00001, I = 89%) as enkele strategieë om die proses van versorgingsmaatreëls in die intensiewe sorgeenheid te verbeter. Die aangepaste intervensie het 'n opvoedkundige handboek, werkswinkelreeks, wyk ronde/bedkant-lesings en onthounotas (sakkaarte en plakkate) ingesluit. 1509 pasiënte is ingesluit in die 16-maande CBA proef analise. Eksperimentele Eenheid A het 'n hoër TISS-28 eenheidspunt [2.3 eenhede, p = 0.004] in die implementeringsfase in vergelyking met die basislyn (pre-implementeringsfase) in Eenheid A en alle fases in beheer Eenheid B gehad. Tyd tot eerste fisioterapie kontak na

intensiewe sorgeenheids toelating in die implementeringsfase was langer [adj. OR 1.2, 95% CI: 1-1.4, p = 0.02] in Eenheid A as die voor-implementeringsfase en voor- en implementeringsfase in Eenheid B. Daar was geen verandering in tyd vir eerste fisioterapie [adj. OR 0.9, 95% CI: 0.7-1.1, p = 0.19] en eerste verpleegster [adj. OR 1, 95% CI: 0.7-1.6, p = 0.84] mobilisering in 'n stoel na die intensiewe sorgeenheid toelating en tyd na fisioterapie na extubasie [adj. OR 1, 95% CI: 0.9-1.2, p = 0.83] in die implementeringsfase nie, ongeag van eenheid en fase. Pasiënte in Eenheid A was meer geneig om die fisioterapie sorg proses te ontvang as pasiënte in eenheid B by basislyn. Daar was geen verskil in hospitaalsterfte [adj. OR 1.1, 95% CI: 0.6 - 2, p = 0.78], intensiewe sorg sterfte [adj. OR 1.22, 95% CI: 0.59 - 2.52, p = 0.59], intubasie [adj. OR 1.1, 95% CI: 0.8 - 1.5, p = 0.68] of proporsie van mislukte ekstubasies [adj. OR 1.2, 95% CI: 0.8 - 2, p = 0.39] in die implementeringsfase tussen Eenhede A en B.

Gevolgtrekking: 'n Gepaste, beste-praktyk, veelvlakkige implementeringstrategie en implementeringstrouheid het nie die effektiewe opname en aaneming van die protokol vergemaklik nie. Die intensiewe sorg fisioterapie profiel, organisasie en struktuur en praktyk variasie, hoë basislyn sorg proses aaneming, gesondheidsorg professionele gedrag, houding, kennis en selfdoeltreffendheid het the aaneming van die protokol beïnvloed. Die gebruik van 'n raamwerk om intensiewe sorg implementeringsinisiatiewe te rig en die implementeringsproses in 'n hulpbron beperkte omgewing te kontekstualiseer, word ondersteun.

Sleutelwoorde: beheer voor en na die verhoor, implementering, intensiewe sorg, fisioterapie, pasgemaakte, Suid-Afrika

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The first step to knowledge is to be QUIET and ATTENTIVE,
then to preserve it, then to put it into PRACTICE, and then to SPREAD it!
Sufyan bin'Uyainah

Dedication

In loving memory of my mother

Amina Bawa Karachi

May Allah grant you the highest place in Jannah Inshallah, Ameen

and

for my dearest father

Abdul Hamid Karachi

***Dad** you are my inspiration **& Mom** you are the wind beneath my wings!*

and

To my loving husband

Prof Mogammad Shahied Soeker

and my dearest son and darling daughters

Mogammad Zohair, Amina and Amara Soeker

This is dedicated to you for all your sacrifices!

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List of Abbreviations

ADJ./Adj.	: Adjusted
ABCDE Bundle	: Awakening and Breathing Coordination, Delirium monitoring/ management and Early exercise/mobility (ABCDE) bundle
APACHE II	: Acute Physiology And Chronic Health Evaluation II
ARDS	: Adult Respiratory Distress Syndrome (ARDS).
ARR	: Absolute Risk Reduction
ASIA Impairment Scale	: American Spinal Injury Association Impairment Scale
CBA	: Controlled Before and After Trial
C-CCT	: Cluster/ed Clinical Controlled Trial
C-CRT	: Cluster/ed Randomised Control Trial
CCT	: Clinical Control Trial
CEO	: Chief Executive Officer
CFIR	: Consolidated Framework of Implementation Research
CI	: Confidence Interval
CINAHL	: Cumulative Index to Nursing and Allied Health Literature
CLABSI	: Central Line Associated Blood Stream Infection
CPAP	: Continuous Positive Airway Pressure
CPAx	: Chelsea Physical Assessment Tool
CPD	: Continuous Professional Development
CPGs	: Clinical Practice Guidelines
CPR	: Cardiopulmonary Rehabilitation
CPRG	: Cardiopulmonary Rehabilitation Group
CRBI	: Catheter Related Bloodstream Infections
DNR	: Do Not Resuscitate
DoH	: Department of Health
DSBT	: Daily Spontaneous Breathing Trial
DVT	: Deep Vein Thrombosis
E.G./e.g.	: Example
EBP	: Evidence Based Practice
EC	: Eastern Cape
EMBASE	: Excerpta Medica dataBase
EN	: Enteral Nutrition
EPOC	: Effective Practice and Organisation of Care

EQ5D	: EuroQol 5Dimension Questionnaire
ERS	: European Respiratory Society
ESICM	: European Society of Intensive Care Medicine
FAQs	: Frequently Asked Question's
FIM	: Functional Independence
FP	: Frozen Plasma
F/up	: Follow-Up
FS	: Free State
GAU	: Gauteng
HOD	: Head of Department
HPCSA	: Health Professions Council of South Africa
HR	: Hazard Ratio
HRQoL	: Health Related Quality of Life
ICF	: International Classification of Functioning Scale (ICF)
ICU	: Intensive Care Unit
IPPB	: Intermittent Positive Pressure Breathing
IQR	: Interquartile Range
ITS	: Intermittent Time Series Study
JSEPTIC	: Japanese Society of Education for Physicians and Trainees in Intensive Care
Kcal	: Kilo Calories
KZN	: KwaZulu-Natal
LIM	: Limpopo
LOS	: Length of Stay
MPU	: Mpumalanga
MSc	: Master in Science
MV	: Mechanical Ventilation
MVT	: Mechanical Ventilation Time
NC	: Northern Cape
NDoH	: National Department of Health
NGT	: Nominal Group Technique
NHI	: National Health Insurance
NHP	: Nottingham Health Profile
NIV	: Non-Invasive Ventilator/Ventilation

NWP	: North West Province
NYHA Classification	: New York Heart Association Classification
O_2	: Oxygen
OR	: Odds Ratio
P-CCT	: Patient level Clinical Controlled Trial
PDF	: Pulmonary Dysfunction
PFIT	: Physical Functioning ICU Test
PGWB	: Psychological Well Being Index
PhD	: Doctor of Philosophy
PN	: Parenteral Nutrition
POC	: Process of Care
POCI	: Process of Care Indicator
PQoL	: Perceived Quality of Life Scale
P-RCT	: Pragmatic Randomised Control Trial
P-CRCT	: Pragmatic Cluster Randomised Control Trial
p-value	: Level of Significance
QoDD	: Quality of Dying and Death Scale
RCT	: Randomised Control Trial
RevMan	: Review Manager
RR	: Relative Risk
SA	: South Africa
SASP	: South African Society of Physiotherapy
SD	: Standard Deviation
SF36	: Short Form 36 Surveys
SIP	: Sickness Impact Profile
SOFA	: Sequential Organ Failure Assessment
SPSS	: Statistical Package for Social Sciences
TISS-28	: Therapeutic Index Scoring System-28
TUG	: Time up and Go
UK	: United Kingdom
US	: United States
VAP	: Ventilator Associated Pneumonia
WC	: Western Cape

Glossary

The use of terms in this thesis is explained or defined within the context of this study.

Algorithm/s: The clinical algorithm (flow chart) is a text format that is specially suited for representing a sequence of clinical decisions, for teaching clinical decision-making, and for guiding patient care (Margolis, 1983).

Champions: "Individuals who dedicate themselves to supporting, marketing, and 'driving through' an implementation, overcoming indifference or resistance that the intervention may provoke in an organisation." www.cfirguide.com

Characteristics of the Individual: described by the CFIR as the healthcare professionals, knowledge & beliefs about the intervention, perceived self-efficacy, individual stage of change, individual identification with organisation and other personal attributes. www.cfirguide.org

Characteristics of the Intervention: These are the characteristics of the CPG or protocols that may be adapted or tailored to suit the targeted organisation or setting. The intervention characteristics to consider according to the CFIR include the source (developer/s) of the intervention, the strength and quality of the evidence, cost-effectiveness, design and packaging of the intervention, its adaptability, trialability, complexity and lastly, its relative advantage in terms of the advantage of implementing it in the targeted organisation or setting. www.cfirguide.com

Clinical Practice Guideline/s: CPG's are "systematically developed statements to assist practitioners and patient decisions about appropriate health care for specific circumstances." Field & Lohr (1990)

Consolidated Framework for Implementation Research: "The CFIR is a framework that can be used to guide the implementation and evaluation of evidence based interventions (protocols and CPGs) and provides a menu of constructs that have been associated with effective implementation. The CFIR considered the spectrum of construct terminology and definitions and compiled them into one organising framework. The CFIR provides a menu of constructs that can be used in a range of applications – as a practical guide for systematically assessing potential barriers and facilitators in preparation for implementing an innovation, to

providing theory-based constructs for developing context-specific logic models or generalizable middle-range theories." www.cfirguide.com

Engaging: "Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modelling, training, and other similar activities." www.cfirguide.com

Evidence Based Practice: "…is the conscientious use of current best evidence in making decisions about patient care." (Sackett, Straus, Richardson, Rosenberg & Haynes, 2000).

Executing: "Carrying out or accomplishing the implementation according to plan." www.cfirguide.com

External Change Agents: "Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction." www.cfirguide.com

Formally Appointed Internal Implementation Leaders: "Individuals from within the organisation who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role." www.cfirguide.com

Formative Evaluation: the objective evaluation using quantitative methods to evaluate the effect of the implementation process. www.cfirguide.com

Implementation Fidelity: the degree to which an intervention (implementation strategy) is delivered as intended and is critical to successful translation of evidence-based interventions (CPGs and/or protocols) into practice. Implementation fidelity therefore refers to both the exposure of the targeted health care professional group to the CPG and/or protocols and the exposure to the implementation strategies used in the implementation process (Breitenstein, Gross, Garvey, Hill, Fogg & Resnick, 2010).

Implementation Outcomes: these are distinct from service system outcomes and clinical treatment outcomes (Proctor et al., 2011). "Implementation outcomes are defined as the effects of deliberate and purposive actions to implement new treatments, practices, and services."

(Proctor et al., 2011). Proctor et al., (2011) states: "Some studies infer implementation success by measuring clinical outcomes at the client or patient level while other studies measure the actual targets of the implementation, quantifying for example the desired provider behaviours associated with delivering the newly implemented treatment. Some studies of implementation strategies assess outcomes in terms of improvement in process of care measures/indicators."

Implementation Process/Process of Implementation/Practice change strategy: This is the fifth domain of the CFIR. an interrelated series of sub-processes that do not necessarily occur sequentially. "There are often related processes progressing simultaneously at multiple levels within the organisation These sub-processes may be formally planned or spontaneous; conscious or subconscious; linear or nonlinear, but ideally are all aimed in the same general direction: effective implementation." (Damschroder et al., 2009)

Implementation Science: "…the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services" (Eccles and Mittman, 2006).

Implementation Strategy: a purposeful procedure used to achieve clinical practice compliance with a guideline recommendation (Mazza et al., 2013). These include professional, organisational, regulatory, financial implementation strategies. The implementation strategy can be a **single (one) strategy or a multifaceted strategy (**two or more single implementation strategies combined) to achieve clinical practice compliance with a guideline recommendation (Grimshaw et al., 2004).

Intervention: "the action or process of intervening" www.google.com/dictionary - accessed 20/07/2018. In this study the intervention refers to the tailored best-practice multifaceted implementation strategy used to implement an evidence-based physiotherapy protocol.

Mobilisation: "the action of making a person movable or capable of movement." www.google.com/dictionary - accessed 20/07/2018.

On-Call duty: "(of a person) able to be contacted in order to provide a professional service if necessary, but not formally on duty." www.google.com/dictionary - accessed 20/07/2018.

Opinion Leaders: "Individuals in an organisation who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention." www.cfirguide.com

Outcome Measures/Indicators: "Outcomes are states of health or events that follow care, and that may be affected by health care. An ideal outcome indicator would capture the effect of care processes on the health and wellbeing of patients and populations." (Mainz, 2003).

Patient needs and resources: "The extent to which patient needs, as well as barriers and facilitators to meet those needs, are accurately known and prioritized by the organisation." www.cfirguide.com

Patient perception: refers to "the ability to see, hear, or become aware of something through the senses" or "the way in which something is regarded, understood, or interpreted." www.google.com/dictionary - accessed 20/07/2018.

Patient satisfaction: Fulfilling patient needs, desires and expectations (Sofaer & Firminger, 2005)

Planning: "The degree to which a scheme or method of behaviour and tasks for implementing an intervention are developed in advance, and the quality of those schemes or methods." www.cfirguide.com

Process of Care Measures/Indicators: "Process indicators assess what the provider did for the patient and how well it was done. Processes are a series of inter-related activities undertaken to achieve objectives. Process indicators measure the activities and tasks in patient episodes of care." (Mainz, 2003). In this study the process of care measures/indicators were used to evaluate whether the protocol was implemented by the physiotherapists in the surgical ICU. "Process measures improve quality and cost by enabling organisations to reduce the amount of variation in care delivery". https://www.healthcatalyst.com/process-vs-outcome-measures-healthcare - accessed 08/08/2018.

Protocol: these can be seen as more specific than CPGs, defined in greater detail. Protocols provide "a comprehensive set of rigid criteria outlining the management steps for a single clinical condition or aspects of organisation" (Mazza et al., 2013).

Reflecting & Evaluating: "Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience." www.cfirguide.com

Rehabilitation: "the action of restoring someone to health or normal life through training and therapy after illness." www.google.com/dictionary - accessed 20/07/2018.

Structural Outcome Measures/Indicators: "Structure refers to health system characteristics that affect the system's ability to meet the health care needs of individual patients or a community. Structural indicators describe the type and amount of resources used by a health system or organisation to deliver programs and services, and they relate to the presence or number of staff, clients, money, beds, supplies, and buildings." (Mainz, 2003).

Summative Evaluation: the subjective evaluation and reflection of the target population on the process of implementation using qualitative method of enquiry. www.cfirguide.com

Sustainability: "the continued use of an intervention (CPG or protocol) in practice" (Aarons, Hurlburt, Horwitz, 2011).

Tailored Implementation Strategy/ies: "Tailoring an implementation strategy means "making fit with individual customers", who are typically healthcare providers in this context". (Wensing et al., 2017). In this study, unit-specific implementation strategies were tailored for the physiotherapists involved in the implementation process.

Ethics Approval

Ethics Approval for the project was obtained from the Health Research Ethics Committee of Stellenbosch University (S13/09/170) [Addendum 1] and renewed yearly. The study was conducted according to the accepted and applicable National and International ethical guidelines and principles, including those of the international Declaration of Helsinki October 2008.

Role of the Funding Source

This study was funded by Harry Crossley, Medical Research Council and the National Research Foundation. The funders had no role in the conceptualization, protocol development, study design; in data collection, analysis, or interpretation; in writing the dissertation; or in the decision to submit the dissertation for review and examination.

Publications and Presentations arising from this Dissertation

Publications: The individual chapters are being edited for submission to appropriately selected journals for publication. The systematic review is being updated for publication.

Scientific Presentations:

Karachi, F., Hanekom, S. D., Gosselink, R. (2015) A Profile of current Physiotherapy Practices in Intensive Care in South Africa. This was a presentation of the combined results of Chapters 2 and 3 [Addendum 2A].

- *Accepted for poster presentation at the Congress of the Critical Care Society of Southern Africa 26 - 30 November 2014, Baxter Theatre Centre, Cape Town, South Africa, (preliminary results of the surveys).*
- *Accepted for poster presentation at the 12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine (WFSICCM), Seoul, South Korea, 29 August – 1 September 2015.*
- *Accepted for oral presentation at the University of the Western Cape, Community and Health Sciences Faculty Research Symposium, 01 October 2015.*

Karachi, F., Hanekom, S. D., Gosselink, R. (2015) Best-Practice Process of Implementation Strategies for effective change in ICU Practice: A Systematic Review. This was a presentation of the results of Chapter 4 [Addendum 2B].

- *Accepted for poster presentation at the 12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine (WFSICCM), Seoul, South Korea, 29 August – 1 September 2015.*
- *Accepted for oral presentation at the University of the Western Cape, Community and Health Sciences Faculty Research Symposium, 01 October 2015.*

van Ness, M. B., Karachi, F., Hanekom, S. (2015). Patient perceptions of ICU care: A scoping review *South African Journal of Critical Care*, 31(1),27. This review informed the primary qualitative study presented in Addendum 4 [Addendum 3A].

- *Accepted for poster presentation at the Congress of the Critical Care Society of Southern Africa, 9-12 July 2015.*

Maritz, J. Karachi, F., Hanekom, S. (2018). Physiotherapists' Perception of a Best-Practice Implementation Process in a Surgical ICU: A Qualitative Study. This will be a presentation of the qualitative findings of the study presented in Addendum 5 [Addendum 3B].

- *Accepted for presentation at The 34th World Congress of Internal Medicine, Cape Town, South Africa, 18-21 October, 2018 (WCIM).*

CHAPTER 1

Introduction & Study Context

1.1 Background

Knowledge of evidence-based clinical practice guidelines (CPGs) and protocols alone is not enough. Implementing and applying standardized evidence- and outcome-based CPGs and protocols for the treatment or management of patients by healthcare professionals into daily clinical practice is vital to improve quality of care and patient outcomes in health care and is a current research priority (Phelan, Lin, Mitchell & Chaboyer, 2017; Bernhardsson et al., 2017; Kredo et al., 2016; Bauer, Damschroder, Hagedor, Smith & Kilbourne, 2015; Hudon, Gervais & Hunt, 2015; Kumar, 2015; Le et al., 2015; Chelluri, 2008). Quality improvement strategies in healthcare include the development of evidence-based validated CPGs and protocols (Grant, Wells & Treweek, 2016; Bauer et al., 2015). Following the development and translation of CPGs and protocols, the successful implementation and uptake or adoption of these CPGs and protocols to improve quality care in healthcare and improve patient outcomes through quality improvement initiatives must follow. How to implement and facilitate CPG and protocol uptake or adoption is part of an area of research known as 'Implementation Science' (Khalil, 2016; Bauer et al., 2015).

Implementation Science is the next step in the continuum of quality improvement initiatives in healthcare. It is defined by Eccles and Mittmann (2006, "Abstract," para.1) as *"…the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services"*. Billions have been invested worldwide on the development of evidence-based CPGs and protocols and on trials supporting the effectiveness of these CPGs and protocols in controlled healthcare environments (Grant et al., 2016, Bauer et al., 2015). Therefore, an enormous body of evidence-based CPGs and protocols in health care is available to healthcare professionals to practice safe, efficient, effective and quality healthcare (Bernhardsson et al., 2017; van der Wees, Jamtvedt, Rebbeck, de Bie, Dekker & Hendriks, 2008). However, the implementation processes or methods to effectively facilitate the systematic uptake and adoption of evidence-based CPGs and protocols into routine daily practice is required

(Bernhardsson et al., 2017; van der Wees, et al., 2008) and has become a focus for implementation researchers globally.

1.2 Clinical Practice Guidelines and Protocols in South Africa

The National Health Insurance (NHI) is in the process of being implemented in South Africa (SA). This process will require co-ordination of health provision across sectors and levels of care. (Wilkinson, MacQuilkan, Mudara, Winch, Pillay & Hofman, 2018). Clinical practice guidelines and protocols informed by evidence are tools that facilitate standardized and optimum patient care. Clinical decision-making is influenced by the use of CPGs and protocols which has consequences for patient outcomes, health system costs and resource use (Wilkinson, et al., 2018). According to Wilkinson et al., (2018), the NHI will use CPGs and protocols to guide the provision of healthcare for South Africans. A systematic review conducted by Wilkinson et al., (2018) in 2017 identified 285 CPGs in the public domain that was produced by SA developers for the South African context and published after January 2000, with topics that varied by developer.

In South Africa, Hanekom, Louw & Coetzee, (2013) developed and validated an evidence-based protocol for the physiotherapeutic management of surgical intensive care unit (ICU) patients for the standardization of physiotherapy practice in the surgical ICU. Although implementation processes for the implementation of CPGs and protocols in healthcare exist, an implementation process tailored for the effective uptake and adoption of ICU physiotherapy protocols by physiotherapists in the "real world" ICU setting in SA has not been developed, implemented nor evaluated. Hanekom et al., (2013) concluded that it would be necessary to develop and fund unit-specific implementation strategies before protocol implementation in the ICU, as these strategies have become necessary in addressing the challenges of changing existing practice.

South Africa has limited health care resources. Available resources are also being redistributed to primary healthcare settings (Benatar, 2013). This redistribution of resources from tertiary to primary care can affect service delivery by healthcare professionals including physiotherapists in ICUs based in these tertiary healthcare settings. This redistribution of resources could in turn influence the implementation of research evidence into clinical practice. Before we can

implement physiotherapy CPGs and protocols into practice in public ICUs in SA we need to determine and describe the profile and availability of physiotherapy services in public sector hospitals with ICU facilities, the public sector physiotherapy organisation and structure and the profile and current practices of ICU physiotherapists in the public sector in SA as this information will provide a foundation and context for implementation of ICU physiotherapy CPGs and protocols.

1.3 Physiotherapy in Intensive Care

In intensive care, physiotherapists are part of the healthcare team and have an integral role to play in managing critically ill patients (Gupte & Swaminathan, 2016; Perme & Chandreshekar, 2009; Denehy et al., 2008; Gosselink et al., 2008; Norrenberg & Vincent, 2000). However, the role and practices of intensive care physiotherapists is variable (Koo et al., 2011; Hodgin, Nordon-Craft, McFann, Mealer & Moss, 2009; Clini & Ambrosino, 2005; van Aswegan & Potterton, 2005; Lewis, 2003; Reeve, 2003; Norrenberg & Vincent, 2000; Jones, 2000; Wiles & Stiller, 2010). Physiotherapy practice varies in the availability of therapists to the ICU and tasks performed. Unit location and size; staffing levels, expertise and educational profile; and intensivists' and critical care nurses' perceptions and referral attitudes have been identified as factors influencing physiotherapy activity in ICUs (Bernhardsson et al., 2017; Gupte & Swaminathan, 2016; Hodgin et al., 2009). These variations in practice can influence implementation and uptake of CPGs and protocols and therefore quality of care that have an effect on the intensive or critical care patient and their clinical outcomes.

While numerous surveys in the last 20 years have been published, describing ICU physiotherapy practice internationally (Sigera et al., 2016; Baidya, Acharya & Coppieters, 2016; Malone et al., 2015; Yeole, Chand, Nandi, Gawali & Adkitte, 2015; Hodgin et al., 2009; Kumar, Maiya & Pereira, 2007; Reeve, 2003; Norrenberg &Vincent, 2000), in South Africa only two studies have described the physiotherapy practice of physiotherapists working in intensive care (van Aswegan & Lottering, 2016, van Aswegan & Potterton, 2005). A poor response rate and combined data from the public and private sector limited the authors' ability to effectively describe the role and practices of the intensive care physiotherapists working in South Africa, specifically in public sector ICUs (van Aswegan & Lottering, 2016; van Aswegan & Potterton, 2005). The profile of the physiotherapists and their organisation and structure in

public sector hospitals that have ICU facilities in South Africa is not available in the literature. Furthermore, there is a dearth of information on the profile, organisation and structure and current practices of the ICU physiotherapists in the public sector ICUs in South Africa. Variability in physiotherapy practices was described in surveys conducted in ICUs in developed and developing countries internationally but, the definitive role of physiotherapists in the resource limited, public sector South African ICUs is unclear. This information is important to benchmark current practice and determine whether ICU physiotherapists are able to implement existing CPGs and protocols in this setting in the current transforming healthcare system in SA.

International guidelines have been developed to define physiotherapists input in ICU (Hanekom et al., 2013; Gosselink et al., 2008). The purpose of these guidelines is to optimize benefit to patients and other healthcare team members (Wilkenson et al., 2018; Hanekom et al., 2013; Gosselink et al., 2008). It is unclear whether physiotherapists are able to adhere to these guidelines within the South African intensive care setting. The current healthcare economic climate and the need to provide evidence for health care practices urge healthcare professionals including physiotherapists to be accountable for services provided in a resource limited setting such as the intensive care setting. Varying physiotherapy ICU practices and the lack of role definition of the ICU physiotherapist presents challenges in improving and maintaining quality care and patient outcomes in intensive care (Malone et al., 2015; Kumar et al., 2007). These challenges are not isolated to the intensive care physiotherapist alone. Other multidisciplinary intensive care team members such as intensive care nurses, intensivists and dieticians are faced with similar challenges (Needham, 2010; Crites, McNamara, Akl, Richardson, Umscheid & Nishikawa, 2009; Reader, Flin, Mearns & Cuthbertson, 2009; Scales et al., 2009; Grimshaw, et al., 2004; Grol & Grimshaw, 2003). Therefore, the implementation of ICU physiotherapy CPGs and protocols in the South African context needs to be explored.

1.4 Implementation in the Intensive Care Setting

Intensive care is a complex and dynamic healthcare setting in which multidisciplinary teams work together in the management of ICU patients (Rose, 2011). Patient care in ICU is expensive and therefore optimising the delivery of treatments known to be effective is a priority rather than developing new treatments (Hanekom et al., 2013). A remarkable amount of knowledge is available to deliver the best care to intensive care patients. However, existing evidence-based

CPGs and protocols cannot change outcomes unless healthcare institutions and healthcare professionals can effectively and efficiently adopt the findings into practice (Bernhardsson et al., 2017; Powell, Beidas & Lewis, 2017; van der Wees et al., 2008). Variations in practice in other areas of intensive care are linked to less than optimal patient outcomes and cost of care (Hanekom at al., 2013; Koo et al., 2011). Therefore, according to Hanekom et al., (2013) developing and implementing evidence-based ICU CPGs and protocols are advocated to address this variation, facilitate clinical decision-making and optimise the use of evidence by practitioners.

A need for new, "real world" ICU implementation studies in which the wealth of existing evidence-based CPGs and protocols can be effectively implemented has been recognised (Scales et al., 2009). Reviews of implementation studies in other areas of healthcare have shown some evidence for improvement in the uptake of evidence-based CPGs and protocols through the evaluation of implementation strategies or processes used in CPG or protocol implementation and improved patient outcomes (Baker et al., 2015; Balas et al., 2013; Grimshaw et al., 2004). Implementation trials evaluating the use of implementation strategies to facilitate the uptake and adoption of CPGs and protocols in the intensive care setting are available in the literature. However, these studies have not been synthesized therefore, it is not clear which implementation strategies are most effective in the uptake of CPGs and protocols into ICU clinical practice. It is also uncertain whether implementation strategies proven to be effective in facilitating the uptake of CPGs and protocols by other ICU healthcare professionals such as medical doctors, nurses and dieticians are appropriate and suitable for the implementation of physiotherapy CPGs and protocols in the ICU due to the variable nature of ICU physiotherapy services and practices reported (Bernhardsson et al., 2017; Gupte & Swaminathan, 2016; Hanekom et al., 2013; Hodgin et al., 2009).

Reviews of implementation studies in physiotherapy could not identify implementation and evaluation of ICU physiotherapy CPGs and protocols (Bernhardsson et al., 2017; van der Wees et al., 2008). Three existing physiotherapy implementation trials identified by van der Wees et al., (2008) implemented whiplash and low back pain guidelines. The strategies used in these trials may not be appropriate for ICU physiotherapy implementation as ICU physiotherapy is complex and diverse and the multidisciplinary nature of care provided in the ICU (Skinner,

Haines, Berney, Warrillow, Harrold and Denehy, 2015) may influence the implementation process and strategies used by ICU physiotherapists in implementing CPGs and protocols. Bernhardsson et al., (2017) presented six cases of physiotherapy CPG and protocol implementation of which none were ICU physiotherapy implementation trials. Therefore, the effectiveness of implementation strategies tailored for ICU physiotherapists needs investigation.

1.5 Implementation Strategies and Tailoring

An implementation strategy is defined as a purposeful procedure used to achieve clinical practice compliance with a guideline recommendation (Mazza et al., 2013). Various implementation strategies have been described and categorized into professional, organisational, financial and regulatory interventions (Mazza, et al., 2013). Implementation strategies include but are not limited to the distribution of education material, educational meetings, local consensus processes, audit and feedback, and reminders (Mazza, et al., 2013; Sinuff et al., 2013). Two key findings from systematic reviews on guideline dissemination and implementation strategies include that 1) multifaceted implementation strategies did not result in significantly greater effect on processes of care when compared to single-faceted ones and 2) passive strategies such as educational materials produced moderate but significant improvements in processes of care and behaviour compared to no strategy, and that passive strategies could be more cost effective in resource limited settings than active strategies (Boaz, Baeza & Fraser, 2011; Higgins & Green, 2011; Needham, 2010; Sinuff, Muscedere, Cook, Dodek & Heyland, 2008; Stevens, Lee, Law &Yamada, 2007; Grimshaw et al., 2004). Scales et al., (2009) also stated that educational outreach, audit and feedback, and reminders are promising strategies for behaviour change. The methodological quality of the studies included in the reviews conducted were reported to be weak with some results of the effectiveness of implementation strategies conflicting and therefore clear conclusion of the effectiveness of various implementation strategies could not be drawn (Scales et al., 2009; Grimshaw et al., 2006; Grimshaw et al., 2004; Grimshaw et al., 2001). The uncertainty regarding effective implementation strategies has been identified for the poor uptake of evidence-based CPGs and protocols in clinical practice (Bernhardsson, et al., 2017; Boaz et al., 2011; Higgins & Green, 2011; Stevens et al., 2007; Rubenstein & Pugh, 2006; Grimshaw, et al., 2004; Grol & Grimshaw, 2003). The best-practice implementation strategy for the uptake of CPGs and

protocols into ICU clinical practice is also not known and needs to be reviewed to guide implementation initiatives in the ICU.

Implementation strategies that may work in other clinical settings may not necessarily work in a setting such as the intensive care (Sinuff et al., 2008). The intensive care environment is a complex and dynamic one (Skinner et al., 2015). Multidisciplinary teams; variations in expertise and educational profile; diverse physician training (anaesthesia, surgery, medicine); team reliance on technological support; heterogeneity of patients and rapidly changing complex critical illness are possible barriers to implementation strategies used in the ICU (Rycroft-Malone et al., 2012; Sinuff et al., 2008). While various implementation strategies have been investigated in ICU, this data has not been synthesized. Little is known about the use and effectiveness of these strategies in intensive care settings. Thus, the optimal best-practice implementation strategies in ICU remain unknown (Sinuff et al., 2008). As stated earlier, implementation strategies that may prove to be effective in ICU CPG and protocol implementation may not be appropriate or suitable for ICU physiotherapists. Therefore, tailoring of these strategies to the target population and organisation may be required.

Tailoring implementation strategies to targeted healthcare professionals, organisations and units has been recommended by implementation researchers to effectively facilitate the uptake of CPGs and protocols into clinical practice (Lewis, Scott & Marriott, 2018; Powell et al., 2017; Wensing et al., 2014). Tailoring implementation strategies should assist to identify and address the needs of the targeted individuals involved in implementation (Powell et al., 2017) and assist effective implementation. However, the methods for tailoring implementation strategies are unclear and not standardized (Baker et al., 2015; Baker et al., 2010) and need to be investigated. Lastly, a lack of attention to implementation processes and use of theoretical frameworks for implementation have been reported (Rycroft-Malone et al., 2012). Frameworks for the implementation of evidence-based CPGs and protocols exist in the literature and can be used to assess barriers to implementation processes or strategies and guide implementation trials. The Consolidated Framework for Implementation Research (CFIR) is one such framework.

1.6 The Consolidated Framework for Implementation Research

The CFIR is one of many implementation theories that exist in health care to guide and facilitate effective implementation of evidence-based CPGs and protocols. It is a pragmatic meta-theoretical framework synthesized from nineteen previously developed frameworks (Breimaier, Heckemann, Halfens & Lohrmann, 2015; Damschroder et al., 2009). The pragmatic nature of the framework allows for "real world" implementation. There is a lack of standardization in the classification/taxonomy, terminology and definitions of terms in implementation science. The CFIR helps to provide consistent taxonomy, terminology and definitions on which an evidence base from multiple contexts can be built (Powell et al, 2017; Balas et al., 2013; Damschroder et al., 2009).

Besides the summative (objective) evaluation of implementation processes, the authors propose the use of the CFIR as a guide to the formative (subjective) evaluation of the implementation process, thereby building the implementation knowledge base across the multiple settings including ICU (Hudon et al., 2015; Damschroder et al., 2009). The formative evaluation assesses the extent to which implementation is effective in terms of adherence and prolonging sustainability in the specific setting and promotes dissemination into other settings (Damschroder et al., 2009). The framework allows for the identification of barriers before and after implementation which helps guide the selection and tailoring of implementation strategies used for implementation within the contextual and organisational framework which could affect implementation (Breimaier et al., 2015; Damschroder et al., 2009).

The CFIR has five major domains [Figure 1.1]. The intervention domain, referring here to the characteristics of the CPG or protocol to be implemented (un-adapted at the start of the process and adapted at the end for the specific setting), inner and outer setting, characteristics of the individuals (healthcare professionals and managers or organisations) involved in the implementation process and the process domain [Figure 1.1]. These domains influence the effectiveness of the implementation process as it is proposed that the interaction between these domains are rich, complex and interwoven (Balas et al., 2013). The Process domain consists of four essential activities related to the process of implementation that are common across organisational change models. These activities are planning, engaging, executing, evaluating and reflecting. A formal or informal (grassroots change effort) approach can be used to

accomplish the four activities. The activities can be accomplished in any order namely spiral, stop-and-start, or incremental approach to implementation and each activity can be revisited, expanded, refined, and re-evaluated throughout the implementation process (Damschroder et al., 2009). The constructs of the 5 domains is illustrated in Figure 1.1. The reader is referred to Damschroder et al., 2009 and the CFIR website (www.cfir.org) for further details regarding the CFIR domains and constructs.

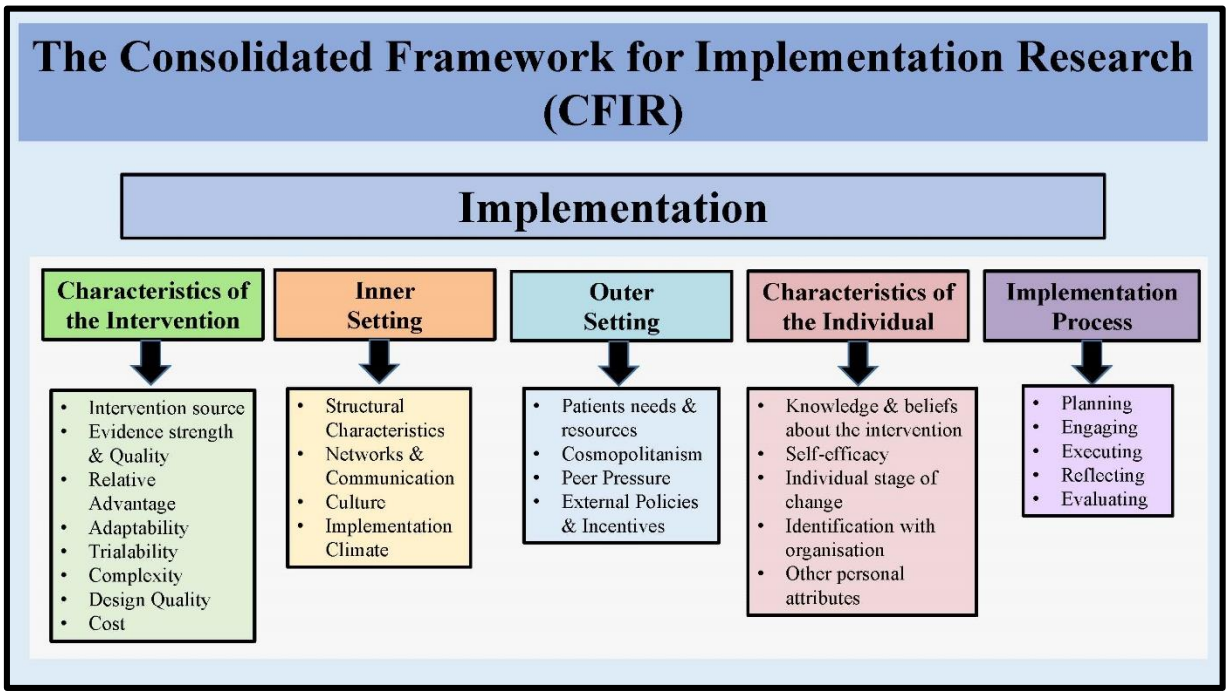


Figure 1.1 CFIR Domains and Constructs (Damschroder et al., 2009)

Currently, there are no known implementation frameworks specifically designed to guide the implementation of evidence-based CPGs and protocols in the intensive care setting. A systematic review of the use of the CFIR by Kirk, Kelley, Yankey, Birken, Abadie, & Damschroder (2016) identified one ICU implementation study by Balas et al., (2013) who used the CFIR for evaluation of the characteristics of the protocol in the post-implementation phase of their implementation study. Balas et al., (2013) used a prospective, before-after, mixed-methods design for the purpose of identifying facilitators for and barriers to the adoption of the Awakening and Breathing Coordination, Delirium monitoring/management and Early exercise/mobility (ABCDE) bundle and to evaluate the extent to which bundle implementation was effective, sustainable, and conducive to dissemination.

The incorporation of constructs from 19 other frameworks, pragmatic nature allowing "real world" implementation, consistent taxonomy, terminology and definitions provided and guided formative evaluation, motivated the decision to use the CFIR to guide the process of implementation in this "real world" ICU physiotherapy implementation trial study in South Africa. The CFIR was used to guide our implementation trial as follows. The design of the CFIR was adapted by the Primary Investigator [FK] as illustrated in Figure 1.2.

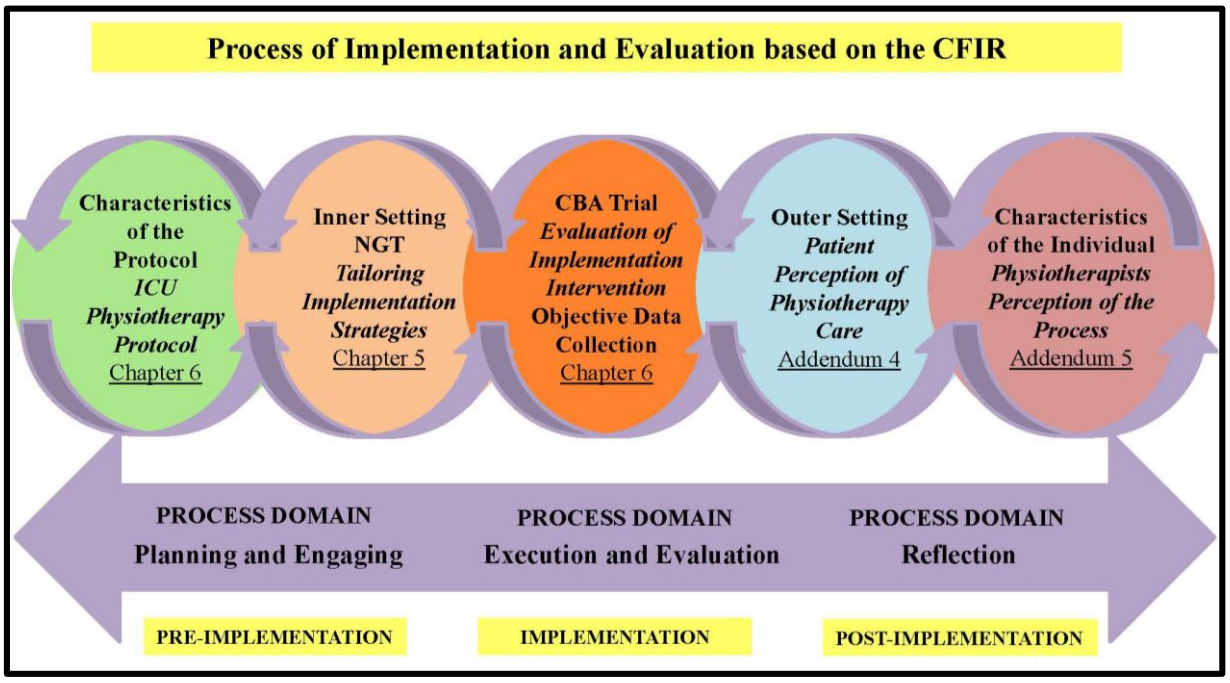


Figure 1.2 The Process of Implementation and Evaluation based on the CFIR

The Primary Investigators' [FK] perspective of the framework is that the implementation process guided by the framework is complex, has a spiralling feature where the constructs of the process domain (purple) namely the planning, engaging, executing, evaluating and reflecting constructs spiral simultaneously backwards and forwards during the implementation or practice change process. Figure 1.2 attempts to illustrate the rich, complex and interwoven feature of the domains and their constructs by the overlapping circles that can be related to the complex nature of the ICU environment. In the current study, the implementation trial addressed each of the domains within the ICU physiotherapy implementation context. The ICU protocol characteristics (green), individual characteristics (characteristics of the ICU physiotherapists) such as their perception of the protocol, implementation strategy or process and adherence to implementation (maroon), inner setting seen as the ICU patient perceptions

of care (blue) and outer setting seen as the identification of barriers and facilitators of the implementation strategy (pink) determined by the organisational structure, climate and networks to name a few and then tailoring of these strategies for the targeted organisation or individuals, are seen as rich and complex domains and constructs that are interwoven with each other that may influence implementation in the ICU.

Therefore, in the current study, the domains of the CFIR are addressed using the constructs of the Process domain. The implementation strategies (pink) and the evidence-based physiotherapy protocol (intervention characteristics referred to as protocol characteristics in this study - green) was tailored prior to implementation and formed part of the planning and engaging constructs of the process domain [Figure 1.2]. The process of implementation (tailored implementation strategy referred to as the intervention in this study) formed part of the engaging, executing and evaluation constructs of the process domain. The evaluation referred to in the latter, included the summative/objective evaluation of the effectiveness of the intervention on uptake of and adherence to the protocol and is coded orange in Figure 1.2 and Figure 1.3 of the construction of the dissertation. Patient satisfaction with ICU physiotherapy care (patient needs and resources as part of the outer setting domain in blue) and the perception of the physiotherapists of the implementation process (characteristics of the individual in maroon) [Figure 1.2] forms part of the formative/subjective evaluation and reflection constructs and is described in Addendum 4 and 5 respectively.

1.7 Overall Project Aim

To implement and evaluate the effectiveness of a tailored best-practice implementation strategy to facilitate the uptake of a validated evidence-based physiotherapy protocol for the management of surgical ICU patients in a surgical ICU in the Western Cape, South Africa. To achieve the aim of the project, the study was conducted in three phases with three central questions:

PHASE 1: What is the profile and current practices of ICU Physiotherapists rendering services in public sector ICUs and the public sector ICU and physiotherapy organisation and structure in SA?

PHASE 2: What are the best-practice implementation strategies to facilitate uptake of evidence-based CPGs and protocols in intensive care?

PHASE 3: Will an evidence-based implementation process, guided by the CFIR, to implement a validated evidence-based physiotherapy protocol in a surgical ICU in SA effectively facilitate uptake, adherence and change in ICU physiotherapy practice?

The following research aims addressed each phase of the study. The aims were to:

1. describe the profile of physiotherapists and their department organisation and structure in public sector hospitals with ICU facilities in SA **(Phase 1)**;
2. describe the profile and current practices of ICU physiotherapists and the ICU organisation and structure in which ICU physiotherapists work in the public sector in SA **(Phase 1)**;
3. systematically identify rigorous evaluations and determine the best-practice implementation strategies to effectively facilitate the uptake of clinical practice guidelines and/or protocols in intensive care **(Phase 2)**;
4. explore and describe the patient perceptions and satisfaction regarding the physiotherapy care received during their surgical ICU stay **(Phase 3)** [Addendum 4 – MSc Physiotherapy Project, van Nes, 2015]**.**
5. explore the barriers and facilitators to the best-practice implementation strategies and develop a tailored best-practice implementation strategy **(Phase 3)**;
6. evaluate (summative) a tailored best-practice implementation strategy (implementation intervention) guided by the Consolidated Framework for Implementation Research [CFIR] **(Phase 3)**. and;
7. explore and describe (formative) the physiotherapists perceptions of the implementation process **(Phase 3)** [Addendum 5 – MSc Physiotherapy Project, Maritz, 2017].

These aims contributed to the overall research aim.

1.8 Dissertation Overview

The structure of the dissertation is illustrated in Figure 1.3. The information documented in this dissertation is presented in the three phases of the project. The three phases of the project consist of seven studies with different methods addressing the aims in 1.7. Two studies addressing aim 5 and 7 in 1.7 are part of two Masters Projects completed under the supervision of the Primary

Investigator [FK] and are available in Addendum 4 and 5 in the dissertation. Each of the studies contributes towards a better understanding of the overall aim of the project. The chapter/s for each phase of the study is presented in article format that will be edited for the journals appropriate for each topic covered and prepared for submission for publication. Individual reference lists will be prepared for each article when submitting for publication. For the purpose of ease of reading this dissertation, one reference list is presented following the concluding chapter. The chapters have been given colour-coded headers according to Figure 1.3 for ease of reference. The chapters for studies in phase 3, including the Addenda of the chapters completed as two Masters Projects has been colour-coded as in Figure 1.3. The colours of these headers for each chapter and addenda related to Phase 3 is aligned to the colour for each CFIR domain addressed by each study as presented in the CFIR diagram [Figure 1.2]. The chapters of the dissertation are outlined as follows:

Chapter one of the dissertation is the introduction to the study and highlights the gaps in the evidence that lead to the overall research question and motivates the aims of the study. It also outlines the framework used in Phase 3 of the trial study and explains how the framework is used to guide the aims of this Phase and the implementation process.

Chapter two (Phase 1) describes the profile of public sector physiotherapists and their department organisation and structure in central, regional and tertiary public sector hospitals with ICU facilities in SA.

Chapter three (Phase 1) describes the profile and the current practices of the physiotherapists rendering services in ICUs in these public hospitals in SA and the organisation and structure of these public ICUs in which the physiotherapists work.

Chapter four (Phase 2) presents the results of the systematic review conducted to determine the best-practice implementation strategies to facilitate clinical practice guidelines and/or protocols in the intensive care setting.

Chapter five (Phase 3) describes the nominal group technique used to identify the barriers and facilitators for the best-practice implementation strategies identified in the review and tailor the

best-practice implementation strategies identified for the targeted group of physiotherapists who would be involved in the implementation of an evidence-based physiotherapy protocol in a surgical ICU.

Chapter six (Phase 3) describes the controlled before and after (CBA) experimental trial guided by the CFIR to implement and evaluate the evidence-based validated physiotherapy protocol for the physiotherapeutic management of surgical ICU patients in an experimental surgical ICU compared to standard/usual physiotherapy care in a control surgical ICU.

Chapter seven describes the entire project in a broader context by means of an overall project discussion integrating the findings of all the separate studies including the strengths of the studies. This is followed by the limitations and recommendations for future studies and a summary of findings.

Finally, **Chapter eight** concludes with main findings and how they can be used in the way forward.

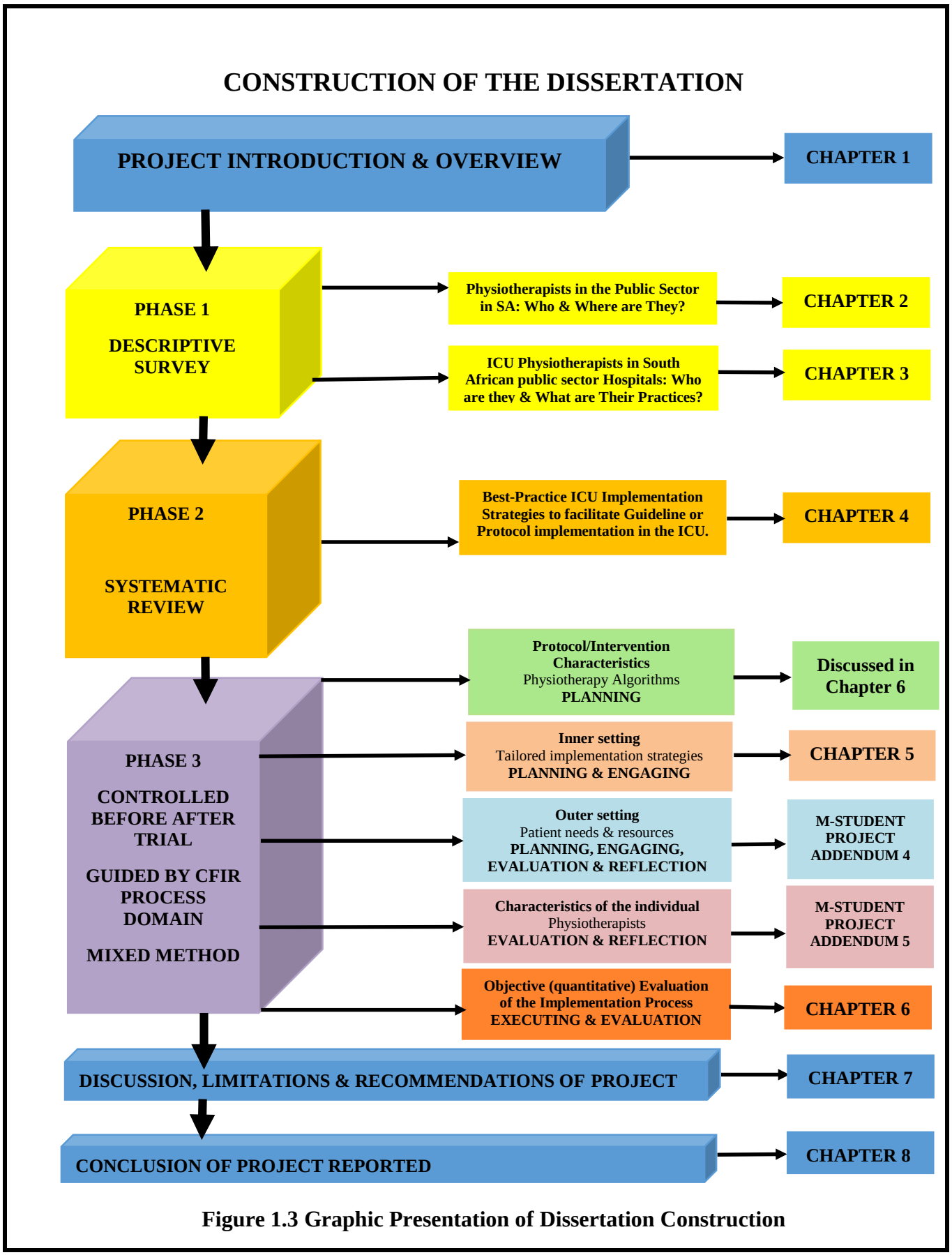


Figure 1.3 Graphic Presentation of Dissertation Construction

CHAPTER 2: PHASE 1

Physiotherapists in the Public Sector in South Africa: Where & Who are They?

2.1 Introduction and Background

Physiotherapy plays an essential role in healthcare and forms part of the interdisciplinary healthcare team. The profession is integral to health promotion and prevention, acute care [intensive or critical care] and rehabilitation (McFadden et al., 2016; Higgs, Refshauge & Ellis, 2001). Physiotherapists contribute to the acute management and rehabilitation of patients with a variety of health-related conditions. They are able to provide quality care and improved patient outcomes with minimal cost to the health care budget thereby improving efficiency in the health care system (McFadden et al., 2016). However, globally the profession has been struggling with variations in their role and practices in healthcare especially in intensive care (Malone et al., 2015; Fisher et al., 2012; Gosselink et al., 2008). In 2003, Struber, stated that the changing healthcare system in Australia resulted in a lack of clear identity and vision. Struber, (2003) stated that their existing physiotherapy roles appeared difficult to sustain in their healthcare climate at the time.

In South Africa (SA), political transformation and reform since 1994, has resulted in changes in the current healthcare system. The healthcare resources in the country are limited, especially so in the public health sector that receives only 13.5% of the countries' total budget (Unicef South Africa, 2017; Benatar, 2013; de Beer, Brysiewicz & Bhengu, 2011). The healthcare system has been dismantled and rebuilt with the limited healthcare resources being redistributed from tertiary level care to primary healthcare due to the increased need for health promotion and prevention rather than curative and rehabilitative care (Benatar, 2013; Higgs et al., 2001). Healthcare resources were withdrawn mainly from academic medical centres specifically those in the Western Cape and Gauteng province (de Beer et al., 2011; Benatar, 2004).

The academic medical centres in SA provide tertiary level care including hi-tech specialized healthcare services such as intensive care. These specialist services such as Level I, II and Level IV (high care/stand down) ICU facilities are situated in central, regional and tertiary public hospitals according to the Government Gazette of South Africa (2011). These tertiary level care public hospitals require skilled and adequately trained medical and allied healthcare

professionals including physiotherapists to deal with the increased burden of disease in the country and may be affected by the redistribution of healthcare resources to primary health care. The redistribution of resources has an effect on both undergraduate and postgraduate academic training for all healthcare professionals and the acquisition and maintenance of skills in the tertiary facilities linked to the academic medical centres (Benatar, 2013; de Beer et al., 2011; Benatar, 2004). Therefore, physiotherapists working in these tertiary level care facilities in SA may also experience challenges with training, development and maintenance of skills, human resource allocation and lack of role definition and vision due to healthcare changes (Struber, 2003).

The public health care sector in SA is overburdened. There is an increased burden of disease and 82 out of 100 people who fall out of the "medical aid net" are largely dependent on public health care in the country (Unicef, South Africa, 2017). This places a burden on healthcare professionals in tertiary level care facilities where resources have been reduced for primary health care. Staff shortages and limited skilled healthcare professionals in these tertiary facilities may affect quality of care and patient outcome. Physiotherapists work in these tertiary level care public sector hospitals. In light of the changing healthcare system, increased burden of disease, redistribution of resources, drive for quality care, improved patient outcomes and reduction in healthcare costs, physiotherapy in SA especially in the public health care sector needs to be explored and assessed.

Very little has been published in the literature about the physiotherapists working in the public health care sector in SA. Minimal information of the current situation of physiotherapists working in the tertiary level care public sector hospitals in SA could be found. There is a paucity of published reports or papers on the age range, job ranks, qualifications, involvement in student supervision and training and continuous professional development of public sector physiotherapists in SA. Very little of this information is available from Statistics SA, the National Department of Health (NDoH), Health Professionals Council of South Africa (HPCSA) regulating body and the South African Society of Physiotherapy (SASP) which is the member society for Physiotherapists in the country. Therefore, we do not have clarity on whether physiotherapy departments exist in the public sector hospitals that house ICU facilities, specifically the central, tertiary and regional hospitals and to what extent they are functioning. We need to clarify the organisation and structure of existing physiotherapy departments and the

profile of the physiotherapists working in these departments. Therefore, the aim of this study was to obtain information about and provide a clear picture of the organisation and structure of physiotherapy departments, number and types of ICUs that need physiotherapy service provision and the profile of these physiotherapists working in the public sector hospitals with existing ICU facilities in SA.

2.2 Method

2.2.1 Research Design

An exploratory descriptive cross-sectional survey was conducted.

2.2.2 Research Setting

The survey was conducted in South African Public Sector Central, Regional and Tertiary Hospitals that house Level I to IV ICUs. It was not known which of these public sector hospitals and their respective ICUs had available Physiotherapy services.

2.2.3 Population

The population consisted of all Physiotherapy Departments situated in the central, regional and tertiary public hospitals in SA.

2.2.3.1 Recruitment of the Sample

The Government Gazette of South Africa, (2011) [Addendum 6] was used to identify the hospitals in each of the nine provinces in SA to be included in the study. Central, regional and tertiary hospitals were chosen as they are defined as those housing both Level I, II and Level IV (high care/stand down) ICU facilities. A total of 10 central, 48 regional and 13 tertiary public sector hospitals were identified.

2.2.3.2 Sampling Method

A total population sampling method was used whereby all the hospitals was contacted based on the information from the Government Gazette and all existing Physiotherapy Departments included in the survey.

2.2.4 Instrumentation

An electronic self-reporting survey [Addendum 7] was designed on Survey Monkey by the

Primary Investigator (FK). The survey was designed by including similar questions used in previous international surveys and according to the specific objectives of the study. The survey related mainly to the organisation and structure of the Physiotherapy Departments and ICUs that exist in the hospitals that physiotherapy services are rendered to and the profile of the physiotherapists working in the respective Physiotherapy Departments.

Organisation and structure included questions on the number of hospital beds in the hospital in which the department is based, who is responsible for running the physiotherapy department, the total number of physiotherapists working in the respective departments, the number of physiotherapists under each job rank category (e.g. Production Level I), permanent or contract employment, the involvement of the departments in training and supervision of student physiotherapists in intensive care and the involvement of the department in intensive care related continuous professional development (CPD) activities. A question regarding the types of ICUs situated in the hospital in which the respective physiotherapy departments are based was also included in the survey in order to determine the number and type of ICUs the physiotherapists render services to.

The profile of the physiotherapists included questions on age categories of the physiotherapists in the department (e.g. 22-25years of age), qualifications, training (e.g. South African or international training), ICU clinical education block training as a student physiotherapist and international intensive care work experience. Lastly, an open-ended question for any further comments from the physiotherapy department heads related to the profile of the physiotherapists, organisation and structure of their departments and provision/rendering of ICU services was included.

2.2.4.1. Functionality of the Survey and Survey Monkey Platform

Emails with the survey link could be sent to the respondents through the Survey Monkey platform. Data from the survey was automatically saved on the survey platform in a Microsoft excel database as the respondent completed it. The respondent could stop the survey at any time and continue completion at another time starting from where they had left off. The survey was also setup to prevent respondents leaving out responses by setting a “response required” option. The respondent could also not go back to change their previous responses when returning to the survey. The survey responses could also not be changed or completed once the survey was

submitted or closed on the platform by the Primary Investigator [FK]. The Survey Monkey platform also keeps track of respondents who either do not or partially respond and these respondents can be sent reminders to complete and submit the survey. This option was used with the survey reminders. There is an option for manual completion of the survey by the researcher for those who respond to the survey telephonically if unable to access it electronically. This was used for the telephonically completed surveys. Survey Monkey requires the account holder (Primary Investigator [FK]) to have a username and password to access surveys and responses allowing protection of data and maintaining anonymity and confidentiality as the data was only accessible to the Primary Investigator [FK].

2.2.4.2 Face and Content Validity

The survey questionnaire and objectives were sent via email through Survey Monkey to a group of four national and international academic and clinical experts in ICU Physiotherapy for face and content validity. They were asked to review the survey questionnaire and state whether the questions were appropriate to meet the objectives of the study by completing a questionnaire on Survey Monkey. Following receipt of responses, the researcher then made the relevant changes according to the comments sent back which included adding additional questions and adjusting some questions to meet all the objectives and saved the final version of the survey on Survey Monkey for data collection. The final version of the survey questionnaire was also piloted for ease of use and time to complete the survey following content and face validity. Three clinical physiotherapists who previously had worked in the public sector and specifically in ICU was included in this pilot. The survey takes on average 5 to 10 minutes to complete via email and 10 to 15 minutes via telephone. There were no problems reported with regards to ease of administration of the survey.

2.2.5 Procedure

Ethics was obtained from the Human Research Ethics Committee of Stellenbosch University (S13/09/170) [Addendum 1]. Permission was obtained from the Departments of Health of each province [Addendum 8] together with permission from the Hospital Chief Executive Officers, Research Ethics Committees or Heads of Physiotherapy Departments of the included hospitals as required. All aspects pertaining to ethical conduct during the study was adhered to. The permission obtained from the Provincial Departments of Health was staggered over time. The survey was therefore conducted between 03 April 2014 and 13 February 2015. Each hospital

was contacted telephonically to determine the existence of ICUs and a Physiotherapy Department. The contact details (telephone number and email address) of the Head of Department (HOD) of each physiotherapy department was obtained. The HODs of each physiotherapy department was then contacted telephonically to describe the purpose and relevance of the study and to determine whether they render services to the ICUs in the included public sector hospitals. Verbal consent was obtained from the HODs following explanation of the study to email the survey to them (HOD). Survey links embedded in an email were sent via the Survey Monkey platform [Addendum 9]. Participation was voluntary and submission of the survey implied consent. Participants could withdraw from the study at any time without consequence.

2.2.5.1 Data Collection

The electronic survey was emailed to all heads of physiotherapy departments through the Survey Monkey platform. They were asked to complete this survey within 5 days and were given two, one week reminders after which a telephonic interview to complete the survey was done at their convenience. This was done to ensure maximum response rate. No further reminders to complete the survey were given after the two electronic and one telephonic reminder. The HODs were proxy respondents in terms of providing profile information that may have been subject to change and therefore must be noted and taken into consideration as the time and effort the HODs took to gather data and ensure accuracy and fidelity of the data submitted were not captured.

2.2.5.2 Data Capturing

All survey data submitted by participants was automatically entered and stored in a Microsoft Excel Database on the Survey Monkey platform. The data was coded in the excel data sheet by the research assistant. The coded data was checked and verified by the Primary Investigator [FK]. The coded data was then exported to the Statistical Package for Social Sciences (SPSS) version 24 for analysis.

2.2.5.3 Data Analysis

All surveys returned formed part of the analysis and therefore included complete and incomplete questionnaires. The response and completion rates were calculated in percentages. Descriptive data analysis was done and categorical and continuous data summarized as

frequencies and percentages and presented in text, tables and figures such as bar graphs and pie charts. Inferential statistics was conducted using non-parametric one sample Chi Square tests for categorical variables, independent samples Kruskal-Walliss test for categorical and continuous data comparison and one sample binomial test for dichotomous variables to test for the probability of equal responses. Results were significant at a p-value of 0.05 two sided.

2.3 Results

All nine provinces took part in the survey with all Provincial Departments of Health giving permission to contact the included hospitals and their relevant physiotherapy departments. A total of 71 public sector central, regional and tertiary hospitals listed in the Government Gazette of South Africa, (2011) was identified and included in the study. In the Eastern Cape Province there were four central hospitals that had joined to form two central hospital complexes and thus this Province had a total of four instead of six hospitals. Three regional hospitals, one in the Western Cape and two in KwaZulu-Natal reported to have no ICUs and thus no ICU physiotherapy services. Therefore, a sample of 66 hospitals was obtained and included. Table 2.1 depicts the distribution and number of hospitals for each Province. Gauteng and KwaZulu-Natal Provinces had the most hospitals. Each of the 66 hospitals provided intensive care services.

Table 2.1 Distribution and Number of Hospitals with ICUs

Province	Central Hospitals	Tertiary Hospitals	Regional Hospitals	Total Hospitals/Province
Eastern Cape	1	2	1	**4**
Free State	1	0	5	**6**
Gauteng	4	0	11	**15**
KwaZulu-Natal	2	2	12	**16**
Limpopo	0	2	5	**7**
Mpumalanga	0	2	3	**5**
Northern Cape	0	1	1	**2**
North West	0	2	3	**5**
Western Cape	2	0	4	**6**
TOTAL	**(10)**	**(11)**	**(45)**	**(66)**

Each hospital had a Physiotherapy Department that rendered ICU services and therefore a total of 66 physiotherapy departments were included in the survey [Figure 2.1].

2.3.1 Response Rate

All Heads of the Physiotherapy Departments (n=66, 100%) responded to the survey but only 70% (n=46/66) completed the survey [Figure 2.1].

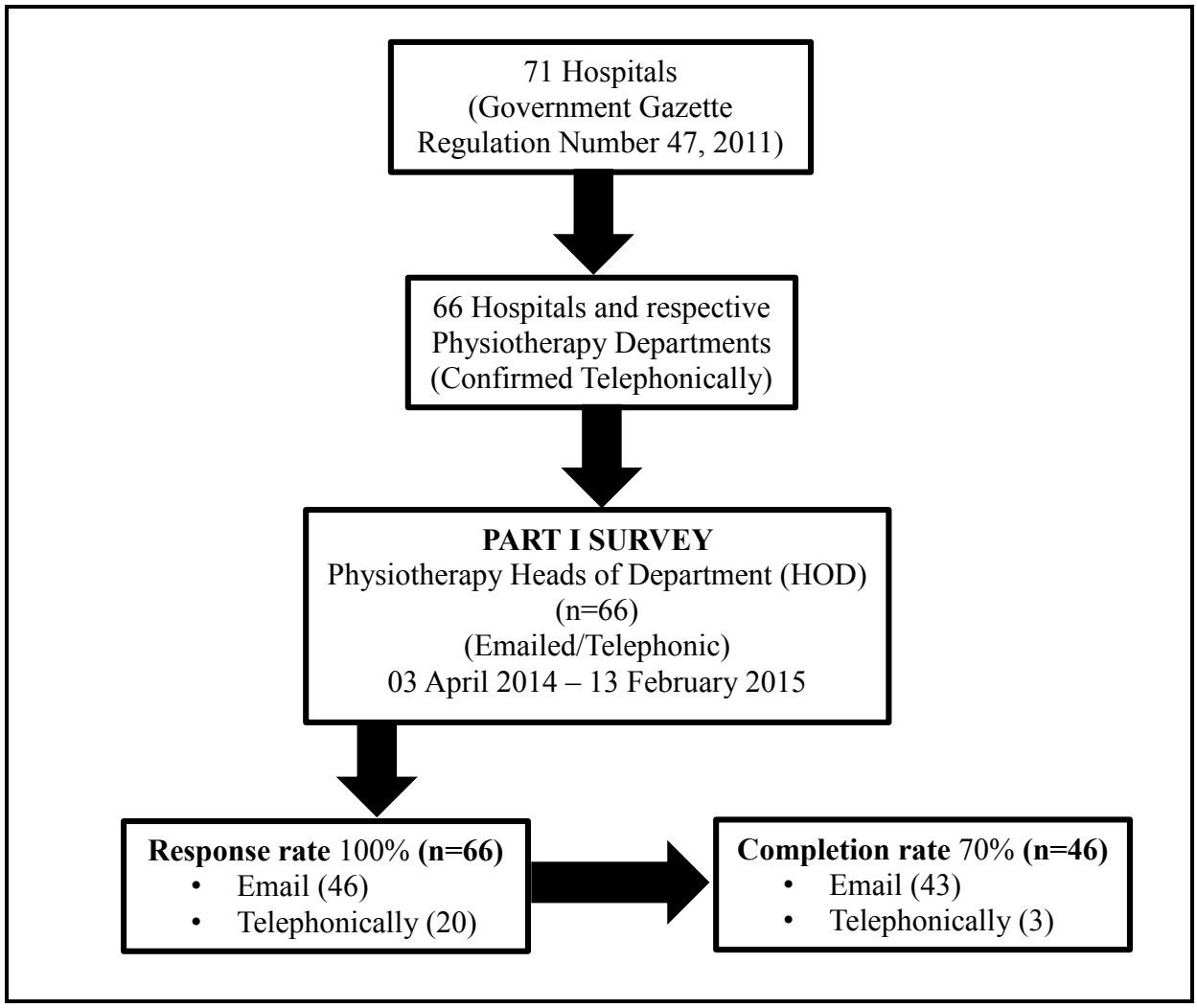


Figure 2.1 Sample of Physiotherapy Departments Recruited and Survey Responses

Figure 2.2 represents the response rate per province. Gauteng and KwaZulu-Natal who have the most hospitals had some of the lower response rates.

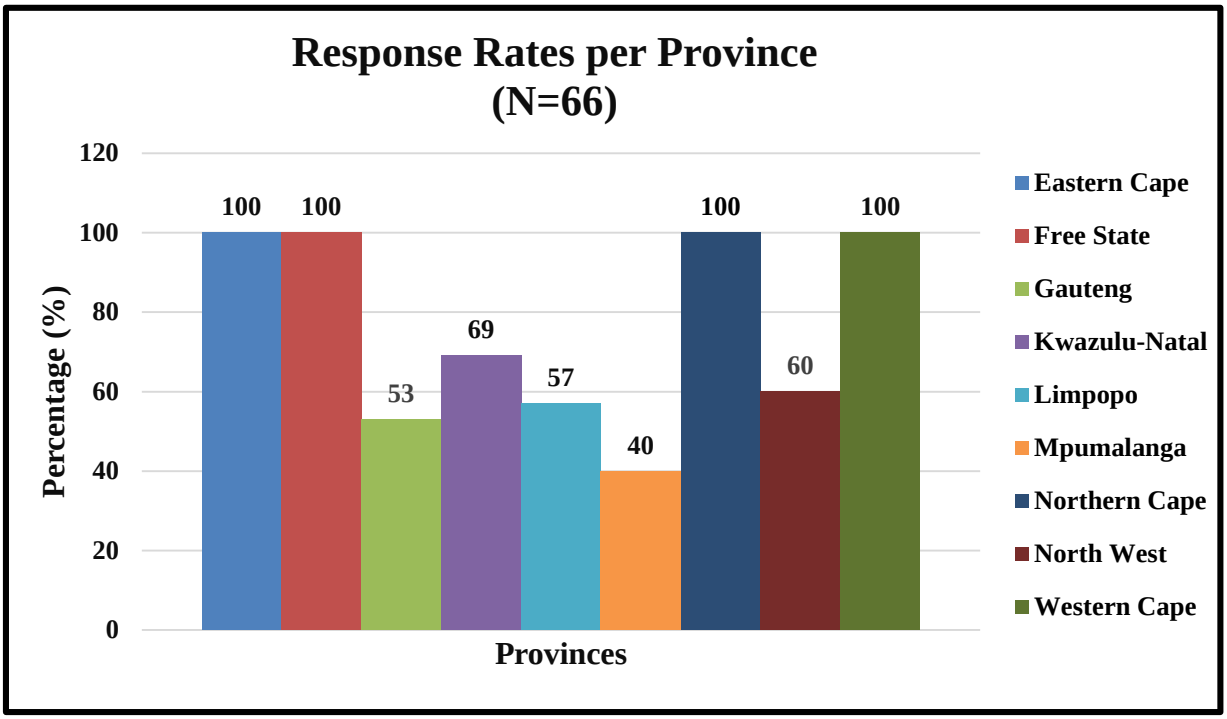


Figure 2.2 Physiotherapists Response Rates per Province

Figure 2.3 represents the geographical distribution of the response rates per province. Although Gauteng, KwaZulu-Natal, Western Cape and North West Provinces presented the highest percentages of the total respondents the responses of the provinces occurred with equal probability (p =0.09).

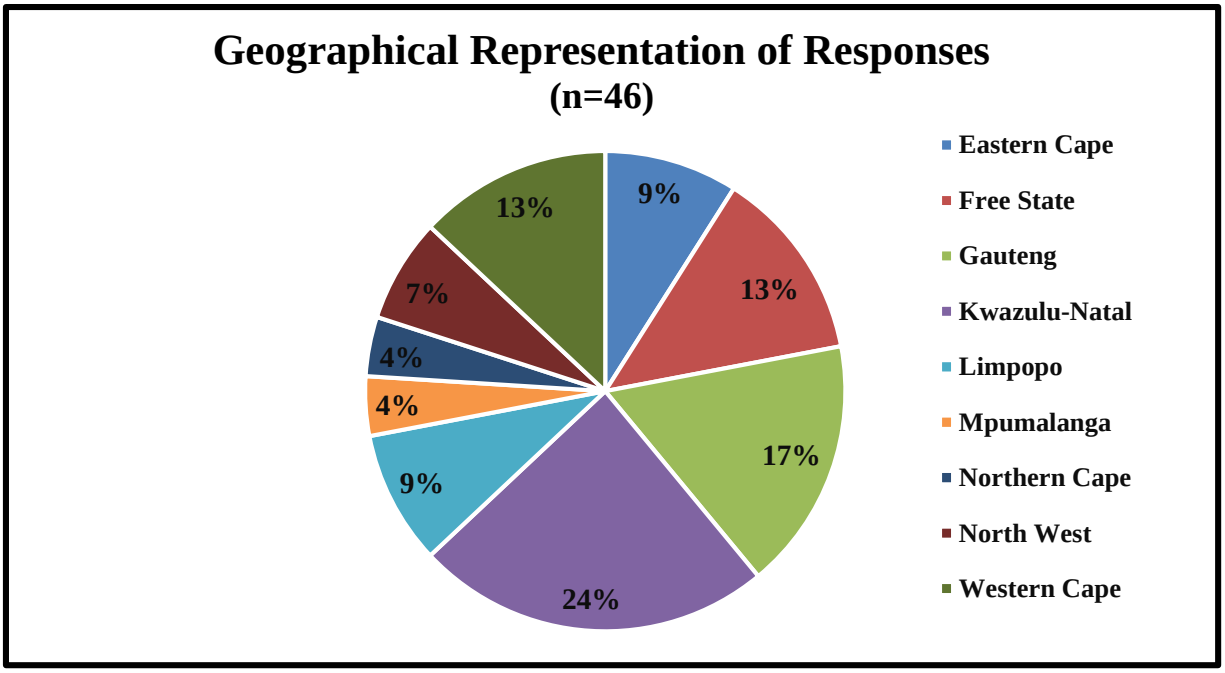


Figure 2.3 Geographical Distribution of Physiotherapist Responses

2.3.2 Public Sector Intensive Care Units in the Country

A total of 170 public sector ICUs were reported to be situated in the included hospitals to which physiotherapy services were rendered. Table 2.2 represents the geographical distribution and different types of ICUs reported by 100% (n =66/66) of the physiotherapy departments in each province. A large number of ICUs are found in Gauteng and KwaZulu-Natal provinces who have the most hospitals. There are more Level I (mixed, neonatal and paediatric) ICUs reported than Level II, specialist ICUs (Burns, Cardiothoracic, Coronary and Acute Spinal Cord) in the country [Table 2.2].

Table 2.2 Geographical Distribution and Type of ICUs in the Public Sector Hospitals

Province	Types of Intensive Care Units Reported (N)												
	Burns	Cardiothoracic	Medical	Medico-Surgical	Mixed	Neonatal	Neurosurgical	Paediatric	Respiratory	Surgical	Trauma	Other*	**Total ICUs/Province**
Eastern Cape	0	1	0	0	6	5	0	3	0	0	0	0	**15**
Free State	0	1	1	0	6	5	1	2	0	1	0	0	**17**
Gauteng	2	3	2	1	12	9	3	3	1	1	3	1	**41**
KwaZulu-Natal	2	1	3	4	8	9	1	5	1	3	1	4	**42**
Limpopo	2	0	0	0	6	2	0	2	0	0	0	1	**13**
Mpumalanga	0	0	0	0	4	1	0	1	0	0	0	0	**6**
Northern Cape	0	0	0	0	5	3	0	1	0	0	0	0	**9**
North West	0	0	0	0	2	1	1	1	0	0	0	1	**6**
Western Cape	1	2	2	0	4	2	2	1	1	2	2	2	**21**
Total ICUs (N)	**7**	**8**	**8**	**5**	**53**	**37**	**8**	**19**	**3**	**7**	**6**	**9**	**170**

*(Coronary, Obstetrics and Gynaecology, Acute Spinal Cord or Renal)

2.3.3 Organisation and Structure of the Physiotherapy Departments

All physiotherapy departments (100%, n=46/46) were run and organised by a qualified and registered physiotherapist. Fifty-nine percent (n= 27/46) of physiotherapy departments were based in hospitals that had ≥400 and <1000 beds, 28% (n=13/46) in hospitals with <400 beds, 9% (n=4/46) in hospitals with ≥1000 and <1500 beds and 4% (n=2/46) in hospitals with ≥1500 beds.

2.3.3.1 Number of Physiotherapists

A total of 429 physiotherapists worked in the responding physiotherapy departments with a total of 50 physiotherapy assistants. Figure 2.4 presents the distribution of physiotherapists working per province. The highest percentage of physiotherapists is reported to work in the Gauteng and KwaZulu-Natal Province who have the most hospitals and ICUs. However, the percentage of physiotherapists across the categories of provinces responding to the survey are the same (p=0.47).

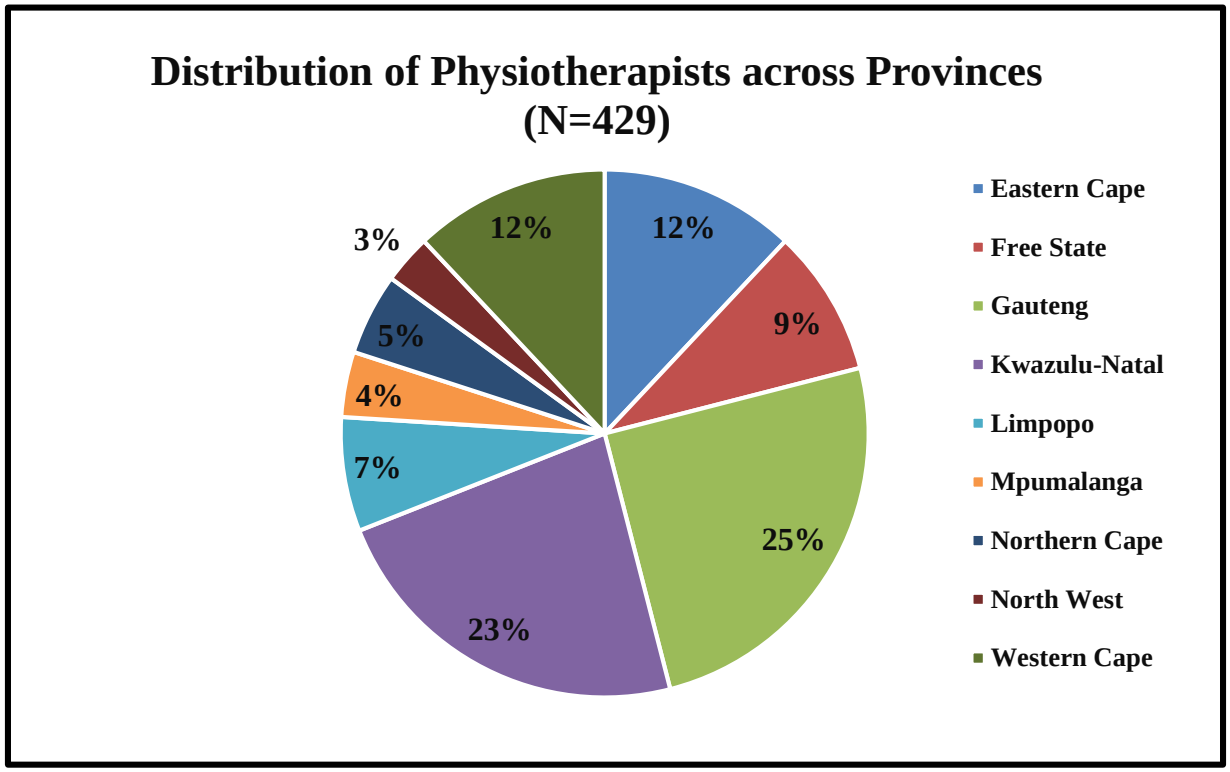


Figure 2.4 Distribution of Physiotherapists Working per Province

2.3.3.2 Job Rank

Approximately a third (31%, n= 133/429) of all the physiotherapists were employed as Production Level I ("Junior") Physiotherapists. Twenty percent (n= 84/429) were community service physiotherapists [Figure 2.5]. It was reported that 79% (n=339/429) of the physiotherapists were employed permanently and full-time. Four (0.95%) were employed on a permanent part time basis and two (0.05%) were employed as a locum and contract physiotherapist respectively. All the community physiotherapists (20%, n=84) were employed as contract physiotherapists.

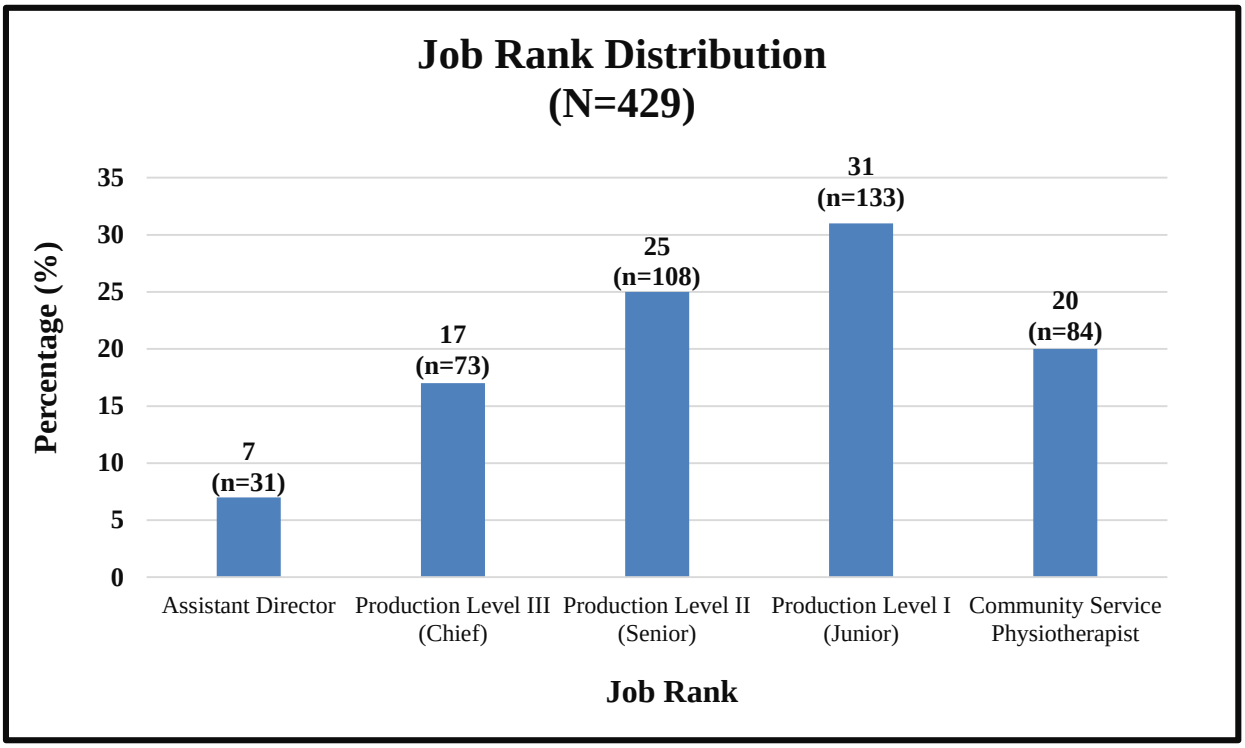


Figure 2.5 Job Rank Distribution of the Public Sector Physiotherapists

2.3.3.3 ICU Services and Training

All departments delivered ICU physiotherapy services. Student training and supervision in intensive care was provided by 52% (n=24/46, p=0.88) of the responding physiotherapy departments [Figure 2.6].

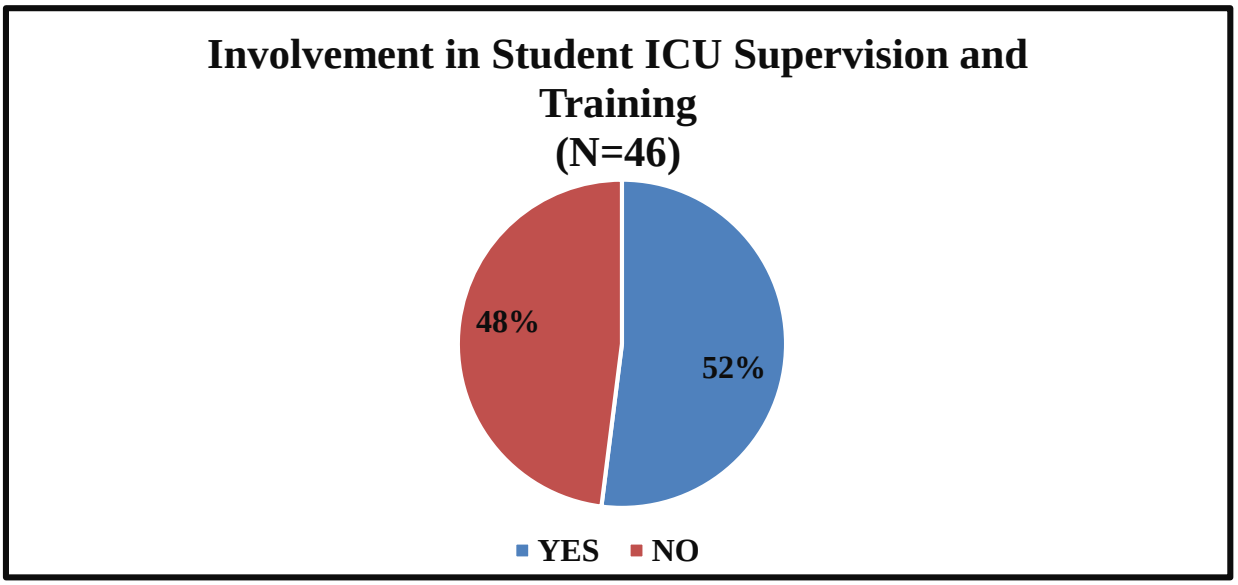


Figure 2. 6 Involvement in Student ICU Training and Supervision

The percentage of physiotherapy departments who had any of their physiotherapists attending any one or more ICU related post-graduate training activity is presented in Figure 2.7. More than a third of the physiotherapy departments reported that the ICU Refresher courses for Adult ICU (39%, n=18/46), the ICU Refresher courses for Paediatric ICU (35%, n=16/46) and ICU or Cardiopulmonary Seminars/Workshops/CPD Activities (35%, n=16/46) were attended by any of their physiotherapists as part of their ICU post-graduate training. Only 6.5% (n=3/46) of the physiotherapy Departments had a Physiotherapist with a Master's degree in the area of intensive care physiotherapy.

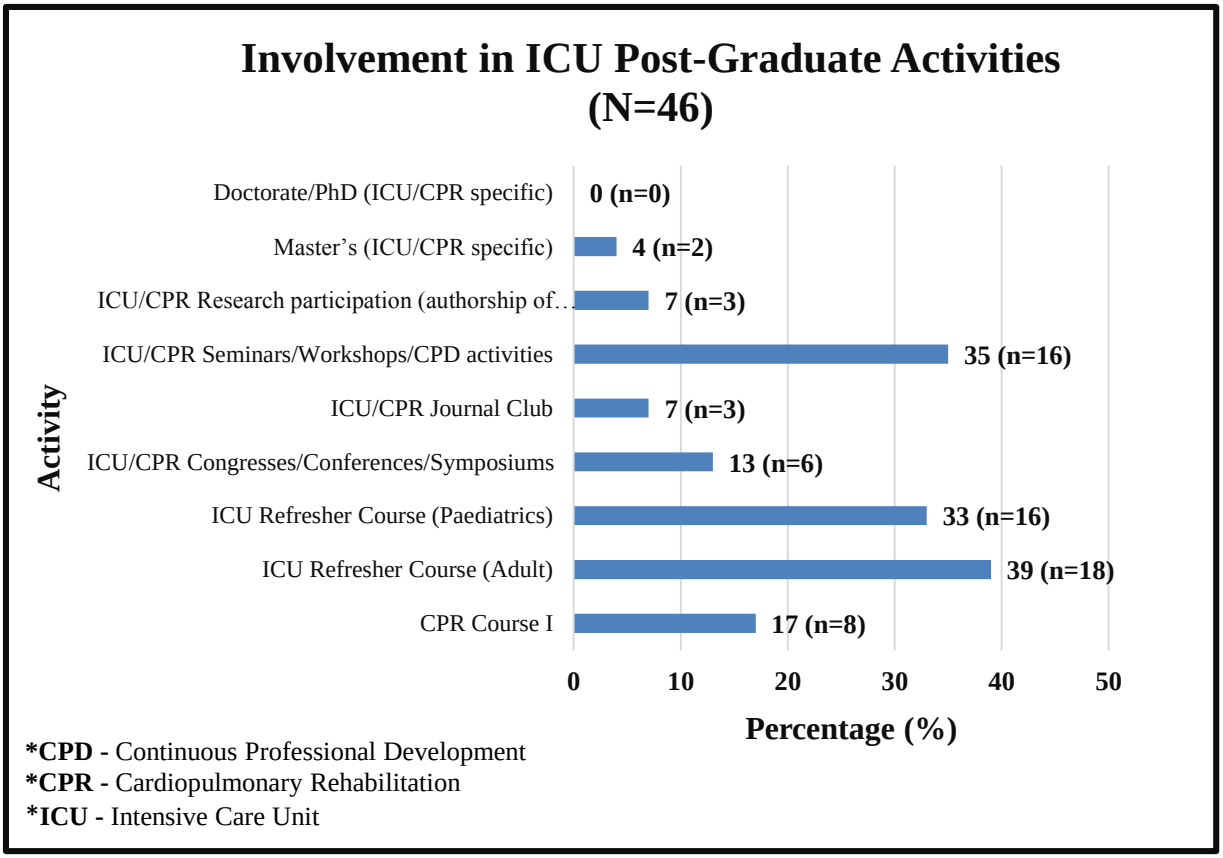


Figure 2.7 Percentage of Physiotherapy Departments' reporting Involvement in ICU or Cardiopulmonary Rehabilitation related Post-Graduate Activities

2.3.4 The Profile of the Physiotherapists

2.3.4.1 Age

The age categories of the physiotherapists working in the public sector physiotherapy departments can be seen in Figure 2.8. The majority (61.5%, n=265/429) were in the 22 to less than and equal to 30-year age category.

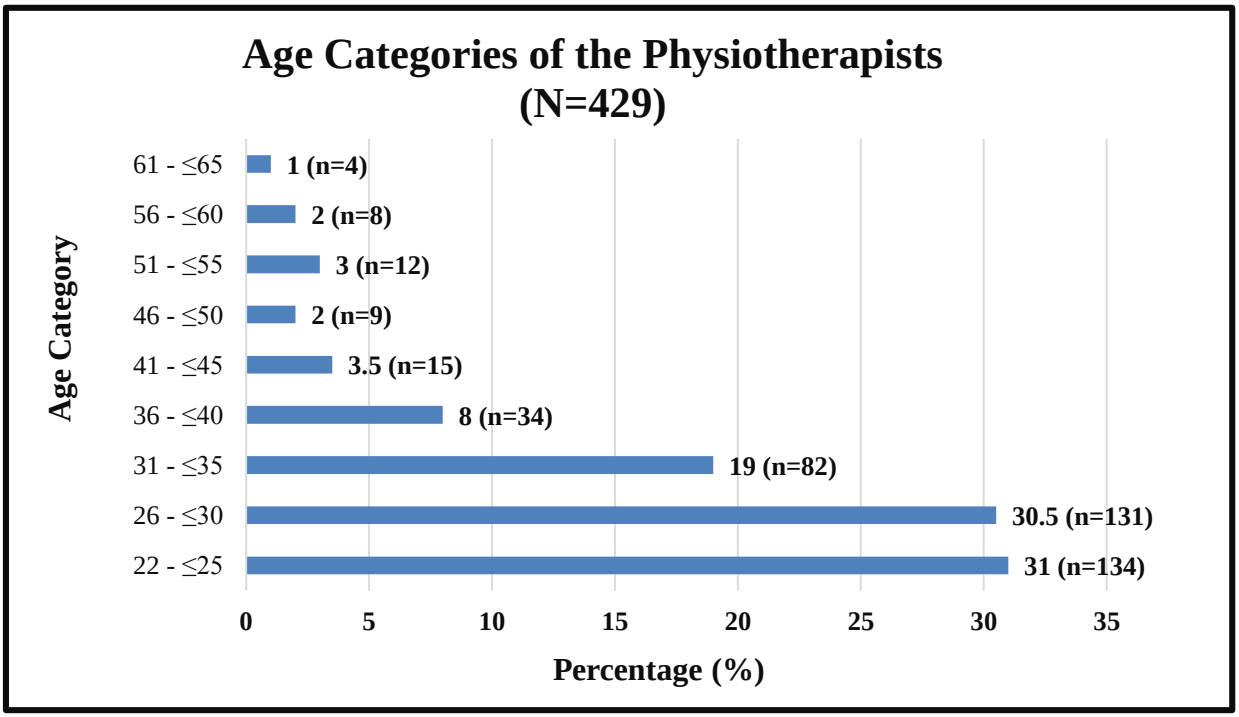


Figure 2.8 Percentage of Physiotherapists per Age Category

2.3.4.2 Qualifications

Significantly more (95.1%, 408/429, p<0.001) physiotherapists had Bachelor Degrees' Only 0.2% (n=1, p=0.01) was reported to have a Masters' Degree specifically in the area of ICU [Figure 2.9].

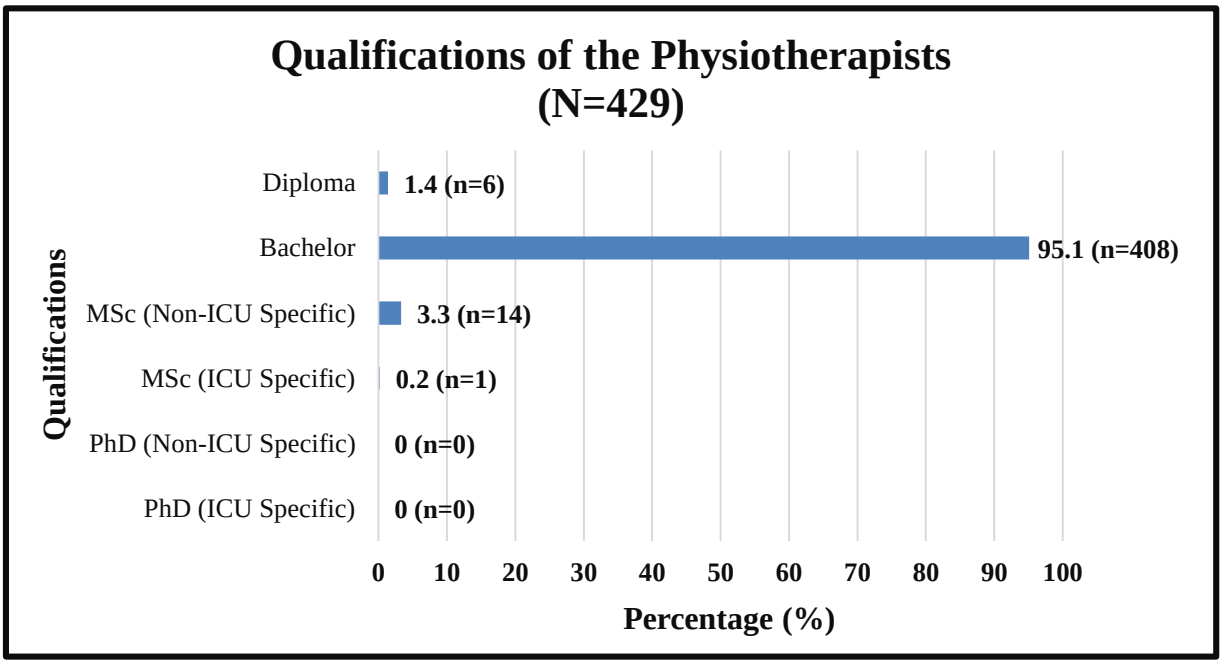


Figure 2. 9 Qualifications of the Public Sector Physiotherapists

2.3.4.3 Training and Work Experience

The majority (74%; n=34/46; p = 0.002) of physiotherapy departments reported that all the physiotherapists working in the respective departments were trained in South Africa (SA) [Figure 2.10]. A total of 3% (n=13/429) trained internationally as physiotherapists.

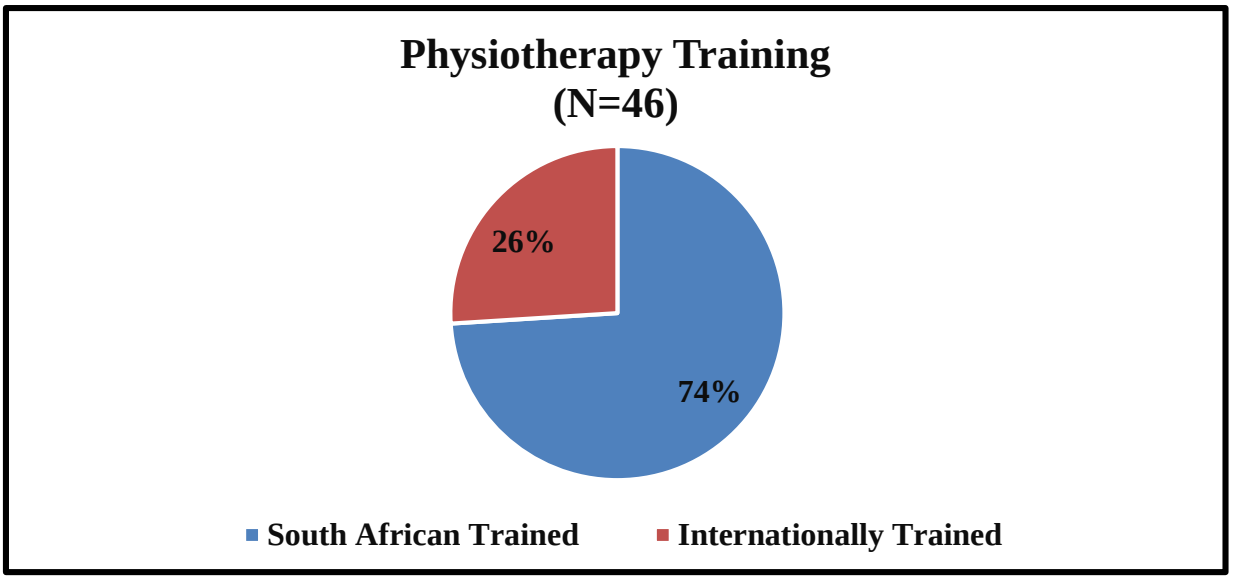


Figure 2.10 Training of the Public Sector Physiotherapists

The majority (93%, n=43/46, p < 0.001) of the physiotherapy departments reported that all physiotherapy staff had a clinical block as a student physiotherapist [Figure 2.11].

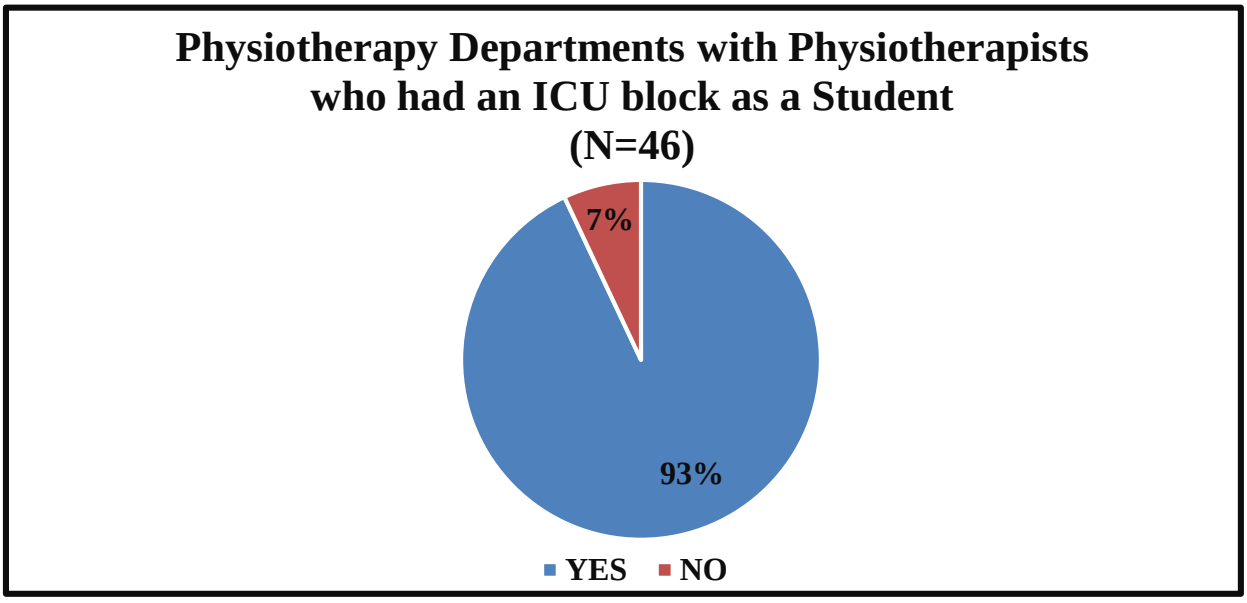


Figure 2.11 Physiotherapy Departments with Physiotherapists who had an ICU Clinical Block as a Student

It was reported by 41% (n=19/46, p=0.30) of physiotherapy departments that there were physiotherapists working in the department who had experience working in international intensive care units. A total of 8% of the total number of physiotherapists (n=34/429) had experience working in international intensive care units. [Figure 2.12].

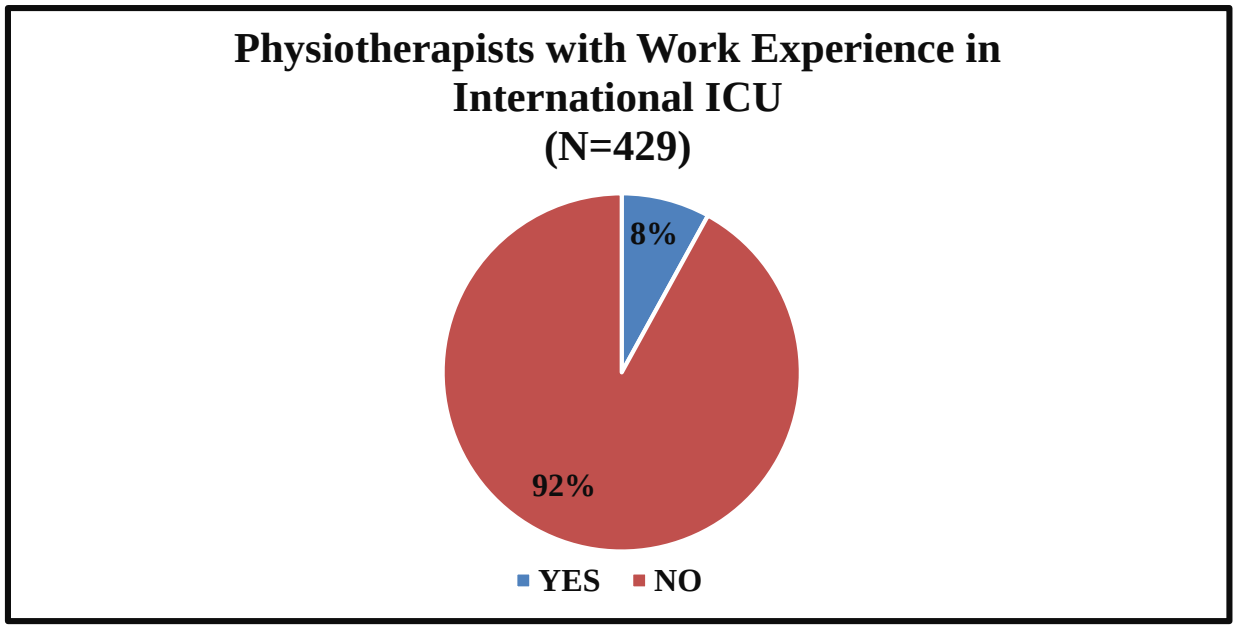


Figure 2.12 International Work Experience of the Public Sector Physiotherapists

2.4 Discussion

In South Africa, there are physiotherapy departments that exist and function in public sector hospitals with ICU facilities. Physiotherapists working in these hospitals are mainly South African trained, young and in the early phase of their careers. They have minimum basic qualifications and are employed mainly in permanent production level grade I ("junior" level) positions.

As physiotherapists in South Africa are recognised as first line practitioners with individual autonomy (Unger, 2010), it is positive to note that all physiotherapy departments are run and organised by qualified physiotherapists who are then autonomously responsible for their own quality and excellence. Fischer et al., (2012) states: *"Hospitals that implement departmental systems have a separate physiotherapy department, and decision-making and quality assurance focus on the best interests of the department as a whole"*. In an organised departmental model patient load tends to be more and this affects the physiotherapists workload. In the South African public hospitals included in the study, the functionally organised departmental model

is still being used with separate physiotherapy departments in each hospital. These organised departmental models tend to be costly because of the multiple levels of management associated with the profession (Fisher et al., 2012). For example, the Physiotherapists are ranked in hierarchical managerial levels with an Assistant Director or Chief/Production Level III at the top managing Senior/Production Level II Physiotherapists. These Senior/Production Level II then manage the Junior/Production Level I and Community Service Physiotherapists who are also managed by the Junior/Production Level I staff.

It has been suggested that process-oriented programme management models may be an option that can be used as they are associated with lower costs, higher clinical productivity and improved integration of staff roles as the model provides opportunities to expand leadership roles and promote communication among healthcare professionals (Fisher et al., 2012). Thus, Physiotherapists would become part of the multidisciplinary team in the areas in which they provide services for example the intensive care multidisciplinary team (Fisher et al., 2012). Although this model has benefits such as improved teamwork and use of human resources, it has its own challenges such as its two levels of accountability (Fisher et al., 2012). However, it can be explored in light of the countries resource constraints and need to save costs.

Physiotherapists have the responsibility to effectively and efficiently manage a variety of patients providing quality care and improving patient outcomes with minimal costs to healthcare. We identified a total of 429 practicing physiotherapists in the responding physiotherapy departments. The total number of beds in the hospitals from which responses were obtained are a total of 29663 (Government Gazette, 2011), which amounts to a physiotherapist to bed ratio of 1:69. This has implications for the physiotherapists in that they may not be able to render services at an optimum level and may not cover all patients every day (Fisher et al., 2012). The increased burden of disease in SA and therefore increased patient load have implications for the availability and quality of services these physiotherapists can provide. Research into staffing ratios for allied health professions, specifically physiotherapy internationally and in SA is scarce and lags behind the nursing and medical fields (Cartmill, Comans, Clark, Ash, & Sheppard, 2012). It would be useful to determine the staff to patient ratio for physiotherapists in the public sector especially in intensive care so as to plan for physiotherapists requirements and guide service planning and delivery.

Physiotherapists are expected to be autonomous and evidence-based practitioners. Quality of care and improved patient outcomes are dependent on skilled and experienced healthcare professionals. The South African public sector physiotherapists had minimal post-graduate degrees or training specifically so in the area of intensive care. Although they were working in hospitals housing ICUs which is a specialized field in medicine, few departments reported physiotherapists being involved in ICU continuous professional development activities and ICU related post-graduate studies. An in-depth analysis as to why the majority of physiotherapists working in these hospitals have not furthered their education and improved their skills and expertise should be explored. The public health care sector needs to evaluate the support or funding required by these physiotherapists to assist in improving knowledge and skills for providing quality care services. Their young age and therefore minimal years of experience also has implications for patient care and outcomes. Community service physiotherapists who are newly qualified graduates made up one fifth of the total number of SA physiotherapists in the included public hospitals. These young physiotherapists have minimal work experience and are building their knowledge and skills base and therefore also require ongoing support.

In a study by Price & Reichert, (2017), it was reported that: *"sufficient training and education to facilitate workplace transitions"* was expected by student and early-career nurses. Price & Reichert, (2017), reported that the student and early-career nurses also expected *"continuing professional development or education opportunities throughout their careers for career laddering."* whereas the mid- to late-career nurses were reported to have an understanding of the importance of lifelong learning for maintaining competency, providing quality patient care and enhancing career opportunities for the future (Price & Reichert, 2017). Price & Reichert (2017) reported that the nurses felt that training and education provided career satisfaction. Work environments that invested in continuing professional development opportunities to ensure continuous growth in nursing practice and provide optimal quality care for patients were perceived by the nurses to be heathy work environments (Price & Reichert, 2017). These findings by Price & Reichert, (2017) are important to consider and relate to the young, early-career group of public sector physiotherapists in SA who will later become the mid- to late-career physiotherapists and may have similar perceptions. The drive towards evidence-based practice especially in physiotherapy where implementation of evidence-based practice remains a challenge (Bernhardsson et al., 2017; Panhale, Bellare & Jiandani, 2017) requires the South

African public sector physiotherapy departments and physiotherapists themselves to increase involvement in continuous professional development activities and post-graduate education to improve competencies, quality care and ultimately patient outcome through evidence based practice.

This is the first study to describe the organisation and structure and the profile of physiotherapists working in public sector hospitals with ICU facilities in South Africa. A minor limitation was that many physiotherapy departments still did not have access to basic email and internet services at work. We therefore attempted to overcome this by conducting telephonic interviews. However, Physiotherapy Heads approached via telephone to complete the survey were mostly "too busy with patient care or administration" and did not have time to sit down to answer the survey. This limited the ability to obtain a 100% response rate. Even so our 70% response rate and ability to directly contact all included hospitals and their respective physiotherapy departments still remains a major strength of the study. Although resource intensive, the process allowed for more accuracy in the sampling and validity of the reported data. The survey was specific to the public sector and therefore gives a clear picture of this specific health care sector as other studies include both the private and public sector with a lack of differentiation between the two groups in their findings (van Aswegan & Lottering, 2016; van Aswegan & Potterton, 2005; Norrenberg & Vincent 2000).

Although we did not determine the gender of the physiotherapists working in the public hospitals we do have data to suggest that the profession has far more females than males. In 2015, the South African Society of Physiotherapy reported a female to male ratio of physiotherapists of 5.67:1 (http://www.wcpt.org/node/24611/cds, accessed 20.05.2017). We are confident that our results are accurate however, we do still need to point out that they must be interpreted with caution. The survey is a self-reporting tool completed by Heads of Department only and not each individual physiotherapist in these hospitals and thus some information may be lacking with regards to continuous professional development activities and international training or work experience. We also do not know the accuracy of records kept by these physiotherapy departments. A minor limitation and recommendation for future surveys would be to include a brief explanation of the study and what the data will be used for, followed by an online indication of acceptance than just providing the information sheet and implied consent on survey completion.

2.5 Conclusion

Until now we did not have a clear picture of the physiotherapists working in our public sector hospitals. This study has contributed to the gap in the evidence for physiotherapists working in the public sector hospitals with ICU facilities in SA, highlighting their current situation. It forms a baseline for future exploration and research of public sector physiotherapists in SA. The young, early-career physiotherapists in these public hospitals may require support for training, continuous professional development and post-graduate training to improve and maintain competencies, improve quality of care, patient outcome and maintain job satisfaction. They may need support to build their knowledge base, gain experience and climb the career ladder. The healthcare policymakers and researchers need to further evaluate the needs of public sector physiotherapists in SA and the physiotherapy to patient ratio to guide service planning and delivery. It is clear that physiotherapists in the public sector hospitals with ICU facilities need to provide ICU physiotherapy services. We now have clarity as to which type of ICUs they deliver services to. However, the ICU organisation and structure, ICU physiotherapists profile and current practices of the physiotherapists who render services to these public sector ICUs requires further study.

CHAPTER 3: PHASE 1

ICU Physiotherapists in South African Public Sector Hospitals: Who are they & What are their Practices?

3.1 Introduction and Background

Physiotherapists are part of the intensive care team and play a critical role in the management of intensive care patients (Hodgson & Tipping, 2017; Sigera et al., 2016; Hanekom, van Aswegan, Plani & Patman, 2014; Stiller, 2013). However, the role of physiotherapists in the intensive care is still being questioned. The European Respiratory Society (ERS) and European Society of Intensive Care Medicine (ESICM), recommended that clinical decision-making and education needs to follow standardized pathways and that the professional profile of intensive care physiotherapists should be defined (Yeole et al., 2015; Stiller, 2013; Gosselink et al., 2008). The ESICM also recommended that, *"the awareness of the benefits of prevention and treatment of immobility and deconditioning for critically ill adult patients must be increased"* (Gosselink et al., 2008). According to Yeole et al., (2015) any intensive care physiotherapy program should apply advanced, cost-saving therapeutic modalities in order to decrease ventilator dependency, improve residual function, prevent readmissions and new hospitalizations, and improve the patient's quality of life (Yeole et al., 2015). It is not clear whether physiotherapists working specifically in the public sector ICUs in South Africa (SA) are achieving these goals through their current practices.

Studies exploring the current practices and availability of physiotherapists in intensive care units have been published globally in low, middle, high income, developed and developing countries since 2000. Surveys have been conducted across all continents. Surveys conducted in European countries (Appleton, MacKinnon, Booth, Wells & Quasim, 2011; Norrenberg & Vincent, 2000), Asia (Baidya, et al., 2016; Sigera et al., 2016; Taito, Sanui, Yasuda, Shime, Lefor & Japanese Society of Education for Physicians and Trainees in Intensive Care (JSEPTIC) Clinical Trial Group, 2016; Yeole et al., 2015; Chokshi, Alaparthi, Krishnan, Vaishali & Zulfeequer, 2013; Kumar, Maiya & Pereira, 2007), Australia (Wiles & Stiller, 2010; Hodgin et al., 2009), America (Malone et al., 2015), and Africa including South Africa, Nigeria and Zimbabwe (van Aswegan & Lottering, 2016; Oke, Birabi & Oghumu, 2015; Tadyanemhandu & Manie, 2015; van Aswegan & Potterton, 2005) have described

physiotherapy services and practice patterns in ICUs in their countries to be variable. The role and practice patterns of the intensive care physiotherapist varies considerably between countries, hospitals and within hospitals (Malone et al., 2015).

There are variations in intensive care physiotherapy practice (Hanekom et al., 2013). The availability of therapists to the intensive care unit (ICU) and tasks performed contribute to this variability (Hanekom et al., 2013). The physiotherapists' activity in ICUs is influence by factors such as location and size of ICUs; ICU staffing levels and expertise, the ICU staff educational profile; and the intensivists' perceptions and referral attitudes (Malone et al., 2015; Hanekom et al., 2013, Kumar et al., 2007; Norrenberg & Vincent 2000). The variations in physiotherapy practices in intensive care settings also vary according to Sigera et al., (2016) in *"low to middle income and high-income countries"*. Physiotherapy practices in public intensive care settings in Sri Lanka, a low to middle income country, varied to practices described in a high-income country, such as the United Kingdom (Norrenberg & Vincent 2000). Although, in this instance the low income country like Sri Lanka (Sigera et al., 2016)., indicated higher proportions of ICUs receiving physiotherapy services on weekends and at night than the UK group of ICU physiotherapists (Norrenberg & Vincent 2000). Treatments provided by ICU physiotherapists also varied between ICUs in different countries such as Sri Lanka (Sigera et al., 2016), Australia (Stiller, 2013) and India (Kumar et al., 2007). Barriers and challenges faced with regards to the role and current practices of ICU physiotherapists such as lack of adequate training, staff numbers and workload in some surveys were however similar (Baidya et al., 2016; Sigera et al., 2016; Malone et al., 2015; Norrenberg & Vincent 2000).

South Africa is defined as an upper middle-income country by the World Bank (http://econ.worldbank.org, accessed 27.08.2017) and is described as both a developed and developing country with vast disparities in the social, economic and healthcare system. It is a country of contrasts in that there is a huge gap between the poor and the rich and also between areas that are developed and still developing (de Beer, et al., 2011). Healthcare and specifically ICU resources are limited in this country and especially so in the public health sector (Benatar, 2013; de Beer et al., 2011). The country has been undergoing changes in healthcare that include the national redistribution of health care resources from tertiary to primary care facilities. This has resulted in resources being withdrawn mainly from academic medical centres specifically those in the Western Cape and Gauteng province (de Beer et al., 2011; Benatar, 2004). This

redistribution of resources has an effect on postgraduate training and the acquisition and maintenance of skills in tertiary centres linked to these academic medical centres (Benatar, 2013; de Beer, et al., 2011; Benatar, 2004). The lack of adequate healthcare resources may have an effect on the training and human resource allocation of physiotherapists especially in ICUs in these tertiary centres in SA. It has been reported that there is no formal training for physiotherapists in the country (Mathiva, 2002) such like the ICU training courses received by nurses and medical doctors in critical care in SA.

South African intensive care resources are limited, with few intensive care beds spread across the country. A total of 92 public sector hospitals have ICU/high care beds in the country (de Beer et al., 2011). According to the Government Gazette of South Africa, (2011), public sector ICUs are found mainly in central, regional and tertiary hospitals with few units in some district and specialist hospitals. According to Mathiva, (2002), ICUs in SA are structured and graded from level I to level IV. Mathiva, (2002) describes the Level I units as units located in the public sector, in tertiary referral, university affiliated hospitals. Level I units have sophisticated equipment and level I units are able to manage a wide spectrum of critical illnesses. Level I units are closed units with 24-hour care. Level I units are directly managed by intensivists together with other support staff and services (Mathiva, 2002). Level II units are specialised units catering for specific populations e.g. cardiac, neurological or coronary care. Level III units provide limited invasive monitoring and are found in community hospitals (Mathiva, 2002). High-dependency units are structured and graded as Level IV units (de Beer et al., 2011; Mathiva, 2002). Most of the Level II-IV units are open units, with limited input from intensivists and have a 1:1 nurse/patient ratio (de Beer et al., 2011; Mathiva, 2002). Very little information is available with regards to the role and practices of the public sector physiotherapists who render services to these public sector ICUs and to what extent physiotherapy services are available.

While numerous surveys have been published describing physiotherapy practice internationally (Sigera et al., 2016; Malone et al., 2015; Nydahl et al., 2014, Appleton et al., 2011; Wiles & Stiller, 2010; Hodgin et al., 2009; Kumar et al., 2007; Norrenberg &Vincent 2000), in South Africa only two published studies, one which was a follow-up study, has described the scope of practice of physiotherapists working in intensive care (van Aswegan & Lottering, 2016; van Aswegan & Potterton, 2005). The original study conducted in 2005 distributed ninety survey

questionnaires. It was distributed to physiotherapy heads of department to only known secondary (regional) and tertiary government hospitals and private practice physiotherapists involved in Cardiopulmonary Physiotherapy that were listed in the South African Society of Physiotherapy Private Practitioners Association Official Membership Directory. The 2005 survey also did not specifically target all the public sector physiotherapists providing services to each of the ICUs in the country. Not all physiotherapists are registered with the South African Society of Physiotherapy (SASP) and the Cardiopulmonary Rehabilitation Specialist Group (CPRG). The SASP and CPRG do not have information as to which of their registered physiotherapists work specifically in public sector ICUs in the country and therefore this proves problematic when trying to describe the profile and current practices of intensive care physiotherapists in the public sector specifically. A low response rate obtained by van Aswegan & Potterton, (2005) also limited the author's ability to effectively describe the profile and practices of the intensive care physiotherapists working in public sector intensive care units in South Africa. The follow-up study by van Aswegan & Lottering, (2016) presented similar limitations in method, population and sampling but the questionnaire was validated. The sample was limited to those with 3 years of experience only, which does not represent those working in the ICU with fewer years of experience. This study by van Aswegan & Lottering, (2016) also had a low response rate of (33.9%, n=108/319) which included both the public and private sector physiotherapists. It was also not conclusive as to what the current practices of specifically the public sector ICU physiotherapists entailed.

It is not clear as to how often and to what extent public sector intensive care physiotherapists are involved in procedures such as chest physiotherapy, mobilisation and rehabilitation including active and passive movements, mobilisation to the chair and walking. The use of outcome measures and evidence-based protocols and the frequency of patient treatments by physiotherapists working in South African public sector ICU's have not been determined. There is also no clear description of the qualifications, training, workload, work hours including on call duty, referral, discharge and follow-up procedures of intensive care physiotherapists in these public sector units specifically. International guidelines have been developed to define physiotherapists input in intensive care. The purpose of these guidelines is to optimize benefit to patients and other healthcare team members (Hanekom et al., 2013; Gosselink et al., 2008). It is unclear whether intensive care physiotherapists are able to adhere to these guidelines within the South African healthcare environment. This information is important to benchmark current

practice. Minimal evidence on who the public sector intensive care physiotherapists in SA are and what they do prompted the development of a survey to determine and describe this. The purpose thus, of this study, is to provide a clear picture of the public ICUs organisation and structure, the profile and current practices of the public sector ICU physiotherapists in SA.

3.2 Method

3.2.1 Research design

An exploratory descriptive cross-sectional survey was conducted.

3.2.2 Research Setting

The survey was conducted in South African Public Sector Central, Regional and Tertiary Hospitals with ICUs and the respective Physiotherapy Departments.

3.2.3 Population

A total of 66 Physiotherapy Departments rendering services to 170 ICUs identified in a previous study (Chapter 2) included the total population.

3.2.3.1 Sampling method

A total population sampling method was used by including all physiotherapists, who worked in each of the 170 ICUs, in the survey.

3.2.4 Instrumentation

An electronic self-reporting survey [Addendum 10] was designed on Survey Monkey by the Primary Investigator (FK). The survey was designed by including similar questions used in previous international surveys and according to the specific objectives of the study. Questions on organisation and structure of the ICUs included the level of the ICU, number of ICU beds, the multidisciplinary team, ICU physiotherapy staff rotation and physiotherapy students working in the ICU. It also included questions about inductive training provided for the ICU physiotherapists regarding emergency on call or call-out duties, physiotherapy services in terms of physiotherapy assessment, treatment, documentation and referral letters in the ICU and organisation/operation of the ICU. Questions on job rank description, academic training, qualifications and general and ICU years of working experience of physiotherapists working exclusively (no ward duties) in the ICUs were included as part of the profile of these

physiotherapists. Current practices of the ICU physiotherapists included questions on workload (hours spent in ICU in the week and weekend, percentage of patient referrals and frequency of patient treatments). It included questions regarding ICU patient care or management. This included a question on who prescribed and decided upon the frequency of patient treatment, positioning, chest physiotherapy, mobilisation and rehabilitation activities. The respondent could choose more than one option for the latter. The frequency of use of chest physiotherapy activities, ventilatory activities, mobilisation and rehabilitation activities were also included under patient care or management. Questions on the utilisation of protocols and outcome measures, referral pattern and system, discharge and follow-up systems were also included.

3.2.4.1 Functionality of the Survey on the Survey Monkey Platform:

Emails with the survey link could be sent to the respondents through the Survey Monkey platform. Data from the survey was automatically saved on the survey platform in a Microsoft excel database as the respondent completed it. The respondent could stop the survey at any time and continue completion at another time starting from where they had left off. The survey was also setup to prevent respondents leaving out responses by setting a "response required" option. The respondent could also not go back to change their previous responses when returning to the survey. The survey responses could also not be changed or completed once the survey was submitted or closed on the platform by the Primary Investigator [FK]. The Survey Monkey platform also keeps track of respondents who either do not or partially respond and these respondents can be sent reminders to complete and submit the survey. This option was used with the survey reminders. There is an option for manual completion of the survey by the Primary Investigator [FK] for those who respond to the survey telephonically if unable to access it electronically. This was not used as no telephonic interviews were conducted as this method required more time from respondents to complete the survey due to the need to repeat questions and responses to each question. Respondents were not always contactable and could not provide the time needed to complete the survey telephonically during work time. Therefore, the respondents were reminded to completed the survey online. The Survey Monkey platform has a user identity and password for each individual account and thus was only accessible to the Primary Investigator [FK] maintaining the confidentiality and anonymity of data responses.

3.2.4.2 Face and Content Validity

The survey questionnaire and objectives were sent via email through Survey Monkey to a group

of four national and international academic and clinical experts in ICU Physiotherapy for face and content validity. They were asked to review the survey questionnaire and state whether the questions were appropriate to meet the objectives of the study by completing a questionnaire on Survey Monkey. Following receipt of responses, the researcher then made the relevant changes according to the comments sent back which included adding additional questions and adjusting some questions to meet all the objectives and saved the final version of the survey on Survey Monkey for data collection. The final version of the survey questionnaire was also piloted for ease of use and time to complete the survey. Three clinical physiotherapists who previously had worked in the public sector ICU were included in this pilot. The survey took on average 20 to 30 minutes to complete online. There were no problems reported with regards to ease of administration of the survey.

3.2.5 Procedure

Ethics was obtained from the Human Research Ethics Committee of Stellenbosch University (S13/09/170) [Addendum 1]. Permission was obtained from the Departments of Health of each province [Addendum 8] together with permission from the Hospital Chief Executive Officers, Research Ethics Committees or Heads of Physiotherapy Departments of the included hospitals as required. All aspects pertaining to ethical conduct during the study was adhered to. The permission obtained from the Provincial Departments of Health was staggered over time The survey was therefore conducted between 03 April 2014 and 01 May 2015. The contact details (telephone number and email address) of the ICU physiotherapists working in the respective ICUs at the time of the survey were obtained from the heads of physiotherapy departments (HOD) permitting the Primary Investigator [FK] to contact the clinicians to take part in the survey. The ICU physiotherapists were then contacted via email or telephonically to describe the purpose and relevance of the study. Verbal or written consent was obtained to email the survey to each of the ICU physiotherapists. Survey links embedded in an email were sent via the Survey Monkey platform [Addendum 11]. Participation was voluntary and submission of the survey implied consent. Participants could withdraw from the study at any time without consequence.

3.2.5.1 Data Collection

The electronic survey was emailed to all the ICU physiotherapists working in the respective ICUs at the time of the survey through the Survey Monkey platform. They were provided two

weeks to complete and submit the survey after which two reminders were sent each giving a further two weeks each to complete the survey. Following this a telephonic reminder to complete the survey online was requested. The reminders were to ensure maximum response rate. No further reminders to complete the survey were given after the two electronic and one telephonic reminder.

3.2.5.2 Data Capturing

Survey data submitted by participants was automatically entered and stored in a Microsoft Excel Database on the Survey Monkey platform. The data was coded in the excel data sheet by the research assistant. The coded data was checked and verified by the Primary investigator [FK]. The coded data was then exported to the Statistical Package for Social Sciences (SPSS) version 24 for analysis.

3.2.5.3 Data Analysis

All surveys returned formed part of the analysis and therefore included complete and incomplete questionnaires. The response and completion rates were calculated in percentages. Descriptive data analysis was conducted, and categorical and continuous data summarized as frequencies and proportions (percentages) and presented in text, tables and figures such as bar graphs. Non-parametric data related to the ranking of most and least used physiotherapy treatment activities were summarized as medians and interquartile ranges (IQR) and presented using boxplots. Inferential statistics was conducted using a one sample chi-square test to test for the equal probability of responses between provinces. Results were significant at a p-value of 0.05 two sided. Data from open ended questions on the referral system and discharge criteria were summarized by the researcher into common categories and presented narratively.

3.3 Results

All nine provinces took part in the survey with all Provincial Departments of Health giving permission to contact the included hospitals and their relevant physiotherapy departments.

3.3.1 Response Rate

Surveys for 34% (n=58/170) of the public sector ICUs were received from the ICU physiotherapists and 25% (n=42/170) of these surveys were complete [Figure 3.1].

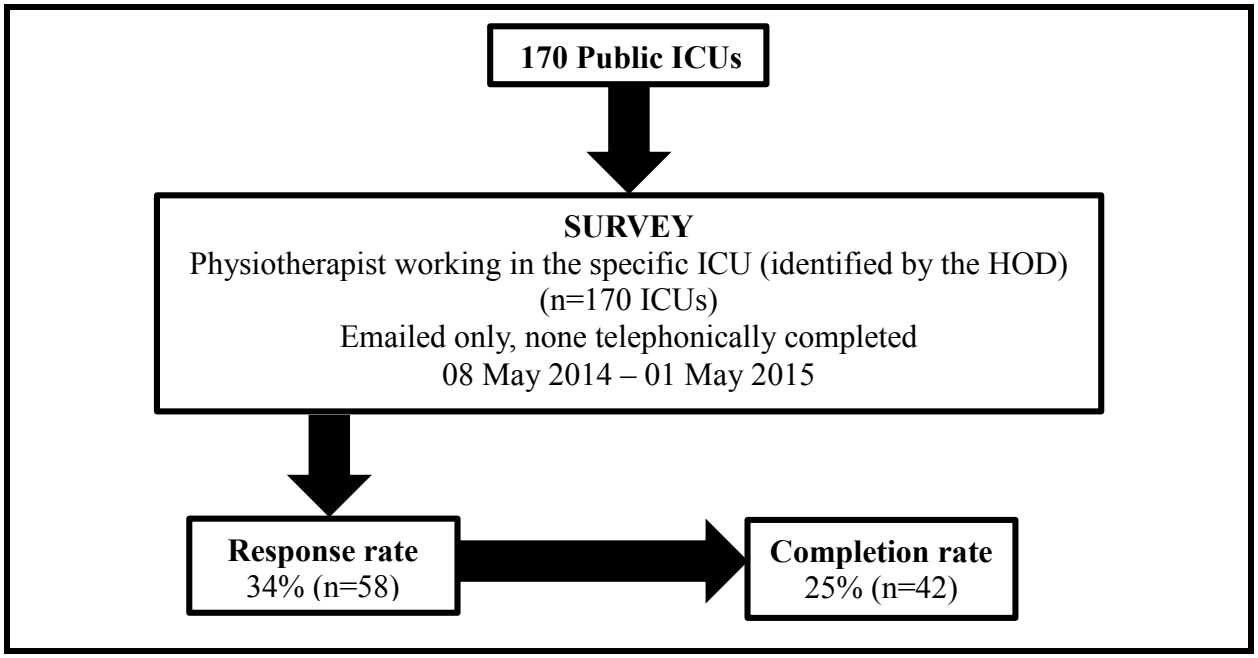


Figure 3.1 ICU Sample and ICU Physiotherapists Survey Responses

Responses were received from all Provinces. The majority of responses were from the Western Cape, Free State and Northern Cape with the lowest responses from Mpumalanga and North West Province [Figure 3.2].

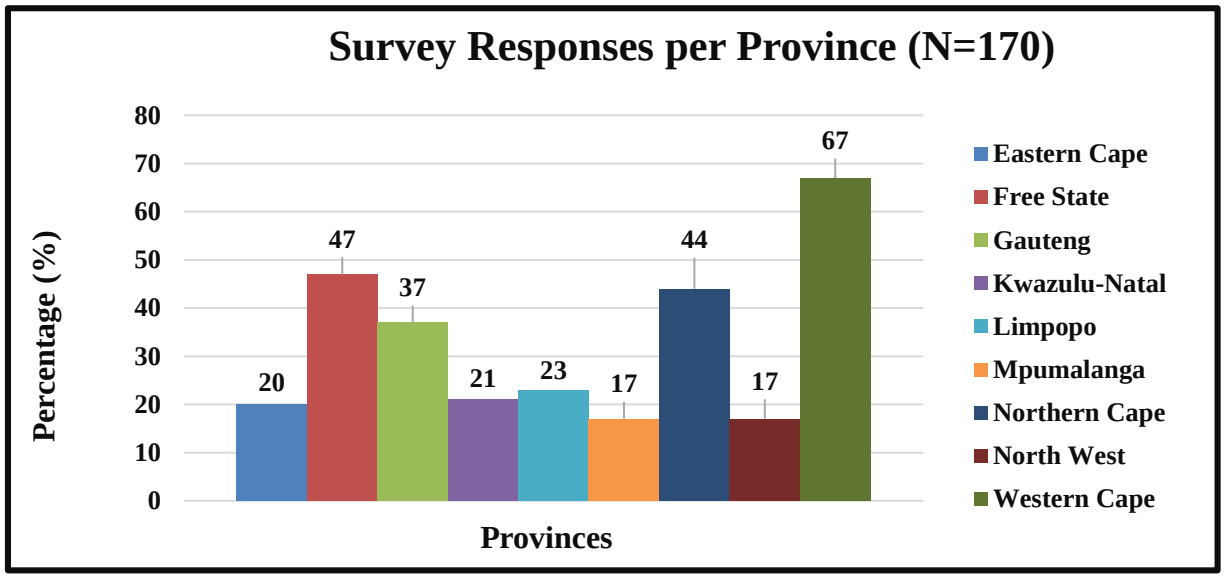


Figure 3.2 Survey Responses per Province

The percentage of responses obtained were not equal across the categories of provinces ($p<0.001$). The majority of responses were obtained from the Gauteng and Western Cape Provinces, followed by KwaZulu-Natal and the Free State [Figure 3.3].

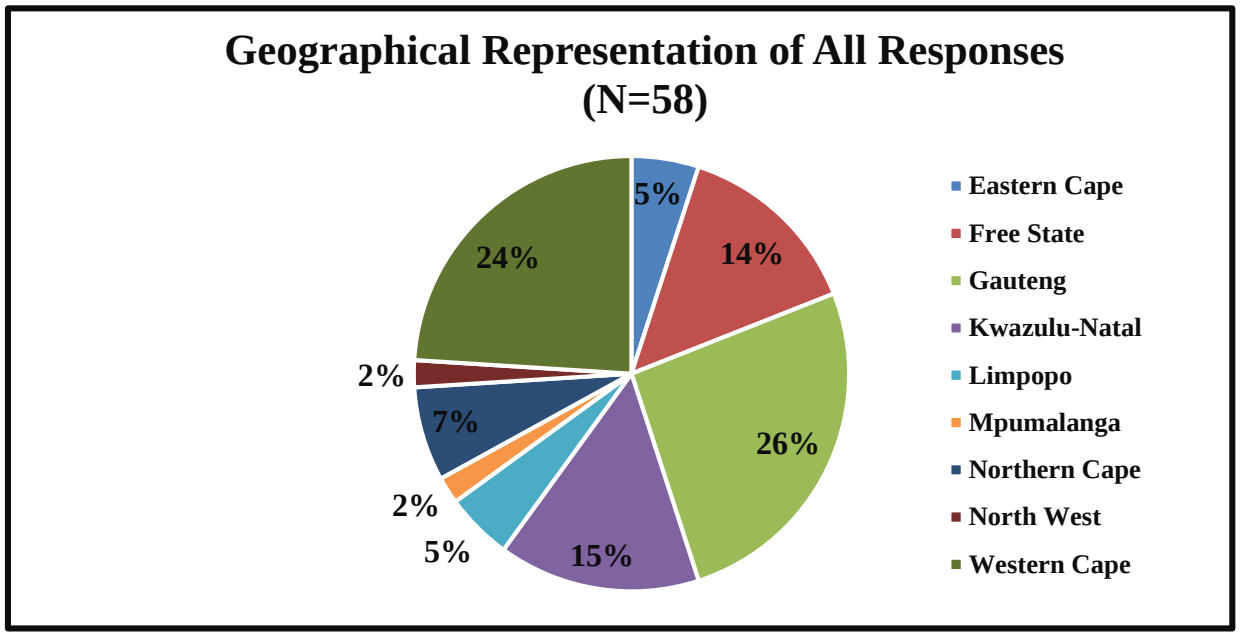
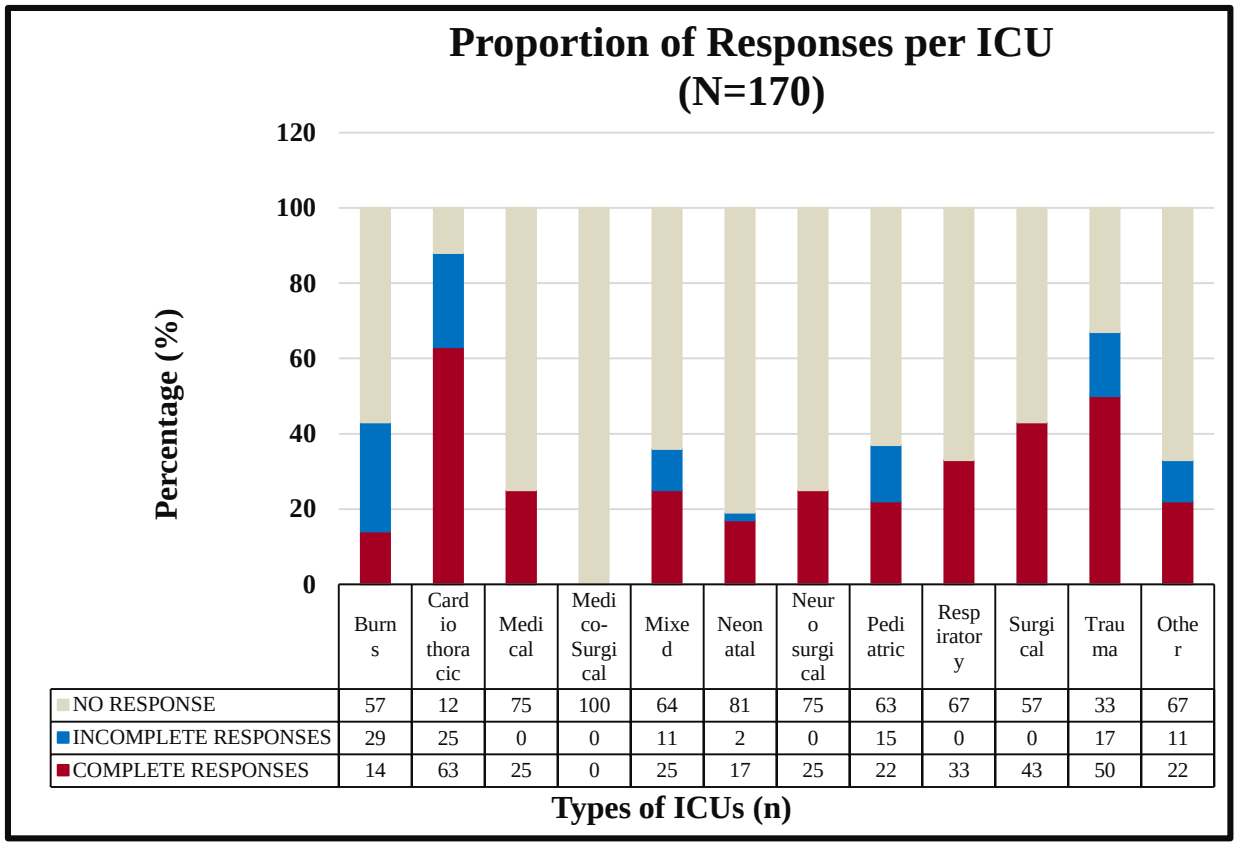


Figure 3.3 Geographical Representation of All Responses

The highest percentage of completed responses were from physiotherapists rendering services to cardiothoracic, trauma and surgical ICUs [Figure 3.4].



	Burns	Cardiothoracic	Medical	Medico-Surgical	Mixed	Neonatal	Neuro surgical	Pediatric	Respiratory	Surgical	Trauma	Other
NO RESPONSE	57	12	75	100	64	81	75	63	67	57	33	67
INCOMPLETE RESPONSES	29	25	0	0	11	2	0	15	0	0	17	11
COMPLETE RESPONSES	14	63	25	0	25	17	25	22	33	43	50	22

Figure 3.4 Proportion of Complete, Incomplete and No Survey Responses per ICU Type.

3.3.2 Organisation and Structure of the ICUs in which the ICU Physiotherapists work

3.3.2.1 ICU Level

Physiotherapists worked in three levels (I, II, IV) of ICUs in the included public sector hospitals. The majority (59%, n=38/58) of responses were from Physiotherapists working in Level I units (surgical, mixed), 22% (n=13/58) from Level II specialized units (for example cardiac, neurological) and 19% (n=11/58) from Level IV step down facility or high care.

3.3.2.2 ICU Beds

The average number of beds for Level I and II units were 8 (SD +/- 2.4) each and Level IV units were 7 (SD +/- 4.8). The average number of beds covered by the responding ICU physiotherapists were 8 (SD+/- 3.14).

3.3.2.3 Multidisciplinary ICU team

The physiotherapist together with the intensive care nurse, medical doctor and dietician were described as the main members of the ICU multidisciplinary team in the ICUs (Figure 3.5). Cardio-thoracic surgery consultants and registrars, radiographers, medical technologist, paediatrician and then a turning team were described as a part of the "Other" category.

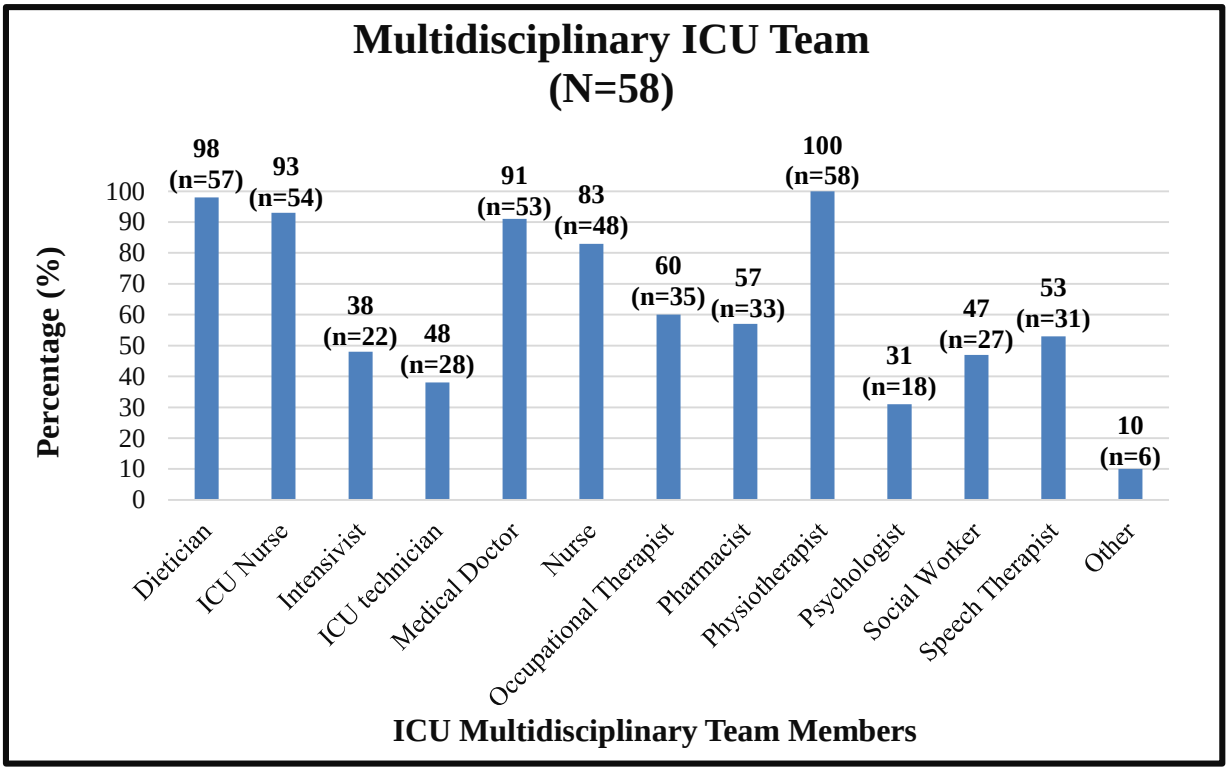


Figure 3.5 Physiotherapists (n) reporting on ICU Multidisciplinary Team Members

3.3.2.4 Induction Training for Physiotherapists working in ICU

Training regarding emergency on call or call-out duties was not always provided. Only 46%, (n=25/54) of the physiotherapists working in the ICUs reported to receive such training whereas 74% (n=40/54) received training regarding physiotherapy assessment, treatment, documentation and referral letters in the ICU and organisation/operation of the ICU [Figure 3.6]. The latter was provided primarily by the previous ICU physiotherapist. Induction training was reported by 56% (n=30/54) to take one hour.

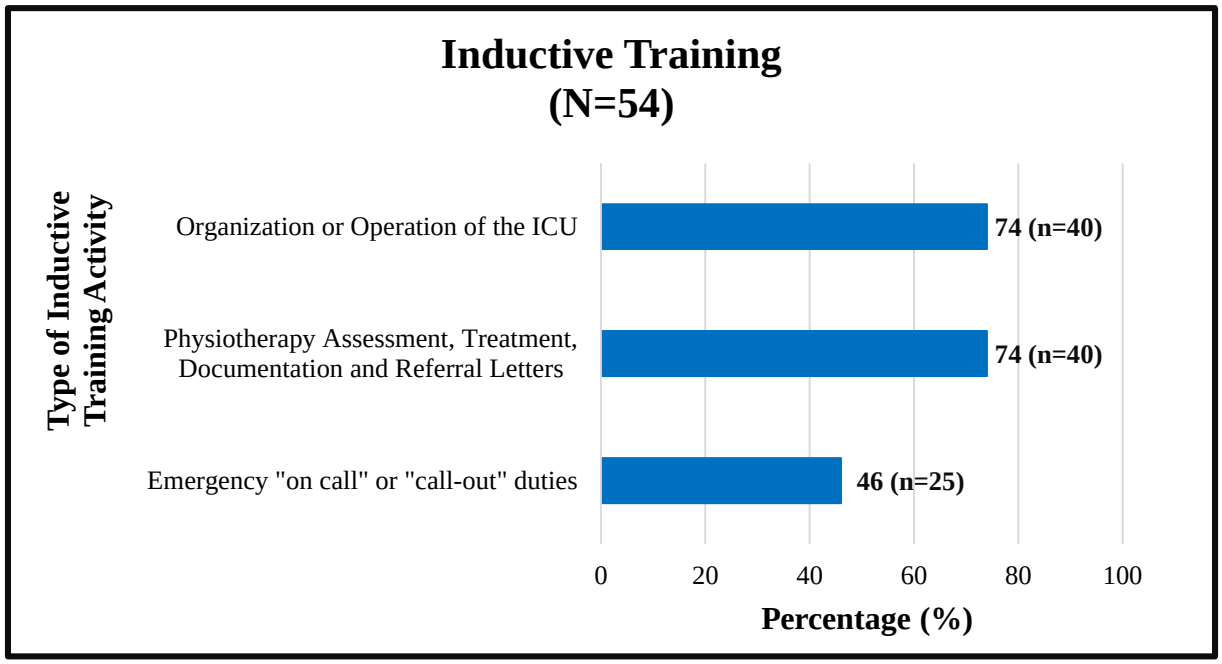


Figure 3.6 Percentage of ICU Physiotherapists receiving Inductive Training

3.3.3 The Profile of "Exclusively Allocated" ICU Physiotherapists

A total of 53% (n=30/57) reported that they were exclusively allocated to the specific intensive care unit to provide physiotherapy services.

3.3.3.1 Qualifications

Bachelor degrees were held by 93% (n=28/30) of the exclusively allocated unit physiotherapists and 7% (n=2/30) had a Diploma in Physiotherapy.

3.3.3.2 Job Rank Description

Fifty percent (n=15/30) of the exclusively allocated physiotherapists were ranked as Production Level I physiotherapists [Figure 3.7].

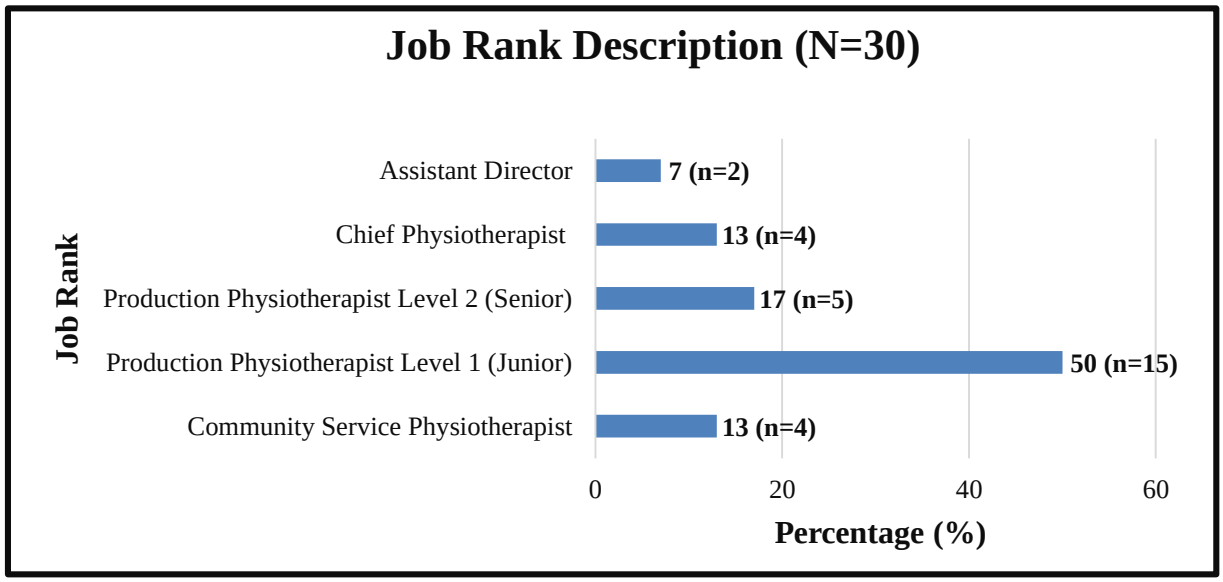


Figure 3.7 Job Rank Description of Exclusively Allocated ICU Physiotherapists

3.3.3.3 Years of Working Experience

The majority of exclusively allocated ICU physiotherapists had 1-5years of general physiotherapy work experience (47%, n=14/30) and experience working in intensive care (43%, n=13/30) [Figure 3.8].

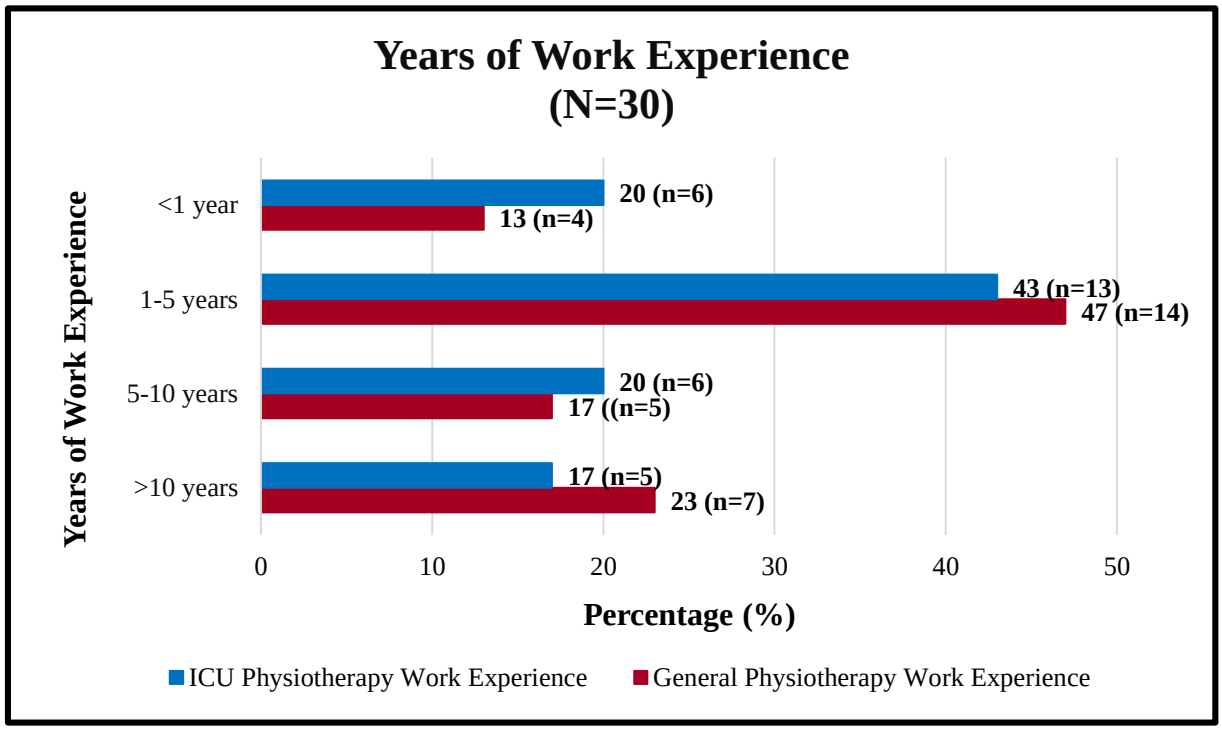


Figure 3.8 Percentage (n) of Exclusively Allocated ICU Physiotherapists per Category of Years of Working Experience

3.3.3.4 ICU Training

All (100%, n=30/30) the exclusively allocated physiotherapists had an ICU clinical block as a student physiotherapist.

The majority of exclusively allocated ICU physiotherapists (87%, n=26/30) did not have any post-graduating ICU training but (77%, n=23/30) were interested in having a specific ICU post-graduate training program for further specialization in Intensive Care.

The ICU Refresher Course for Adults and ICU or Cardiopulmonary Congresses/Conferences/ Symposiums were attended by 100% (n=4/4) of those reporting to have attended post-graduating ICU training. The ICU Refresher Course for Paediatrics and ICU or Cardiopulmonary Seminars/Workshops/CPD activities were attended by 25% (n=1/4) and 75% (n=3/4) respectively.

More than half (63%, n=19/30) of these exclusively allocated ICU physiotherapists were involved in training or supervising students in the ICU setting.

3.3.4 Current Practice

3.3.4.1 Referral Systems for ICU Physiotherapists

Seventy-one percent (n=37/52) of ICU physiotherapists reported that patients were referred to physiotherapy in their units. These ICU Physiotherapists were asked to rank on a scale from 1 (most used) to 4 (least used) method of referral. The majority of the physiotherapists reported that the doctor/intensivist/physician is the most used method of referral to the ICU physiotherapists in the week on site 70% (n=26/37) or on call 62% (n=23/37) compared to referral from the nurse, ICU team or through routine assessment.

Eighty-one percent (n=42/52) of ICU physiotherapists reported that ICU patients are not seen in their specific ICU on weekends. However, in the units receiving weekend physiotherapy services, the doctor/intensivist/physician is the most used method of referral to the ICU physiotherapists, with 60% (n=6/10) reporting on site and 50% (n=5/10) reporting on call referrals.

Only 42% (n=22/52) of physiotherapy departments had referral guidelines for ICU patients in the specific units. The referral guidelines were mainly developed and employed by the physiotherapists with 49% (n=25/51) reporting onsite referral and 35% (n=18/51) reporting on call/offsite referral.

An open-ended question asked the ICU physiotherapists to elaborate on the referral guidelines [Addendum 12 - raw response data]. The ICU physiotherapists stated that the referral guidelines "formed part of the ICU management policy", the Standard Operation Procedure Policy" and "Agreed Clinical Physiotherapy Guidelines." They also stated that ICU patients were screened or assessed daily for suitability for treatment especially in the week and were referred following communication with the doctor and nursing staff on the ward round. In some units the unit physiotherapist would draw up a list of patients to be seen on weekends or the doctor would choose two patients who were most in need of the treatment on each weekend day. Referral from the doctors would be via telephone or bleep directly to the physiotherapist, the physiotherapy department, on the ward round, via a referral card or "compulsory" referral letter. Some reported that the referral guideline would include contra-indications to physiotherapy, call-out criteria for the weekend, the time by which all referrals should be completed and by who. It was reported that doctors refer patients with chest/respiratory complications or neurological conditions. In some units it was reported that not all patients are screened on weekends and after hours and that there was no on call services due to "remuneration issues". One unit reported that a previously existing 24-hour service to ICU was terminated as management stopped allied health professionals 24-hour services in the hospital as it was considered a "waste of funds". Another unit reported no fixed referral policy or guideline.

3.3.4.2 Availability of ICU Physiotherapist Services and Workload Allocation

i) Staff Rotation System: A rotation system for physiotherapists rendering services in the ICUs exists. Eighty-eight percent (n=51/58) of physiotherapists reported staff rotating in the ICUs. and the majority (75%, n=38/51) reported that these staff rotations were on a quarterly basis. Only 2% (n=1/51) rotated yearly, 14% (n=8/51) rotated every six months and 8% (n=4/51) rotated monthly.

ii) "On Call"/Emergency Call-out Roster: Sixty-seven percent of ICU physiotherapists (n=38/57) reported having an on-call roster. All physiotherapists were allocated to the on-call

roster for the units. Mainly Production Physiotherapists Level III [Chief] were reported by 74% (n=42/57) to be allocated to this roster followed by Production Physiotherapists Level II [Senior] (58%, n=33/57), Production Physiotherapists Level 1 [Junior] (54%, n=31/57) and Community Service Physiotherapists (51%, n=29/57). Assistant directors were only reported by 23% (n=13/57) to be allocated on the roster.

iii) Student Physiotherapists in the ICUs: Forty-seven percent (n=27/57) reported having students work in their units with an average of 3 students per unit in the week and 2 on a weekend.

iv) Allocation to the ICU: The majority of the ICU Physiotherapists reported that in the week when on site they were exclusively allocated to the unit (53%, n=30/57) [Table 3.1]. On the weekend there were a variety of physiotherapists allocated to the unit with ward duties (37%, n=21/57) [Table3.1]. However, in the week at night (79%, n=45/57) and on a weekend at night (74%, n= 42/57) the majority reported no physiotherapists available [Table 3.1].

v) Time spent working in the ICU: In the week 46% (n=26/57) reported spending only 0-25% of their time in the ICU compared to 21% (12/57) who spend 100% of their time in the ICU [Table 3.1]. In the units where physiotherapists provided services in the week at night, weekend and weekend at night the percentage of time spent was 0-25% [Table 3.1]. An average of 4.5 hours and 1.5 hours per day in the week and weekend (on site) respectively were spent in the units by the ICU physiotherapists.

vi) "On-call" ICU patient load: Forty-five percent (n=24/53) and 59% (n=31/53) received 0-25% on-call referrals in the week and on a weekend respectively, while 9% (n=5/53) and 2% (n=1/53) received 100% on-call referrals in the week and on a weekend respectively [Table 3.1].

vii) Daily ICU patient load: Forty-three percent (n=23/53) reported that 100% of the patients in the units receive physiotherapy management in the week compared to the reported 10% (n=5/53) of physiotherapists seeing 100% of patients on a weekend [Table 3.1].

viii) Frequency of ICU patient treatments: The majority (76%, n=41/54) of the ICU physiotherapists reported that patients received one physiotherapy treatment per day in the week. Fewer physiotherapists (37%, 20/54) reported that patients received one physiotherapy treatment per day in the week when on-call. More than half (59%, n=32/54) of the ICU physiotherapists reported that patients received one physiotherapy treatment per day on the weekend. A third (33%, n=18/54) reported either no treatment/day or one treatment/day on a weekend when on call respectively and 32% (n=17/54) not applicable (no on-call duty on a weekend) [Table 3.1].

Table 3.1 Availability of ICU Physiotherapy Services, Patient Load and Treatment Frequency (light grey shaded area – not applicable).

	Staff Allocation to the ICUs % (N=57)					% Time Spent in Unit % (N=57)					% On Call Patient Referrals % (N=53)					% Patients receiving Physiotherapy Management/day % (N=53)					Treatment Frequency (%) % (N=54)					
	Exclusively Allocated	Exclusively Allocated with Ward Duties	A variety of Physiotherapists Allocated	A variety of physiotherapists allocated with Ward Duties	No Physiotherapist in the Unit	No Physiotherapy Service	0-25%	26-50%	51-75%	76-100%	0%	≤25%	≤50%	≤75%	100%	0%	≤25%	≤50% (n=53)	≤75% (n=53)	100% (n=53)	No Treatment /day	One Treatment/day	Two Treatments/day	Three Treatments/day	> Three Treatments/day	Not Applicable –No On Call
Week (on site)	**53 (30)**	33 (19)	0 (0)	14 (8)	0 (0)	0 (0)	**45.6 (26)**	22.8 (13)	10.5 (6)	21.1 (12)						5.7 (3)	17 (9)	15.1 (8)	18.9 (10)	**43.3 (23)**	0 (0)	**76 (41)**	20 (11)	0 (0)	0 (0)	4 (2)
Week ON CALL (off site)											39.6 (21)	**45.3 (24)**	3.8 (2)	1.9 (1)	9.4 (5)						0 (0)	**37 (20)**	30 (16)	0 (0)	0 (0)	33 (18)
Week NIGHT (on site)	1.7 (1)	7 (4)	0 (0)	12.3 (7)	**79 (45)**	**86 (49)**	14 (8)	0 (0)	0 (0)	0 (0)																
Weekend (on site)	12.3 (7)	15.8 (9)	5.3 (3)	**36.8 (21)**	29.8 (17)	**47.4 (27)**	28.1 (16)	15.8 (9)	5 (3)	3.5 (2)						26.4 (14)	39.6 (21)	13.2 (7)	11.3 (6)	**9.5 (5)**	20 (11)	**59 (32)**	2 (1)	0 (0)	0 (0)	19 (10)
Weekend ON CALL (off site)											37.7 (20)	**58.5 (31)**	1.9 (1)	0 (0)	1.9 (1)						**33 (18)**	**33 (18)**	2 (1)	0 (0)	0 (0)	**32 (17)**
Weekend NIGHT (on site)	9 (5)	9 (5)	1.3 (1)	7 (4)	**73.7 (42)**	**84 (48)**	14 (8)	2 (1)	0 (0)	0 (0)																

3.3.4.3 Prescription of ICU Physiotherapy Treatment Activities

The majority of ICU physiotherapists reported that decisions related to patient management were made by ICU physiotherapists following a structured physical examination [Table 3.2]. However, it was reported that prescription and decisions regarding these treatment activities was also by ICU Doctor/Intensivist/Physician orders and by discussing this with or together with the ICU Doctor/Intensivist/Physician more than Nurses Orders, discussing this with or together with the Nurses, ICU Team or Other (specified by ICU Physiotherapists as not applicable to their unit for example in the neonatal ICU).

Table 3.2 Prescription of ICU Physiotherapy Treatment Activities (%, N=42)

PRESCRIBED OR DECIDED / ACTIVITY	Personally following Structured Physical Examination	By Physician/Intensivist/Doctors Orders	By discussing with or together with Physician/Intensivist/Doctors	By Nurses Orders	By discussing with or together with Nurse/s	By discussing with or together with the ICU Team	Other
Frequency of Treatment	**88% (37)**	**28% (12)**	**43% (18)**	0% (0)	10% (4)	26% (11)	2% (1)
Position Changes	**83% (35)**	26% (11)	**40% (17)**	2% (1)	**36% (15)**	29% (12)	2% (1)
Chest Physiotherapy	**86% (36)**	**45% (19)**	**45% (19)**	2% (1)	12% (5)	21% (9)	0% (0)
Mobilisation	**88% (37)**	**38% (16)**	**38% (16)**	0% (0)	14% (6)	19% (8)	2% (1)
Rehabilitation	**79% (33)**	**33% (14)**	**38% (16)**	0% (0)	14% (6)	19% (8)	7% (3)

3.3.4.4 Involvement in ICU Treatment Activities

i) Positioning: The majority (43%, n=18/42) of ICU physiotherapists ranked the Nurse and Physiotherapist as most involved in **positioning** ICU patients followed by the Nurse only, (36%, n=15/42), Physiotherapists only (17%, n=7/42) and then the Doctor/ Physician/Intensivist (4%, n=2/42).

ii) Mobilisation: The majority of ICU physiotherapists ranked Physiotherapists only (64.3%, n=27/42) as most involved in **mobilisation** activities, followed by the nurse and physiotherapist (23.8%, n=10/42), the nurse only (7.1%, n=3/42) and then the ICU Team (2.4%, n=1/42) and Doctor/ Physician/ Intensivist (2.4%, n=1/42).

iii) Rehabilitation: The majority of ICU physiotherapists ranked Physiotherapists only (88%, n=37/42) as most involved in **rehabilitation** activities, followed by the nurse and physiotherapist (4%, n=2/42) and ICU team (4%, n=2/42) then by the nurse only (2%, n=1/42) and Doctor/ Physician/ Intensivist (2%, n=1/42)

3.3.4.5 Treatment Activities

Boxplots were used to present the results. The boxes depict the 25th percentile, median and 75th percentile. Whiskers depict the minimum and maximum values and outliers are presented by circles and asterisks.

i) Chest Physiotherapy Activities: Manual techniques (percussion, vibration and shaking), breathing techniques, secretion removal via suctioning and positioning to improve ventilation/perfusion ratios were reported to be the most used (ranked as 1) chest physiotherapy activities [Figure 3.9].

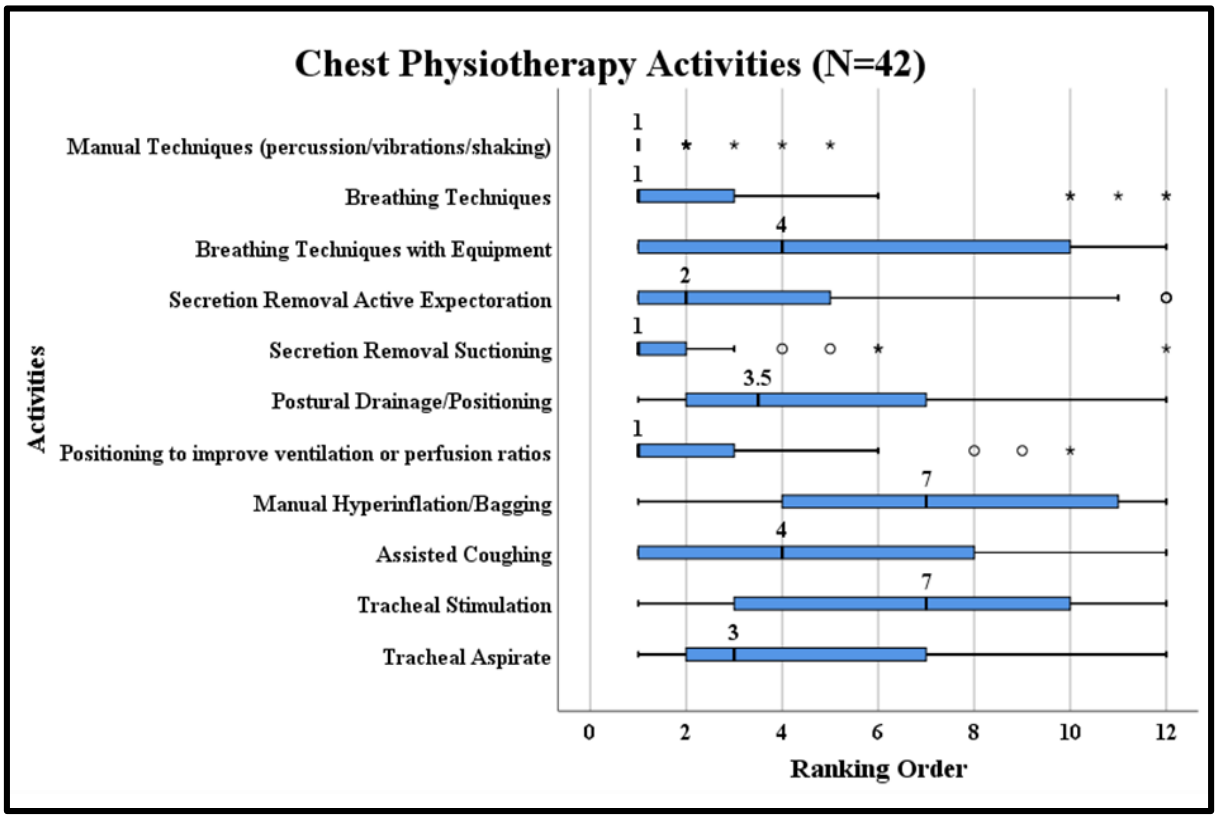


Figure 3.9 Chest Physiotherapy Activities used in ICU Patient Management

ii) Ventilatory Activities: Weaning for extubation, adjustment of ventilator settings and supervision and implementation of non-invasive ventilator support (CPAP/mask intermittent positive pressure ventilation) techniques were reported as activities not used by ICU physiotherapists (ranked 5) and extubation was reported as the least used ventilatory activity (ranked 4) [Figure 3.10].

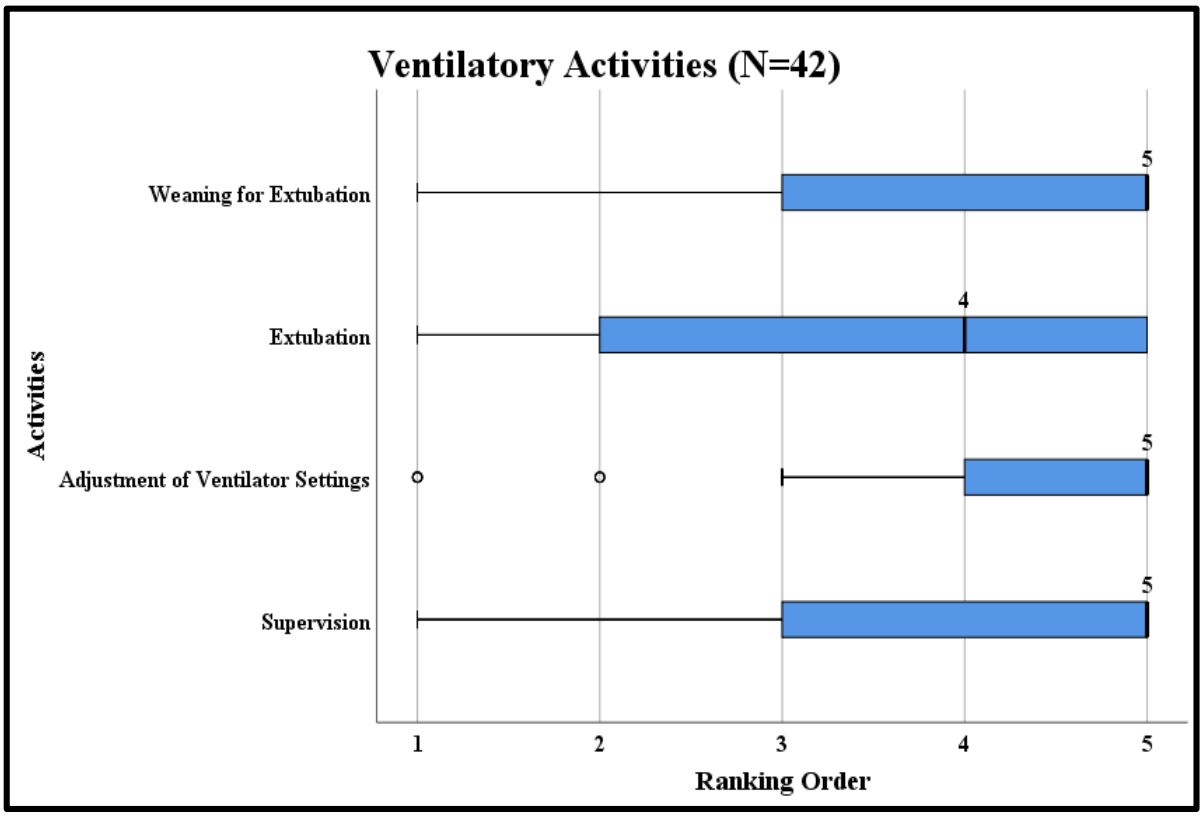


Figure 3.10 Ventilatory Activities used in ICU Patient Management

iii) Mobilisation Activities: Passive movements and active exercises in bed ranked as 1, followed by sitting over the edge of the bed (ranked 2), then active/passive transfer to chair and sitting out in chair (ranked 3) were the most used mobilisation activities. [Figure 3.11]. Bed cycling was least used (ranked 9). And continuous passive movement was not used (ranked 10) [Figure 3.11]. There was a wide variation in mobilisation activities reported that can be related to the different ICUs for example neonatal and paediatric ICUs versus adult ICUs including acute spinal and neurosurgical ICUs where mobilisation practices may differ.

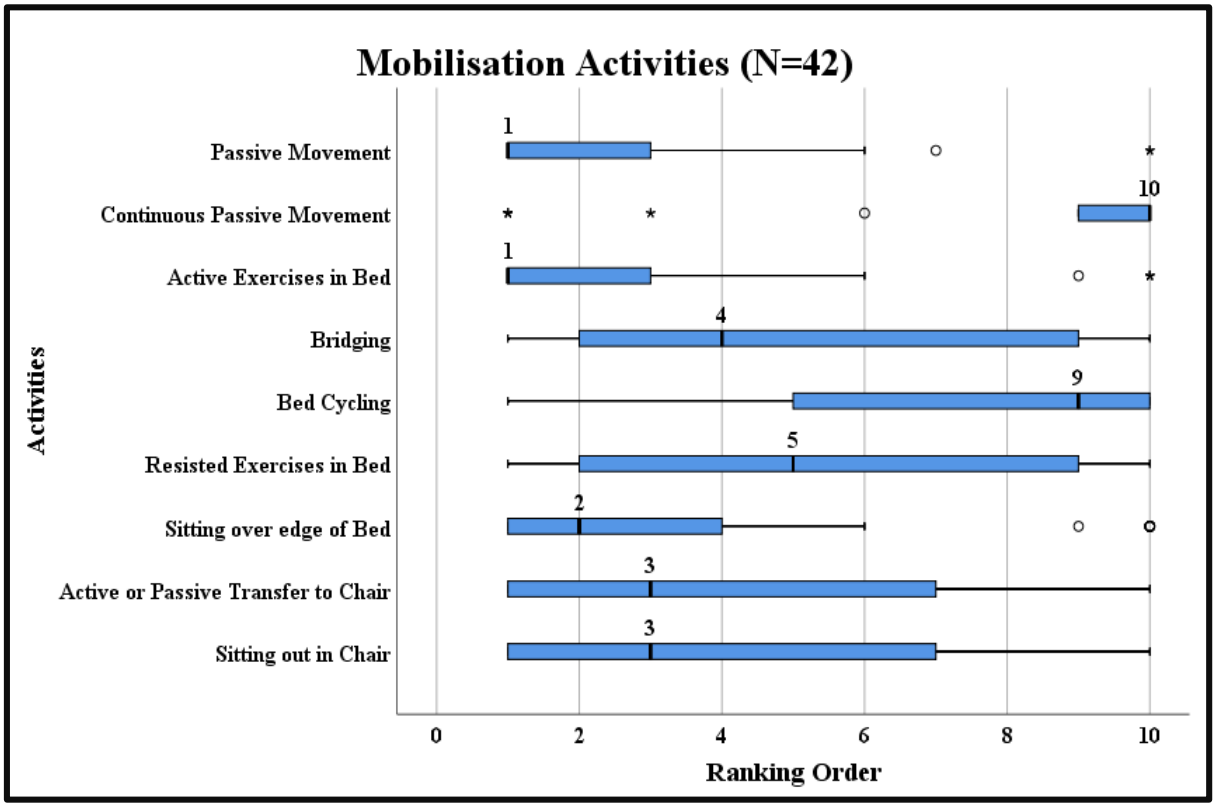


Figure 3.11 Mobilisation Activities used in ICU Physiotherapy Patient Management

iv) Rehabilitation Activities: Active exercises in the chair (ranked 2) and resisted exercises in chair and marching on the spot (ranked 3) were the most used rehabilitation activities [Figure 3.12]. The tilt table and ambulation with the ventilator (away from bed) were the least used rehabilitation activities (ranked 9). Cycling in the chair, stationary cycling and standing frame were not used by the ICU physiotherapists in the ICUs (ranked 10) [Figure 3.12].

v) Proportion of Time Spent on Treatment Activities: The majority 62% (n=26/42) of the physiotherapists working in the ICUs spent more than 50% of the time doing chest physiotherapy activities in the ICUs. Fewer physiotherapists (36%, n=15/42) spent >50% of their time performing mobilisation and rehabilitation activities in the ICU. Only 10% (n=4/42) of physiotherapists spent >50% of the time on ventilatory activities.

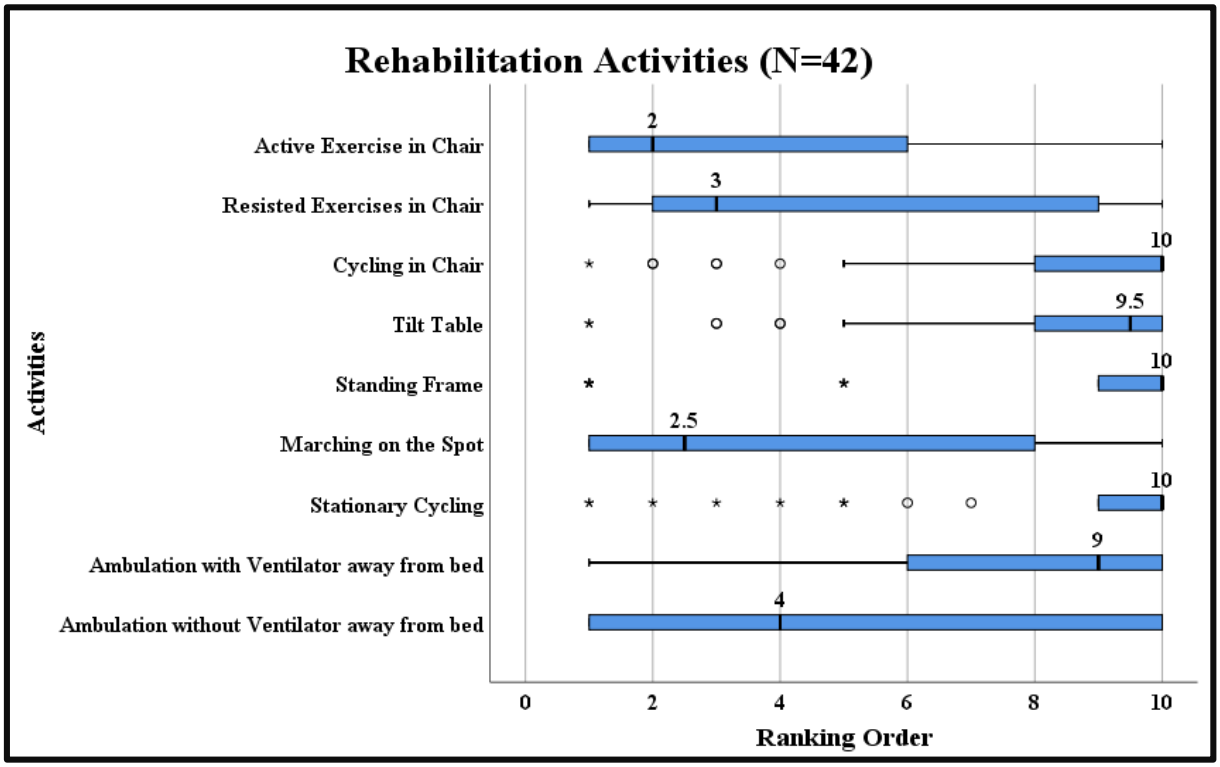


Figure 3.12 Rehabilitation Activities used in ICU Physiotherapy Patient Management

3.3.4.6 Outcome measures used by the ICU Physiotherapists

The use of Physiological, Physical Functioning and Health related Quality of Life Outcome Measures are presented in Table 3.3.

i) Physiological Outcomes: A minority of ICU physiotherapists (26%, n=11/42) used pulmonary function tests. The use of "other" physiological measures were by 29% (n=12/42) and were described by the ICU physiotherapists as "chest X-rays", "vital signs", "arterial blood gas readings", "ventilator values", "how the patient feels and progresses", "tidal volumes and peak pressures", range of movement", "muscle strength and length" [Table 3.3].

ii) Physical Functioning Outcomes: In general, these outcomes were not widely used by the ICU physiotherapists. The New York Heart Association (NYHA) Functional Classification (19%, n=8/42) and the 6 Minute Walk Test for Exercise Tolerance (17%, n=7/42) were the most used. Nineteen percent (n= 8/42) reported using "Other" physical functioning measures such as the "ASIA Impairment Scale", "Modified Functional Scale" and "International Classification of Functioning (ICF) Scale". No physiotherapists reported using the Physical Function ICU Test (PFIT) [Table 3.3].

iii) Health related Quality of Life Outcomes (HRQoL): Overall HRQoL outcome measures were not used. The International Classification of Functioning (ICF) Scale was reported to be used by 36% of the ICU physiotherapists. Those who reported "Other" (14%, 6/42) explained that none of the HRQoL outcome measures or that no HRQoL measure was used in the ICU [Table 3.3].

Table 3.3 Outcome Measures used by the ICU Physiotherapists

Physiological Outcomes	**YES % (n)**	**NO % (n)**
Lung Auscultation	**100 (42)**	0 (0)
Pulmonary Function Tests	26 (11)	74 (31)
Saturation of O2	**90 (38)**	10 (4)
Other	29 (12)	71 (30)
Physical Functioning Outcomes	**YES % (n)**	**NO % (n)**
Walk Test Exercise Tolerance – 6 Minute Walk Test	**17 (7)**	83 (35)
Time up and Go Test (TUG)	2 (1)	98 (41)
Barthel Index	7 (3)	93 (39)
New York Heart Association (NYHA) Functional Classification	**19 (8)**	81 (34)
Functional Independence Measure (FIM)	14 (6)	86 (36)
Physical Function ICU Test (PFIT)	0 (0)	**100 (42)**
Other	**19 (8)**	81 (34)
Health Related Quality of Life	**YES % (n)**	**NO % (n)**
Sickness Impact Profile (SIP)	0 (0)	100 (42)
Perceived Quality of Life Scale (PQOL)	2 (1)	98(41)
Nottingham Health Profile (NHP)	0 (0)	100 (42)
EuroQol 5Dimension Questionnaire (EQ5D)	0 (0)	100 (42)
Short Form 36 Surveys (SF36)	2 (1)	98(41)
Rosser's disability and distress categories	0 (0)	100 (42)
Spitzer's quality of life index and uniscale	0 (0)	100 (42)
Psychological Well Being Index (PGWB)	0 (0)	100 (42)
Fernandez's questionnaire	0 (0)	100 (42)
Whinston Hospital questionnaire	0 (0)	100 (42)
ICF International Classification of Functioning Scale	**36 (15)**	64 (27)
Other	14 (6)	86 (36)

3.3.4.7 Evidence based ICU Protocols used/implemented in the ICUs

The majority (≥59%) reported that evidence-based clinical practice guidelines (CPGs) and protocols are used in the ICUs. Table 3.4 represents the utilisation of evidence-based CPGs and protocols in the ICU. Suctioning, positioning, and weaning for extubation were reported to be used by more ICU physiotherapists in the ICUs in that order. This was followed by the use of mobilisation and rehabilitation CPGs and protocols [Table 3.4]. The majority reported that the CPGs and protocols are evidence-based (based on systematically developed, reviewed and appraised clinical research). Eighteen percent (n=6/34) reported "other" CPGs and protocols such as proning, ventilator-associated pneumonia (VAP) and central-line associated bloodstream infection (CLABSI) CPGs and protocols used in the ICUs. The minority (29%, n=5/17) of ICU physiotherapists reported that these are evidence-based (based on systematically developed, reviewed and appraised clinical research).

Table 3.4 Utilization of Evidence-Based Protocols and Clinical Practice Guidelines

Protocol/Clinical Guideline	**Yes %(n)**	**No %(n)**	**Evidence Based** ***(systematically developed, reviewed and appraised clinical research)***	**Non Evidence Based** ***(clinical research or literature that has not gone through a rigorous, unbiased and transparent process of systematic review and appraisal, non-peer reviewed and unpublished research)***
Weaning for Extubation	**72 (28/39)**	28 (11/39)	**85 (28/33)**	15 (5/33)
Suctioning	**77 (30/39)**	23 (9/39)	**81 (29/36)**	19 (7/36)
Positioning	**74 (29/39)**	26 (10/39)	**89 (31/35)**	11 (4/35)
Mobilisation	69 (27/39)	31 (12/39)	74 (26/35)	26 (9/35)
Rehabilitation	62 (24/39)	38 (15/39)	74 (26/35)	26 (9/35)
Sedation	62 (24/39)	38 (15/39)	84 (27/32)	16 (5/32)
Analgesia	59 (23/39)	41 (16/39)	84 (26/31)	16 (5/31)
Decontamination	67 (26/39)	33 (13/39)	84 (26/31)	16 (6/31)
Other	18 (6/34)	82 (28/34)	29 (5/17)	71 (12/17)

3.3.4.8 Patient Goal Setting

Seventy-nine percent (n=33/42) of the physiotherapists working in the ICUs were involved in patient goal setting. Forty-two percent (n=14/33) of those who reported being involved in goal setting reported being involved in this together with the ICU team and the patient respectively.

3.3.4.9 Discharge Planning

One third (33%, n=14/42) of the physiotherapists were involved in the discharge of patients from the ICU. Only 14% (n=6/42) of physiotherapists reported specific ICU physiotherapy discharge criteria. They described the discharge criteria as "respiratory readiness" (n=1) as decided by the doctor and physiotherapist or "respiratory independence" (n=1) of the patient, when "weaned off oxygen" (n=1), being able to "tolerate extubation for 6 hours" (n=1), "gained weight according to criteria" (n=1) and discharge criteria set out in the guideline and protocol of the specific institution" (n=1). More than 80% of the physiotherapists reported that the ICU doctor/intensivist/physician was mainly involved in the discharge of patients from the ICU.

3.3.4.10 Follow-Up Physiotherapy and Rehabilitation

Follow-up physiotherapy and rehabilitation in the ward, of ICU patients, was considered as a requirement by 98% (n=41/42) of the ICU physiotherapists. This was followed by 74% (n=31/42) and 57% (n=24/42) who considered follow-up physiotherapy and rehabilitation in an out-patient setting, and in the community (home visit) as a requirement respectively. Referral to follow-up physiotherapy and rehabilitation following ICU and hospital discharge was reported by 62% (n=26/42) and 36% (n=15/42) to be done by the unit physiotherapists when on site in the ICUs and when "on call" (offsite) respectively. Sixty-four percent (n=27/42) of these physiotherapists were aware of any follow-up physiotherapy and rehabilitation services for ICU patients in the surrounding community. They reported these services being provided at local, district or community clinics or health centres, step down facilities or rehabilitation centres, high risk clinics and through home visits. Sixty-two percent (n=26/42) of the physiotherapists reported that follow-up physiotherapy and rehabilitation services are provided in the hospital in which they work.

3.4 Discussion

This study provides a clear picture of the organisation and structure of the ICUs in which ICU physiotherapists work, their role, profile and current practice in public sector ICUs in SA. The public sector ICU physiotherapists work in different types and levels of ICUs and are part of a multi-disciplinary team that include mainly the intensive care nurse, medical doctor and dietician. They cover on average 8 ICU beds per ICU Physiotherapist and do receive induction training with regards to working in an ICU. The ICU physiotherapists working exclusively (no ward duties) in the public ICUs are early-career physiotherapists with minimal basic

qualifications and years of experience and are mainly employed in permanent production level grade I ("junior" level) positions.

Physiotherapists working exclusively (no ward duties) in the public ICUs reported having minimal to no post-graduate ICU qualifications, ICU-related continuous professional development (CPD) and training. van Aswegan & Lottering, (2016) reported a similar lack of post-graduate ICU training in the public and private sector ICU physiotherapists in South Africa. At the eight universities in SA, all undergraduate physiotherapy students receive compulsory theory, practical and clinical education and training on the aspects of care of intensive care or critically ill patients (Hanekom, 2016). Since postgraduate physiotherapy education and training is voluntary but not free of cost, it may explain the lack of any post-graduate training and education reported by the public sector exclusively allocated ICU physiotherapists. However, a definite interest in having a specific ICU post-graduate training program for further specialisation in intensive care was shown by the majority of the physiotherapists exclusively allocated to the unit. This indicates that these physiotherapists are willing and ready to build up and improve on their existing undergraduate knowledge base in order to safely and effectively treat ICU patients with quality care to improve patient outcomes. This interest in post-graduate ICU training is confirmed by van Aswegan & Lottering, (2016) who reported that physiotherapists working in South African private and public sector hospitals showed an increase in post-graduate qualifications from 36% in the survey in 2005 (van Aswegen & Potterton, 2005) to 46% in the updated survey by van Aswegan & Lottering, 2016. Compared to some international studies (Sigero et al., 2016; Malone et al., 2015; Kumar et al, 2007), South African ICU Physiotherapists fall short in terms of post-graduate degrees in physiotherapy and ICU training. Exploration around the factors limiting public sector ICU physiotherapists participation in CPD activities and training and the acquisition of post-graduate qualification in ICU is required. The majority of the ICU physiotherapists are involved in student training in the ICU thus sharing their knowledge.

While physiotherapists are autonomous practitioners (Stiller, 2013) and regarded as first line practitioners by the Health Professional Council of South Africa (Unger, 2010), public sector ICU physiotherapists in SA are still struggling with autonomy in the ICU setting. They work on a referral system where the ICU doctor/intensivist/physician refer ICU patients for assessment and management rather than routine assessments by the ICU physiotherapist.

Guidelines for onsite and offsite "on-call/call out" referral exist in some physiotherapy departments. These guidelines however varied with no standardized referral guideline in place across departments and hospitals. Although the ICU physiotherapists are involved in goal setting with the ICU team and patient, the ICU physiotherapists are minimally involved and provide minimal input in discharge planning of ICU patients. As rehabilitation specialists and knowledge of respiratory functioning (Hanekom, 2016; Stiller, 2013), the involvement and input of ICU physiotherapists in discharge planning is of utmost importance as their input may minimize readmissions to the unit due to respiratory failure or general muscle weakness. ICU Physiotherapists should be able to identify whether patients are ready to go to the ward and cope without ICU support as they are the ones who will follow-up these patients until discharge home. Discharge criteria reported, included "respiratory readiness' and maintaining adequate ventilation 24-hours post-extubation. However, the physical ability of the ICU patient is an area that physiotherapists can provide input to the ICU team especially when planning ICU patient discharge. ICU physiotherapists have knowledge regarding ventilatory and functional readiness for ICU discharge which could prevent ventilatory complications in the ward and reduce ICU readmissions. However, the reported lack of ICU physiotherapy discharge criteria available may be a factor limiting their input and role in the ICU team regarding discharge and affects their holistic management of the ICU patient. They therefore lack autonomy within the ICU team with discharge decisions still mainly being taken by the ICU doctor/intensivist/physician. However, decisions for follow-up referral of ICU patients in the ward, out-patient setting, community facility or home visit was reported to be made by the ICU physiotherapists.

A recent scoping review by Lasiter, Oles, Mundell, London & Khan (2016) states that ICU follow-up clinics exist but evidence for the interventions (treatment/management) applied in these follow-up clinics and their effectiveness have not been well explored. None of the surveys conducted (van Aswegan & Lottering, 2016; Sigera et al., 2016; Malone et al., 2015; Nydahl et al., 2014; Appleton et al., 2011; Wiles & Stiller, 2010; Hodgin et al., 2009; Kumar et al., 2007; van Aswegen & Potterton, 2005; Norrenberg &Vincent 2000) reported on the physiotherapists involvement in decision-making regarding follow-up after ICU discharge. In the UK, less than 30% of their healthcare organisations provide any formal post-ICU rehabilitation service and it is reported that a paucity of data on ICU follow-up exists for other health care systems (Walsh et al., 2015). Although we report on the involvement of physiotherapists in decision-making

around follow-up referral of ICU patients, we need to further explore the extent of these follow-up clinics or services.

The availability of ICU physiotherapy services in the public sector is variable with fragmented services and a lack of continuity in care due to staff rotation and limited weekend duty. ICU Physiotherapists work on a rotation basis in the public sector, therefore a different physiotherapist will cover the ICU every quarter unless the physiotherapist is allowed to stay for another quarter. They also rotate when providing weekend ICU physiotherapy services and rotate when providing week and weekend "on call/call out" ICU physiotherapy services. The latter can affect team dynamics and communication as a new relationship with the ICU team needs to be built continuously and affects the continuity of patient care and therefore the quality of care and patient outcome.

Some ICU Physiotherapists are exclusively allocated to the ICU (no ward duties) and others to both ICU and ward duties therefore, they may experience increased workloads. The ICU physiotherapists spend minimal time treating patients in the ICU with the majority providing one treatment a patient which could be explained by the added responsibility of ward patient duties and administration. Although, weekend and week and weekend "on call"/call out" physiotherapy services are still a priority for ICU care as the majority reported providing such services, the service is limited due to minimal resources for after hour remuneration for allied health care professionals and a lack of referral guidelines reported in some ICUs. The limited service therefore contributes to the variations in ICU physiotherapy practice that can affect the standardisation and quality of ICU patient care and outcome across units within and between hospitals as described by other surveys (Malone et al., 2015; Norrenberg & Vincent, 2000). International guidelines have been developed to define the input of physiotherapists in the ICU in order to optimise benefit to patients and other healthcare team members (Wilkinson et al., 2018; Hanekom et al., 2013; Gosselink et al., 2008). However, it seems that the public sector ICU physiotherapists are not able to effectively follow these guidelines due to the organisation and structure of their services therefore affecting ICU patient care with possible reduced benefits to patients.

Physiotherapists need to evaluate the effectiveness of their treatments. The use of reliable and valid outcome measures is necessary and important to determine how ICU patients' respond to

physiotherapy treatment and also evaluates how effective the particular treatment is (Hanekom et al., 2013; Marques, Bruto & Barney, 2006; Maher & Williams, 2005). Physiological outcome measures such as lung auscultation and saturation of oxygen in the blood are mainly being used by public sector ICU physiotherapists to assess physiotherapy care although patient-centred outcomes are advocated (Hanekom et al., 2013; Gosselink et al, 2008; Hanekom et al., 2007). The majority of ICU physiotherapists do not use pulmonary function tests in the ICU. Whether they lack the knowledge and skill to conduct and interpret these tests or whether they are not required to conduct these tests must be investigated. Standardised physical functioning outcome measures and HRQoL outcomes are minimally utilised. It is interesting to note that the ICF is one HRQoL measure being implemented by a third of the ICU physiotherapists. The ICF is included in the physiotherapy academic curriculum in SA and is included in the content of the physiotherapy modules. Physiotherapy students in SA are trained in the use of this particular outcome measure for all patients (Jelsma & Scott, 2011). In general, there is a lack and variability of use of standardised outcome measures, especially physical functioning and HRQoL outcomes, by public sector ICU physiotherapists in SA. The latter may affect quality care, appropriate goal setting for and outcomes of ICU patients. Factors influencing the use of physical functioning and HRQoL outcomes by public sector ICU physiotherapists must be investigated.

Providing evidence-based practice has become a goal of physiotherapists (Bernhardsson et al., 2017). The ESICM have recommended that clinical decision-making and education needs to follow standardised pathways and that awareness regarding benefits of prevention and treatment of immobility and deconditioning for ICU adult patients must be increased (Gosselink et al., 2008). The application of advanced, cost-saving therapeutic modalities to decrease ventilator dependency, improve residual function, prevent ICU readmissions or new hospitalisations and improve the patient's quality of life have been recommended (Yeole et al., 2015). The majority of ICU physiotherapists reported to use evidence-based weaning, suctioning, positioning, mobilisation and rehabilitation CPGs and protocols. There is strong evidence for the effectiveness of early mobilisation and strengthening exercises on reducing ICU and hospital length of stay, the number of ventilator-free days and improving functional outcomes (Cameron et al., 2015; Stiller, 2013). However, the reported use of evidence-based mobilisation and rehabilitation CPGs and protocols by the ICU physiotherapists seems to be contradictory as the majority of the ICU physiotherapists reported using mobilisation and

rehabilitation activities less than 50% of the time in the ICU. Therefore, the use of evidence-based CPGs and protocols by public sector ICU physiotherapists must be further explored to determine why all ICU physiotherapists are not able to provide evidence-based care all of the time in order to assist them in achieving the goals set out by the ESICM.

The ICU physiotherapists in the public sector seem to have more autonomy with regards to the prescription and decision-making regarding ICU physiotherapy treatment activities. The majority reported that they prescribe or decide on the frequency of treatments such as position changes, chest physiotherapy, mobilisation and rehabilitation, personally following a structured physical assessment. However, some did report that prescription is still via the ICU doctor/intensivist/physician orders or through discussion with them, the nurses and the ICU team, indicating their involvement and acceptance as part of the ICU multidisciplinary team.

The majority of physiotherapists reported having a joint role with the nurses with regards to positioning of critically ill patients. Although the ICU physiotherapists reported mainly being involved in mobilisation of the ICU patient, they share this role with the nurses to some extent. This finding is similar to the ICU physiotherapists in Sri Lanka (Sigera et al., 2016). Furthermore, more ICU physiotherapists reported being involved in rehabilitation of ICU patients with minimal input from the ICU nurses, ICU doctor/intensivist/physician or ICU team. This indicates that physiotherapists play a more specific role in rehabilitation of ICU patients that is supported by Hanekom, (2016, p.3) that "*physiotherapists are rehabilitation experts within the multidisciplinary team treating ICU patients".* Although these physiotherapists reported to be more involved in mobilisation and rehabilitation than the rest of the ICU team, the majority of the ICU physiotherapists reported spending less than half of the time doing these activities in the ICU. More than half of the time spent in the ICU was still spent on chest physiotherapy treatment activities by the majority of ICU physiotherapists whereas the evidence suggests that early mobilisation including positioning and rehabilitation reduces the need for prolonged ventilation and reduces respiratory or pulmonary complications improving patient outcomes (Phelan et al., 2017; Pathmanathan, Beaumont & Gratrix, 2014; Needham et al., 2010). The reasons for the amount of time spent on the different activities is not known and should be investigated. The time spent on physiotherapy treatment activities in the ICU has not been previously reported and therefore comparisons are not possible (Sigera et al., 2016).

Ventilatory activities were the least used activities amongst the majority of public sector ICU physiotherapists. This finding was similar to that reported by other developing countries (Yeole et al., 2015; Chokshi et al., 2013; Kumar et al., 2007). The ESICM recommended the implementation of therapist-driven weaning protocols in ICUs dependent on ICU physician staffing. The ESICM also recommended that physiotherapists should consider respiratory muscle training in ICU patients with respiratory muscle weakness and weaning failure (Gosselink et al., 2008). However, we did not include respiratory muscle training in our survey which is a recommendation for future survey studies. Chest physiotherapy, mobilisation and rehabilitation activities requiring the use of equipment such as manual hyperinflation (bagging), ambulation with mechanical ventilation, bed, chair or stationary cycling, tilt table and standing frame were noted to be the least used activities. The latter may either be due to a lack of equipment or lack of skill and expertise in the use of these activities and must be investigated. In a survey conducted in Sri Lanka, a developing country, manual hyperinflation (bagging) was widely used (Sigera et al., 2016). The lack of use of ventilatory activities indicates that the public sector ICU physiotherapists in SA are not following therapist-driven weaning protocols as recommended by the ESICM.

A poor response rate of 34% and completion rate of 25% limits our interpretation of the results. Only physiotherapists who worked exclusively in the ICUs completed the training section as the survey would use skip logic to only allow these physiotherapists to answer the questions on training and qualifications, so these results must be interpreted keeping this in mind. A few limitations of the study were that the public sector ICU physiotherapists lacked access to internet and email with problems of stable connectivity. It was also difficult to complete the survey telephonically as it would take between 20 and 30 minutes or more for completion, time which the physiotherapists could not provide due to work responsibilities. Although a resource intensive method of obtaining survey information was used by calling all departments to identify the physiotherapists working the ICUs at the time of the survey, the process allowed for accuracy in the sampling and validity of the reported ICU physiotherapy profile, availability of services and current ICU practices of those working in the public ICUs at the current time.

Gender was not recorded in the survey as it was not an original objective of the study. Other surveys available at the time of development of the current South African survey for this study, also did not include gender (Kumar et al., 2007; van Aswegan & Potterton, 2005; Norrenberg

& Vincent 2000). Attendance of ward rounds and communication with the ICU team were not investigated. The availability of equipment for use in the ICU for example hyperinflation bags, incentive spirometers, suction equipment and intermittent positive pressure breathing devices was also not investigated. The Chelsea Physical Assessment tool (CPAx) which is a relatively new physical functioning tool validated between 2012 and 2014 (Corner, Soni, Handy & Brett, 2014) was not included in the section on physical functioning and should be included in future surveys as well as functional electrical stimulation as a treatment technique in the ICU.

3.5 Conclusion

The study provides a clear picture of the ICU physiotherapy services and current ICU practices specifically in public hospitals in South Africa. There is a need for the early-career ICU physiotherapists who have minimal years of ICU experience, minimum basic degrees and minimal CPD attendance and post-graduate ICU training and qualifications, to be supported in the acquisition and maintenance of intensive care knowledge and skills in order to improve patient care and outcomes, communication and leadership in the South African public sector intensive care setting. ICU physiotherapists working in these public ICUs need to consider the available physiotherapy resources and evaluate their current service delivery and practices and how this affects the quality of their care and patient outcomes. ICU physiotherapists and healthcare policymakers and researchers must use this information to advocate for "dedicated" ICU physiotherapists that can assist to improve ICU physiotherapy practice, patient outcome and reduce cost of ICU care. Lastly, ICU physiotherapists in the public sector ICUs in SA need to improve their use of evidence-based practices through the use of CPGs and protocols and outcome measures to reduce practice variability. ICU physiotherapists can then provide evidence for effectiveness in the ICU. ICU physiotherapists and researchers need to identify and evaluate appropriate implementation strategies for the implementation of best-practice physiotherapy care in the public sector ICU setting in SA.

CHAPTER 4: PHASE 2

Best-practice implementation strategies to facilitate guideline or protocol implementation in intensive care: A Systematic Review

4.1 Introduction and Background

Less than optimal patient outcomes and increased costs of patient care are linked to variations in practice in intensive care including intensive care physiotherapy (Hanekom et al., 2013; Koo et al, 2011). The use of clinical practice guidelines (CPGs) and protocols to inform clinical practice not only improves the effectiveness and efficiency of healthcare but reduces the inappropriate care and variations in health care practice (Medves et al., 2010). Evidence-based, validated CPGs and protocols for ICU care that improve critical care outcomes exist in the current era of medical practice (Weiss & Baker, 2014). Such evidence-based, validated CPGs and protocols for the physiotherapeutic management of intensive care patients also exist and have been published (Hanekom et al., 2013; Rycroft-Malone et al., 2012). However, a major challenge faced by physiotherapists, is implementing this evidence into practice (Bernhardsson et al., 2017; Sinuff et al., 2008). This challenge is not isolated to the intensive care physiotherapist. Other multidisciplinary intensive care team members such as intensive care nurses, intensivists and dieticians are faced with similar challenges (Weiss & Baker, 2014; Needham, 2010; Crites et al., 2009; Grimshaw et al., 2004; Grol & Grimshaw, 2003).

Implementation science is defined by Eccles & Mittman (2006, "Abstract," para.1) as: *"…the scientific study of methods to promote the systematic uptake of research findings and other EBPs into routine practice, and, hence, to improve the quality and effectiveness of health services."* Eccles & Mittman (2006, "Abstract," para.1) further state: *"This relatively new field includes the study of influences on healthcare professional and organisational behaviour."* This new science supports and recognises the need for new, "real world" implementation studies in which the increasing body of evidence-based clinical practices can be effectively implemented (Bauer et al., 2015; Scales et al., 2009).

Questions about accelerating the uptake or adoption of evidence-based practices and how an increase in implementation fidelity can be achieved have arisen (Weiss & Baker, 2014). Implementation fidelity is defined as the "*degree to which an intervention* (implementation strategy) *is delivered as intended and is critical to successful translation of evidence-based*

interventions (CPGs and/or protocols) *into practice*" (Breitenstein, Gross, Garvey, Hill, Fogg & Resnick, 2010, "Abstract," p.164). Implementation fidelity therefore refers to both the exposure of the targeted healthcare professional group to the CPG and/or protocols and the exposure to the implementation strategies used in the implementation process (Breitenstein et al., 2010). An implementation strategy is a *"purposeful procedure used to achieve clinical practice compliance with a guideline recommendation"* (Mazza et al., 2013, "Background," para.1). In implementation science, implementation strategies are important as these strategies are part of the 'how to' aspect of practice change in healthcare (Proctor, Powell & McMillen, 2013). The pace and effectiveness of implementing evidence into practice is a high research priority (Proctor et al., 2013). Various factors have been identified for the poor uptake of validated evidence-based CPGs and protocols in clinical practice since the 1990s (Rubenstein & Pugh, 2006; Grimshaw et al., 2004; Grol & Grimshaw, 2003; Oxman, Thomson, Davis, Haynes et al., 1995). Uncertainty regarding which implementation strategies (Boaz et al, 2011; Higgins & Green, 2011; Stevens et al., 2007) are effective for the uptake of CPGs and protocols into clinical practice can affect the outcome of implementation processes in healthcare including intensive care. Therefore, the effectiveness of implementation strategies in the intensive care setting needs to be explored.

Various implementation strategies have been described and categorised into professional, organisational, financial and regulatory interventions that cover 49 distinct strategies according to the Cochrane Effective Practice and Organisation of Care (EPOC) Review Group (Mazza et al., 2013). Professional implementation strategies include the distribution of educational material, educational meetings and outreach visits, patient-mediated interventions, local consensus processes and opinion leaders, audit and feedback, reminders, marketing and mass media. Organisational implementation strategies include the revision of professional roles, clinical multidisciplinary teams, formal integration of services, skill mix changes, continuity of care, satisfaction of providers (interventions to "boost" morale) and communication and case discussion between distant health professionals. Implementation strategies can be active (active feedback strategy) or passive (distribution of educational material via printed booklets or websites). A single implementation strategy or a combination of single implementation strategies referred to as a multifaceted strategy can be used to implement research into practice (Proctor et al., 2013; Grimshaw et al., 2004). Two key findings from systematic reviews on guideline dissemination and implementation strategies include that 1) multifaceted

implementation strategies do not result in a significantly greater effect on process of care outcomes when compared to single-faceted strategies and 2) passive strategies, such as educational materials, produced moderate but significant improvements in process of care outcomes and behaviour compared to no strategy. The findings also indicated that passive strategies could be more cost effective in resource limited settings than active strategies (Boaz et al., 2011; Higgins & Green, 2011; Needham, 2010; Sinuff et al., 2008; Stevens et al., 2007; Grimshaw et al., 2004). Findings from the reviews on implementation in healthcare also indicated that the methodological quality of the studies were generally poor, meta-analysis prevented due to variability in outcomes and strategies compared and results on effectiveness of implementation strategies conflicting (Scales et al., 2009; Grimshaw et al., 2006; Grimshaw et al., 2004; Grimshaw et al., 2001).

Implementation strategies that work in other clinical settings may not necessarily work in a setting such as intensive care (Sinuff et al., 2008). The intensive care environment is a complex and dynamic one (Stiller, 2013). Multidisciplinary teams; variations in healthcare professionals including physiotherapists expertise and educational profile, diverse physician training (anaesthesia; surgery; medicine), team reliance on technological support, heterogeneity of patients and rapidly changing complex critical illness are possible barriers to implementation strategies in the intensive care setting (Rycroft-Malone et al., 2012; Sinuff et al., 2008). While the use and effectiveness of various implementation strategies in the implementation of CPGs and/or protocols have been investigated in the intensive care, this data has not been synthesized. Thus, the optimal best-practice implementation strategies in the intensive care remain unknown (Sinuff et al., 2008).

There has been a huge investment in the development of evidence-based CPGs and protocols that can benefit and improve patient care and patient outcome (Bernhardsson et al., 2017; Bauer et al., 2015; Grant et al., 2016). Thus, the need to adopt these CPGs and protocols into clinical practice including intensive care practice is advocated. There are many challenges in providing evidence-based care and in changing practice. One of these challenges include identifying the best-practice implementation strategies required to best implement these guidelines and change practice (Bernhardsson, et al., 2017; Boaz et al., 2011; Higgins & Green, 2011; Stevens et al., 2007; Rubenstein & Pugh, 2006; Grimshaw, et al., 2004; Grol & Grimshaw, 2003). This

resulted in the review question: ***"What is the best-practice process of implementation strategy for effective uptake of CPGs and protocols for changing ICU practice?"***

Reviews have investigated professional or knowledge translation strategies in implementation of evidence-based practices in other areas of healthcare and included different study designs (Medves et al., 2010; Grimshaw et al. 2004). Some reviews in ICU have specifically looked at implementation strategies that affect the uptake of specific care bundles or practices (Trogrlić et al., 2014; Cahill, Dhaliwal, Day, Jiang & Heyland, 2010). There has been no review in the literature that determined which specific implementation strategies would be effective in the uptake of CPGs and protocols, change practice and improve process of care and patient outcomes in the ICU. This information is valuable as it will provide an evidence base from which implementation processes or guidelines can be developed and may contribute to the successful uptake of CPGs and protocols in a unique environment such as the intensive care setting. Therefore, this review aimed to systematically identify rigorous evaluations and determine the best-practice implementation strategy to facilitate effective uptake of evidence-based CPGs and protocols to change intensive care practice. The specific objectives of the review were to i) describe the various implementation strategies used, ii) describe the outcomes used to measure effectiveness following implementation, iii) estimate the effectiveness of implementation strategies in changing intensive care practice, iv) describe the factors associated with successful practice change implementation and v) describe implementation fidelity achieved in the included studies.

4.2 Methods

The methods for this review were adopted from a systematic review on guideline dissemination and implementation strategies in healthcare conducted by Grimshaw et al., (2004). The methodological approach used for the review is described in detail below.

4.2.1 Literature Search

A health research librarian was consulted by the Primary Reviewer [FK] in order to assist in the development of a search strategy (search terms and databases to be searched). Searches were conducted in seven electronic databases namely PubMed (Medline in Pubmed), Cochrane Library, Ebscohost (included Academic Search Premier, Africa Wide Studies, Health Source: Nursing/Academic Edition, CINAHL and Medline), Web of Science, Scopus (EMBASE in

Scopus), Proquest Medical Library and Science Direct using language (English) and date restrictions (date of inception of databases to 31 March 2014) [Addendum 13]. A recent systematic review by Morrison et al., (2012) found no evidence of a systematic bias from the use of language restrictions in systematic review-based meta-analyses in conventional medicine and thus the reason to only include English studies. Screening of the reference lists of included full text studies (pearling) for other potential studies for inclusion was conducted following the same selection process as that of the electronic search. Thesis and dissertations and conference proceedings were not included in the search as only peer reviewed, published full text studies were included.

4.2.2 Study Inclusion Criteria

Studies were included if they met the criteria outlined in Table 4.1.

Table 4.1 Study Inclusion Criteria

Study Inclusion Criteria	
Participants	• Multidisciplinary Intensive Care Health Care Professionals
Interventions	• Single, Multifaceted, Active or Passive Professional and Organisational Implementation Strategies (interventions) used to implement clinical guidelines or evidence-based protocols in intensive care
Comparisons	Studies comparing: • two single implementation strategies; • two multifaceted strategies; • active strategies to passive strategies; • a single strategy to a multi-faceted strategy or • more than two types of strategies at a time.
Outcomes	Studies reporting: • patient outcome and/or • process of care indicators and/or • objective measures of health care provider behaviour, knowledge, attitude and self-efficacy
Study Designs	• Randomised controlled trials (RCT), involving either individual randomisation at the level of the patient (P-RCT) or cluster randomisation at the level of professional, practice or healthcare organisation (C-RCT); • controlled clinical trials (CCT), involving either individual allocation at the level of the patient; (P-CCT) or cluster allocation at the level of professional, practice or healthcare organisation (C-CCT); • controlled before and after (CBA) studies and • interrupted time series (ITS) studies was included for selection in the review (Grimshaw et al., 2004).
Methodological Quality Criteria for EPOC Review	• Two criteria i) study design (RCT, CCT, CBA, ITS) and ii) methodological criteria - included if the objective measurement of performance/provider behaviour or health/patient outcomes was reported and relevant and interpretable data was presented or obtainable [Addendum 14]. • CBA – Include: i) if contemporaneous data collection was reported and ii) if there was an appropriate choice of control site/activity (studies had to contain a minimum of two intervention and two control groups) [see in Addendum 14 under study design]. • ITS – Include: i) a clearly defined point in time when the intervention occurred and ii) at least 3 data points before and 3 after the intervention had to be reported [see in Addendum 14 under study design].

4.2.3 Intervention Reporting

The Cochrane Effective Practice and Organisation of Care Review Group classify the implementation strategies according to a taxonomy of professional and organisational interventions [Addendum 14]. The implementation strategies in the current review are therefore reported based on the EPOC classification. Studies using professional and organisational strategies were included. A standard definition of "Clinical Practice Guidelines" by Field & Lohr (1990) was adopted for use in this study. According to the definition of Field & Lohr (1990), CPG's are "systematically developed statements to assist practitioners and patient decisions about appropriate health care for specific circumstances." This definition was also used in a review by Medves et al., (2010) and Grimshaw et al., (2004) on implementation and dissemination strategies in healthcare. Clinical protocols can be seen as more specific than CPGs, defined in greater detail. Protocols provide "a comprehensive set of rigid criteria outlining the management steps for a single clinical condition or aspects of organisation" (Mazza et al., 2013). Studies that evaluated an intervention that was considered by the reviewers to meet the above criteria were included regardless if the term clinical practice guideline or protocol was used (Grimshaw et al., 2004).

4.2.4 Study Selection and Review Process

The Primary Reviewer [FK] searched the predetermined databases using the predetermined search strategies. The Primary Reviewer [FK] and Second Reviewer [CK] independently screened articles at title, abstract and full text level for inclusion in the review. No further titles were identified through pearling. Disagreements were resolved through discussion between the two reviewers and a Third Reviewer [SH] was consulted as an independent consensus reviewer when the disagreement between the primary and secondary reviewer at any of the aforementioned levels of paper selection and inclusion could not be resolved.

4.2.5 Data Abstraction/Extraction

The Cochrane Effective Practice and Organisation of Care Review Group Data Collection Checklist [Addendum 14] and Data Abstraction Form [Addendum 15] was used to extract the study data required. Data were extracted by the Primary Reviewer [FK] and verified by the Second Reviewer [CK]. Disagreements were resolved by discussion and by consulting the Third Reviewer [SH].

4.2.6 Methodological Quality Criteria (internal validity) and Risk of Bias Assessment

The two reviewers [FK and CK] independently assessed the methodological quality and risk of bias assessment of the included studies and disagreement was resolved by discussion and by consulting the Third Reviewer [SH]. The EPOC methodological quality criteria in the EPOC data collection checklist [Addendum 14] was used to critically appraise the included studies for each design. Studies had to meet the minimum criteria for EPOC scope, design, and methodology for inclusion in EPOC reviews [Table 4.1]. Seven standard criteria are used for RCTs and CCTs to assess the methodological quality of the study. For CBAs there are also seven standard criteria which are different to the RCT and CCT criteria. Two standard criteria that are further divided into four specific criteria each are used for ITS designs. The criteria are rated as "Done", "Not Clear" or "Not Done". The authors were not contacted when a particular criterion was found to be "Not Clear". The Cochrane Risk of Bias Assessment for each study was conducted and is rated as "Low Risk", Unclear Risk" or "High Risk" [Addendum 16] (Higgins & Green, 2011; Grimshaw et al., 2004).

4.2.7 Data Analysis/Synthesis

A summary statistic for homogenous data was calculated to describe the intervention effect. Studies that contained dichotomous (binary) data was analysed using RevMan 5.1.0 (2011) to calculate the odds ratio (OR) with 95% confidence intervals (CI) of the effect of the intervention on the process of care measures. The Chi square test was used to determine heterogeneity of the results of the included studies and to examine inconsistency across studies (Higgins & Altman, 2008). RevMan 5.1.0 (2011) was used to determine effect estimates by performing meta-analysis. Heterogeneity was based on whether similar outcomes were measured using different units of measurement and therefore could not be combined for measures of effectiveness. Heterogeneity was also based on measures that were different but used the same unit of analysis and could thus be combined to measure effectiveness using meta-analysis. Data or results obtained from heterogeneous studies was summarized in a narrative report (meta-synthesis).

4.3 Results

The electronic literature search identified 507 potentially useful citations (studies) after 117 duplicates were removed [Figure 4.1]. Table 4.2 presents the total studies found per database searched including duplicates.

Table 4.2 Total Studies found per Database with Duplicates

Electronic Databases Searched	Total Hits	Duplicates Removed	Total Studies Included
PubMed	33	0	33
EbscoHost	41	17	24
Web of Science	114	2	112
Cochrane Library	11	0	11
Science Direct	129	1	128
Scopus	112	1	111
ProQuest Medical Library	184	0	184

Following the review process 50 papers were included at full text level and only 9 of these papers (Sinuff et al., 2013; van der Veer et al., 2013; Acolet, Allen, Houston, Costeloe & Elbourne, 2011; Arnold et al., 2011; Curtis et al., 2011; Scales et al., 2011; Horbar et al., 2004; Martin, Doig, Heyland, Morrison & Sibbald, 2004; Doig et al., 2008) were included in the review [Figure 4.1]. All included studies were in English. There were no foreign language studies found in the search process and thus no studies were excluded on this criterion. A list of the 41 excluded studies and reasons for exclusion are documented in [Addendum 17].

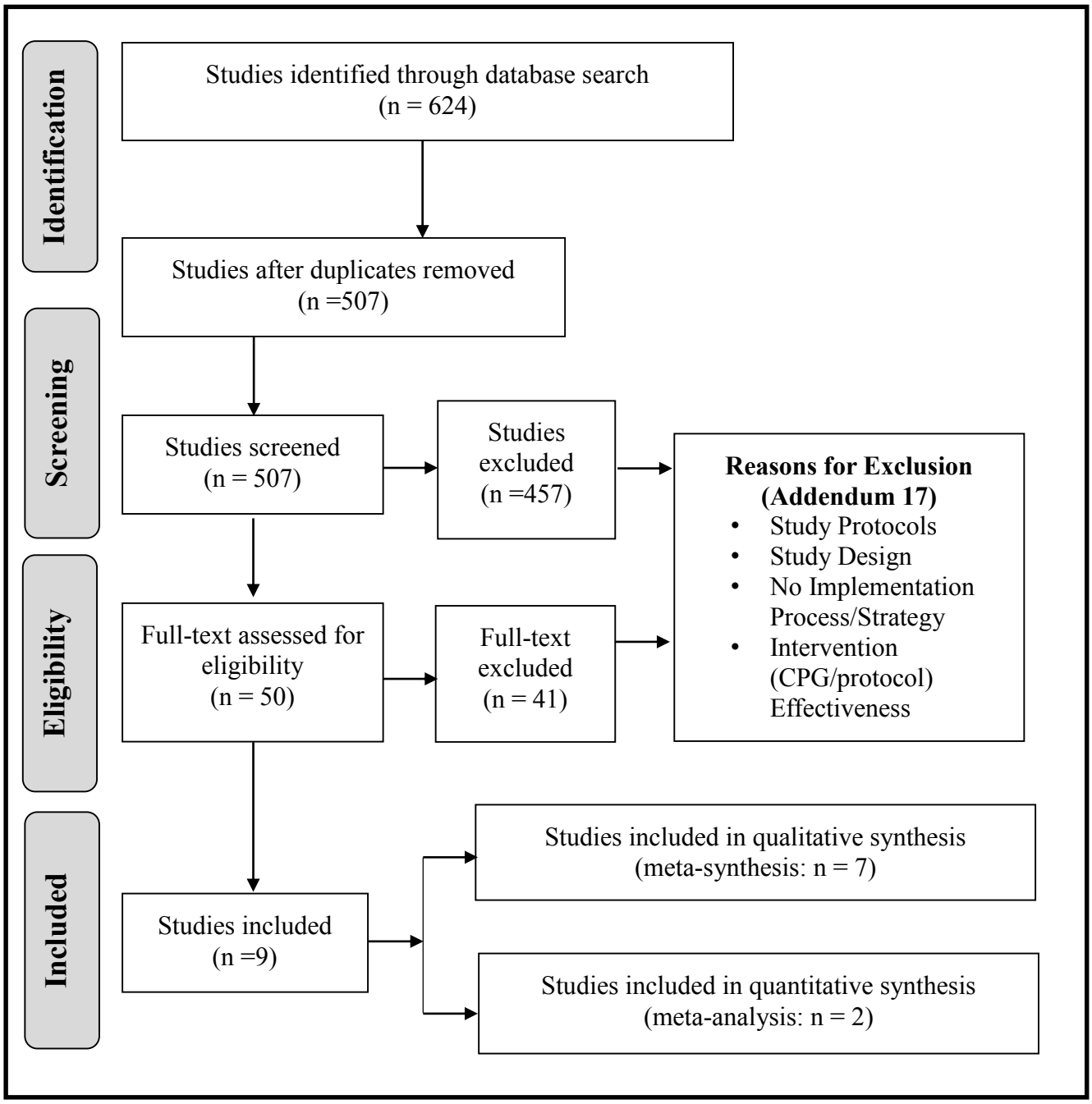


Figure 4.1 PRISMA Flow Diagram outlining the Review Process and Study Selection (Diagram Template: Moher, 2009)

4.3.1 Characteristics of the Included Studies

The characteristics of the included studies is summarised in Table 4.3. The nine studies were conducted in intensive care units based in community and teaching hospitals in developed countries. The majority of studies were conducted in North America, specifically in Canada. All studies were published in the last two decades between 2004 and 2013 with an increase in the number of studies from 2011. There were more RCT than ITS designs and no CCT and

Table 4.3 Characteristics of the Included Studies *(light grey shaded area – not applicable)*

Author/s and Year of Publication	Country/ies	Study Design			ICU Setting					Targeted ICU Healthcare Professional/s				Implementation Strategy/s			Evidence-Based Practices Implemented
		CRCT	PCRCT	ITS	Medical	Surgical	Mixed (medical-surgical)	Neonatal	Not stated	**Medical:** Physician, Surgeon, Consultant	**Nursing:** Nurses, Nurse, Educator, Respiratory Therapists	**Allied Health:** Dietician, Pharmacists	**Other:** Trainees, Lead Clinicians, Hospital Staff, Quality Improvement Team	Multifaceted vs Single Strategy	Multifaceted vs No Strategy	Multifaceted vs Multifaceted	
Martin et al., 2004	Canada, Ontario	✓			✓	✓				✓	✓	✓			✓		Nutritional Support.
Horbar et al., 2004	North America	✓						✓		✓	✓			✓			Surfactant Treatment of Preterm Infants (23-29 weeks) Gestation.
Doig et al., 2008	Australia and New Zealand	✓					✓			✓	✓	✓			✓		Feeding Guidelines
Scales et al., 2011	Canada, Ontario		✓				✓									✓	**6 target care practices:** * VAP Prevention & Prophylaxis against DVT * DSBT & Prevention of CRBI * Early Enteral Feeding & Decubitus Ulcer Prevention
Arnold et al., 2011	Canada, Ontario			✓			✓			✓	✓		✓		✓		Appropriate use of Frozen Plasma Transfusions.
Acolet et al., 2011	UK, England	✓						✓					✓	✓			Change in Policy & Practice - Care of Preterm babies.
Curtis et al., 2011	US, Tecoma & Seattle	✓							✓				✓		✓		End of Life Care
Sinuff et al., 2013	Canada & US			✓	✓	✓				✓	✓		✓		✓		Prevention, Diagnosis, and Treatment of VAP
van der Veer et al., 2013	Netherlands		✓				✓						✓	✓			Daily ICU practice - Quality Improvement Initiative to monitor and improve ICU Performance.

CBA designs found in this review. The multidisciplinary healthcare professionals targeted in the studies varied. However, mostly physicians, nurses and respiratory therapists were targeted in the implementation process and very few allied healthcare professionals. Studies implemented a wide range of different evidence-based guidelines and protocols but interestingly no study implementing ICU physiotherapy evidence-based guidelines or protocols was found. The study periods varied between 6 months and 4 years with varying pre-, implementation and post-implementation periods. Only three studies (RCTs) compared a multifaceted to a single implementation strategy for inclusion in a meta-analysis. Seven studies included adult ICU patients (van der Veer et al., 2013; Arnold et al., 2011; Curtis et al., 2011; Scales et al., 2011; Sinuff et al., 2011 Doig et al., 2008; Martin et al., 2004) and two included neonatal patients (Acolet et al., 2011; Horbar et al., 2004). The characteristics of the patients admitted to the adult and neonatal studies are described in the next paragraph.

The total number of patients enrolled in the adult ICU studies ranged from a total of 88 patients to 13539 patients. The mean ages of patients were more than 55 years of age and the majority (≥ 50%) of patients in both the intervention and control ICUs were male. The mean APACHE II scores for five of the seven adult ICU studies in both the control and intervention groups indicated that all patients admitted in these trials were severely ill on admission (van der Veer et al., 2013; Arnold et al., 2011; Sinuff et al., 2011; Doig et al., 2008 and Martin et al., 2004). Two RCTs did not report on APACHE II Scores for patients admitted in their studies (Curtis et al., 2011 and Scales et al., 2011). The neonatal ICU studies admitted 6039 neonates at a gestational age of 27 weeks (Horbar et al., 2011) and 355 neonates with a gestational age of < 27 weeks (Acolet et al., 2011) each. The median (IQR) number of admissions of very low birth weight (VLBW) infants (< 1.5kg) was 48.5 (30-88) (Acolet et al., 2011) and 75 (53-106) (Horbar et al., 2004) in the intervention arm and 44 (24-68) (Acolet et al., 2011) and 71 (41-114) in the control arm (Horbar et al., 2004).

4.3.2 Methodological Quality Criteria (Internal Validity) & Risk of Bias Assessment

All studies were included in the data synthesis and no studies were excluded based on the methodological quality and/or risk of bias assessment. The studies included 7 (78%) RCT and 2 (22%) ITS designs. The quality of the studies by design and allocation level is summarised in

Table 4.4a and 4.4b. The Risk of Bias Assessment for the RCTs is also included under 4.3.2.1 [Figure 4.2].

4.3.2.1 RCTs

Follow-up of professionals (protection against exclusion bias) was not clear for 71.4% of the RCT's as it was not reported in the studies. Curtis et al., (2011) had nurses in the ICU complete a questionnaire for one of the outcome measures. Their response rate was ≤ 80% to their questionnaire and thus ≤ 80% for that outcome measure. Thus, protection against exclusion bias was scored "not done" for this study. Scales et al., (2011) reported that semi-structured interviews with the healthcare professionals was done. However, they did not report on the protection of exclusion bias and thus it was unclear as to the risk of exclusion bias.

The other studies did not report on any evaluation of outcomes at the level of the healthcare professional (protection of exclusion bias) and thus were scored as "not clear". More than half the studies (57.1%) scored "done" for blinded assessment of the primary outcome mainly as primary outcome measures were objective measures and not because assessments of outcomes or study assessments were blinded to the data capturers or statistician. Horbar et al., (2004) was one exception where the statistician was masked to the study assignment or data.

Table 4.4a Methodological Quality of the RCT's

Quality Criteria	Concealment of allocation (protection against selection bias)	Follow-up of professionals (protection against exclusion bias)	Follow-up of patients or episodes of care	Blinded assessment of primary outcome(s)* (protection against detection bias)	Baseline measurement	Reliable primary outcome measure(s)*	Protection against contamination
Done ✓ n(%)	7 (100%)	-	4 (57.1%)	4 (57.1%)	7 (100%)	6 (85.7%)	7 (100%)
Not Clear ? n (%)	-	5 (71.4%)	1 (14.3%)	2 (28.6%)	-	1 (14.3%)	-
Not Done ✖ n (%)	-	2 (28.6%)	2 (28.6%)	1 (14.3%)	-	-	-
Martin et al., 2004	✓	?	✓	✓	✓	✓	✓
Horbar et al., 2004	✓	?	✓	✓	✓	✓	✓
Doig et al., 2008	✓	?	✓	✓	✓	✓	✓
Acolet et al., 2011	✓	✖	✖	?	✓	?	✓
Curtis et al., 2011	✓	✖	✖	✖	✓	✓	✓
Scales et al., 2011	✓	?	?	?	✓	✓	✓
van der Veer et al., 2013	✓	?	✓	✓	✓	✓	✓

Performance and attrition bias were two key areas of bias of five (71.4%) of the included RCT study designs. In 42.8% of the studies blinding of the participants and personnel was not possible. Overall the risk of bias of the RCTs can be categorised as "low risk".

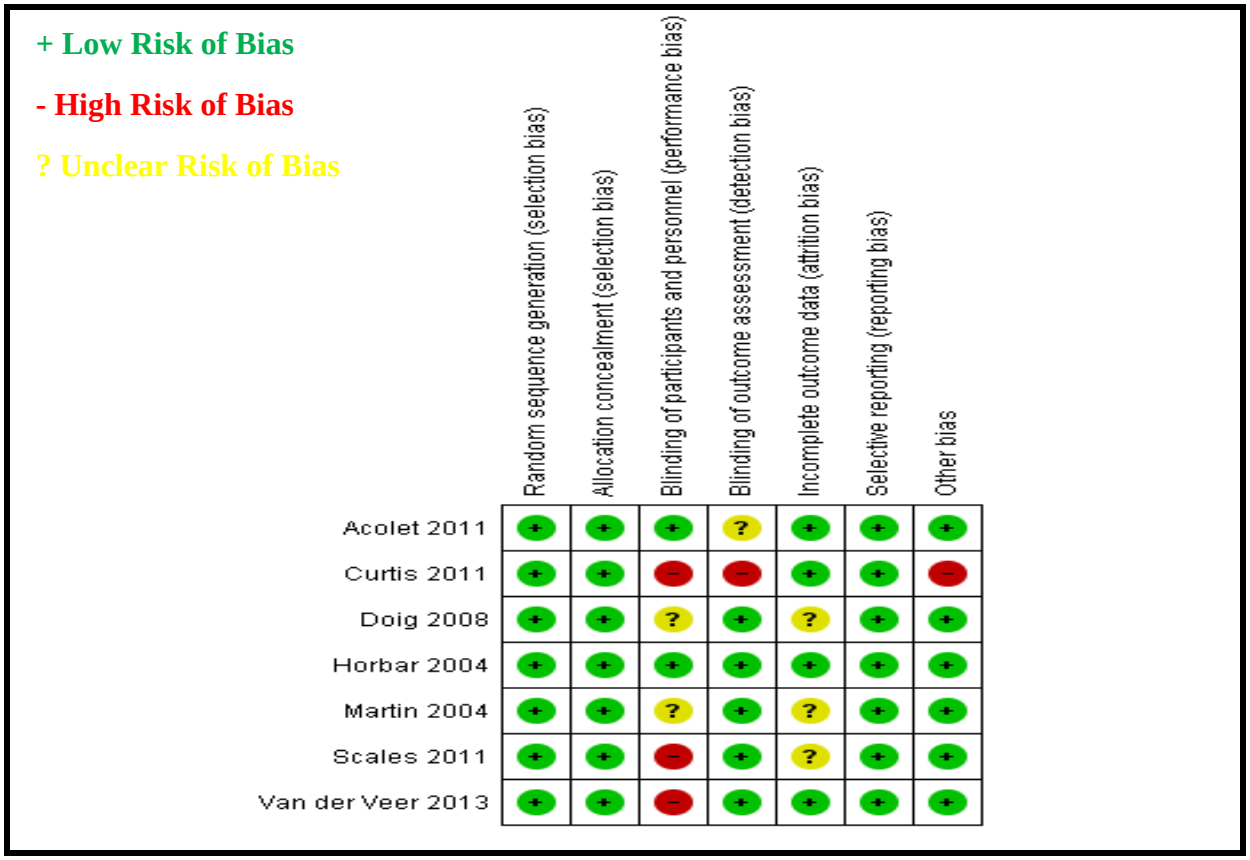


Figure 4.2 Risk of Bias Summary: Review Authors' Judgements about each Risk of Bias Item for each Included Study.

4.3.2.2 ITSs

Both ITS designs presented secular changes and detection bias.

Table 4.4b Methodological Quality of the ITS Studies

Quality Criteria	Protection against secular changes				Protection against detection bias			
	Intervention is independent of other changes	Data were analysed appropriately	Reason for the number of points pre and post intervention given	Shape of the intervention effect was specified	Intervention unlikely to affect data collection	Blinded assessment of primary outcome(s)	Completeness of data set	Reliable primary outcome measure(s)
% Done ✓	-	2 (100%)	2 (100%)	-	-	1 (50%)	2 (100%)	1 (50%)
% Not Done ✖	2 (100%)	-	-	2 (100%)	2 (100%)	1 (50%)	-	1 (50%)
Arnold et al., 2011	✖	✓	✓	✖	✖	✓	✓	✖
Sinuff et al., 2013	✖	✓	✓	✖	✖	✖	✓	✓

4.3.3 Implementation Strategies Identified in the Included Studies.

Table 4.5a represents the professional and/or organisational implementation strategies used in the included studies to implement CPGs and/or protocols in intensive care. Strategies used in the implementation of CPGs or protocols in the intensive care setting were either multifaceted or single-faceted strategies and active or passive implementation or dissemination strategies. Only four professional implementation strategies and three organisational implementation strategies were used in the included studies. One study used a combination of only professional implementation strategies whereas eight studies used a combination of professional and organisational implementation strategies combined. Educational strategies were shown to be the most frequent implementation strategy used and was used in all included studies (100%, n=9/9), followed by 89% (n= 8/9) using audit and feedback and 67% (n=5/9) of studies using reminders. In 56% (n=5) of the studies, a combined strategy of education, audit and feedback and reminders were used. There are a variety of educational strategies. Table 4.5b presents the various educational strategies used per study. All except one study (van der Veer et al., 2013) used two or more types of the educational implementation strategies.

4.3.3.1 Decision-making regarding Selection of Implementation Strategies

Four studies did not report on how the implementation strategy used in the implementation process was decided upon (Scales et al., 2011; Arnold et al., 2011; Acolet et al., 2011 and Horbar et al., 2004). Three studies based their strategy/ies on evidence in the literature. van der Veer et al., (2013) used the activating performance feedback strategy based on evidence from two reviews. Curtis et al., (2011) developed their 5-component implementation strategy based on a self-efficacy theory that clinicians change behaviour when knowledge is increased, attitudes are enhanced and appropriate behaviour is modelled. Martin et al., (2004) based their implementation strategy on outcomes from a review on translating guidelines into practice. Sinuff et al., (2013) and Doig et al., (2008) did not report on how the implementation strategies were chosen. However, Sinuff et al., (2013) introduced the implementation or practice change strategy to the involved healthcare professionals and received their input and made changes. Doig et al., (2008) had a discussion around the multifaceted implementation strategies and its use for practice change at a 2-day workshop before implementation.

Table 4.5a Professional & Organisational Implementation Strategies (*shaded light grey areas=strategies not used,* ✓***- intervention unit,*** ✓***- control unit***)

	Professional Implementation Strategies															**Organisational Implementation Strategies**									
	Education	**Audit & Feedback** (Active & Passive)			**Reminders** All passive, local clinician-active reminder											**Local Opinion Leader/Champion**			**Clinical MDT Teams** (Quality Improvement Team and Plan)				**Communication & Case Discussion**			**Support**	
	Educational Strategies (see Table 4.5b)	**Audit of care processes**	**ICU Performance Feedback Reports**	**Peer/Individual Performance Feedback Reports**	**Promotional Items** Posters	Lapels	Pens	Pins	Stamps	Pocket Cards	Checklists	Bulletins/Pamphlets	Monthly Newsletters	Pre-printed Order Sets/Request Forms	Local Clinician Active Reminders (face to face chat/prompts)	Lead ICU Clinician	Local ICU Champion/Opinion Leader	Regional ICU Champion/Opinion Leader	Multidisciplinary QI Team/meetings	Quality Improvement Plan	QI Activities Initiated	Peer-Nominated, Educationally Influential Opinion Leaders	Conference Calls/Telephone calls	Email Discussion List/Google Group	Telemedicine	Local Champions/ Clinician Support	System Supports (order/request form)
Martin et al., 2004	✓	✓		✓	✓					✓							✓									
Horbar et al., 2004	✓	✓	✓✓	✓																			✓	✓			
Doig et al., 2008	✓	✓	✓		✓										✓							✓					
Scales et al., 2011	✓✓	✓✓	✓✓	✓✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓			✓ ✓											✓ ✓		
Arnold et al., 2011	✓	✓		✓										✓	✓												
Acolet et al., 2011	✓✓		✓													✓		✓									
Curtis et al.,2011	✓		✓		✓							✓		✓			✓									✓	✓
Sinuff et al., 2013	✓										✓		✓	✓			✓		✓				✓	✓		✓	
van der Veer et al., 2013	✓		✓ ✓																✓	✓	✓						

Table 4.5b Educational Implementation Strategies (*shaded light grey areas=strategies not used,* ✓***- intervention unit***)

Educational Strategies	Single Didactic Lecture	Workshop (1DAY)	Workshop Series (2/> days)	Site Team Exercises (Unit Level)	Multi-Institutional Group Exercises (Regional)	Academic Detailing	Grand Rounds Lecture or Bedside Teaching	Teaching/Educational Rounds	Educational Outreach/ Guideline Initiation Site Visits	In service education session/series/training	Discussion Sessions on teaching video/clinical scenarios	Video Conference Education - Telecommunication	Video Presentation/Teaching	Scientific Poster Presentations	Resource Manual (evidence-based literature)	Educational Pamphlets	Easy to read Bulletins	Copies of the Published Guidelines			Bibliography of EB Literature/Scientific Article/ Critical Appraisal Summaries			Slide set			FAQ's – Frequently asked questions			Self-Assessment Quiz		
																		Paper -Based	Web- Based	Emailed	Paper -Based	Web- Based	Emailed	Paper -Based	Web- Based	Emailed	Paper -Based	Web- Based	Emailed	Paper -Based	Web- Based	Emailed
Martin et al., 2004	✓									✓																						
Horbar et al., 2004	✓		✓	✓	✓																											
Doig et al., 2008						✓	✓		✓	✓					✓			✓			✓											
Scales et al., 2011								✓				✓				✓	✓					✓										
Arnold et al., 2011								✓		✓				✓																		
Acolet et al., 2011		✓	✓																						✓							
Curtis et al.,2011			✓			✓	✓				✓		✓			✓																
Sinuff et al., 2013																		✓	✓	✓	✓	✓	✓				✓	✓	✓		✓	
van der Veer et al., 2013									✓																							

4.3.5 Estimate of Effectiveness of Implementation Strategies

4.3.5.1 Process of Care Measures

Dichotomous process of care measures from Horbar et al., (2004) and Acolet et al., (2011) were computed into Revman 5.1 (2011) and a meta-analysis performed. Figure 4.3 represents the measure of effectiveness of multifaceted versus single implementation strategies between studies with dichotomous process of care outcomes (Horbar et al., 2004 and Acolet et al., 2011).

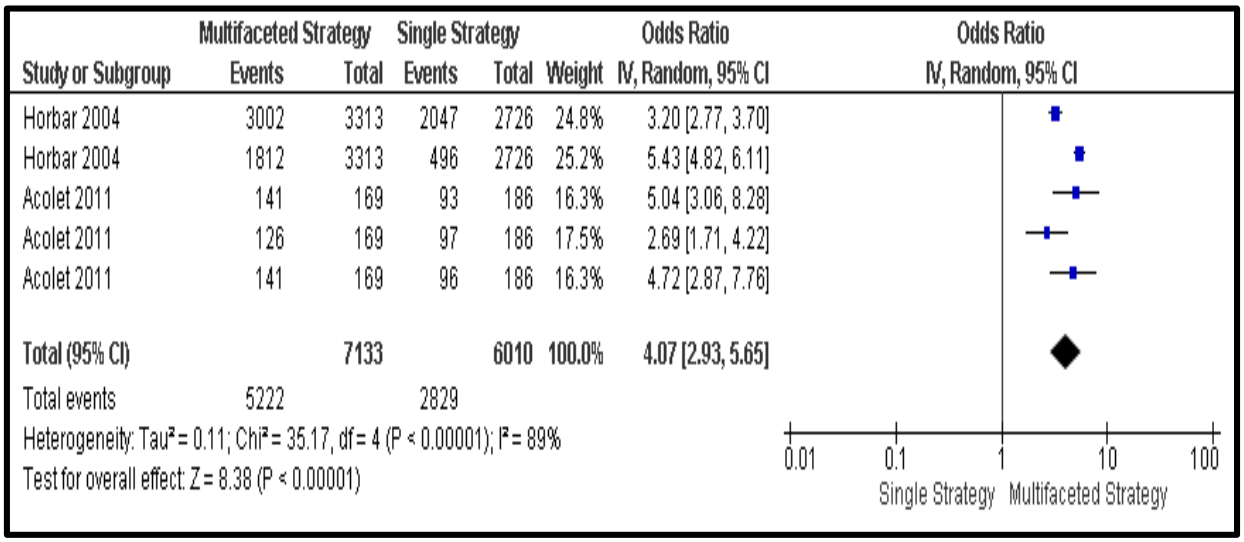


Figure 4.3 Forest Plot of Comparison (Meta-analysis): Multifaceted Strategy versus Single Strategy, Outcome: Dichotomous Process of Care Measure

The overall effect estimate favoured the intervention thus favouring the multifaceted implementation strategy. The multifaceted strategy is significantly more effective [OR 4.07, 95% CI: 2.93-5.65; p<0.00001] than the single strategy in improving process of care measures. It is four times more likely that the multifaceted implementation strategy is more effective in changing practice than a single implementation strategy and we can be 95% sure that if the studies were repeated the outcome would be the same as there is a narrow confidence interval. There was substantial to considerable heterogeneity (I^2=89%) (Higgins & Green et al., 2008) between process of care outcomes with a statistically significant p-value < 0.00001 indicating significant heterogeneity of process of care outcomes between studies. Both studies had an overall low risk of bias with rigorous designs. Thus, it can be confidently said that the results found are likely to be true. van der Veer et al., (2013) did not evaluate process of care measures and thus could not be included in the meta-analysis. There was only one continuous process of

care measure described in Horbar et al., (2004) and Acolet et al., (2011) respectively but these differed in the measure used. These continuous process of care measures were the time to first surfactant treatment in minutes (Horbar et al., 2004) and temperature on admission to the neonatal ICU [degrees Celsius] (Acolet et al., 2011). Both these process of care measures were reported to have improved in the intervention units with a reduction in time to first surfactant treatment administered and increase in temperature in infants admitted to the neonatal ICU respectively (Table 4.6a).

4.3.5.2 Patient-Centred/Oriented Clinical Outcome Measures

Due to clinical heterogeneity of the patient-oriented/centred clinical outcomes a meta-analysis was not possible, thus they are described narratively and are presented in Table 4.6b. None of the primary or secondary patient-centred/oriented clinical outcome measures in van der Veer et al., (2013) showed any statistically significant differences in the intervention versus the control units comparing a multifaceted to a single implementation strategy respectively. Two primary patient-centred/oriented clinical outcomes were measured in Horbar et al., (2004). The secondary patient-centred/oriented clinical outcomes in Horbar et al., (2004) namely intubation in the delivery room and severe intra-ventricular haemorrhage (grades 3 or 4) showed statistically significant improvements favouring the multifaceted implementation strategy implemented in the intervention units. Intubation in the delivery room increased due to early surfactant therapy being introduced and severe intra-ventricular haemorrhage (grades 3 or 4) as a complication had decreased. Acolet et al., (2011) did not evaluate any patient oriented/centred clinical outcome measures.

4.3.5.3 Healthcare Provider Behaviour, Knowledge, Attitude and Self-Efficacy Measures

None of the studies reported on outcomes such as healthcare provider behaviour, knowledge, attitude and self-efficacy. There were no reports of provider satisfaction in any of the studies. This still cannot be determined and remains unknown.

4.3.4 Outcomes Measured in the Implementation Studies

The primary outcomes measured by each study included either process of care measures specific to the CPG and/or protocol implemented and/or patient-oriented/centred clinical outcomes. The majority of studies (78%, n=7/9) used process of care measures as their primary outcomes and 67% (n=6/9) of the studies used clinical outcomes as their primary outcomes.

The process of care and patient-oriented/centred clinical outcomes measured by these studies are presented in Table 4.6a and 4.6b. Studies reported more improvements in the process of care measures than patient-oriented/centred clinical outcomes when comparing the implementation strategies used in their respective studies.

Table 4.6a Process of Care Measures or Indicators *(* - Primary Process of Care Outcomes, # - Secondary Process of Care Outcomes, shaded light grey areas = studies included in the meta-analysis)*

Author/s and Year of Publication	Process of Care Indicators/Measures (↑- increased or ↓- reduced favouring the intervention or stayed the same [-])	Outcome Results (Intervention versus Control Unit)	Favoured the Intervention (✓)
Martin et al., 2004	*Number of days fed on EN ↑ *Number of days fed on any feed (any Nutrition) ↑ *Time from ICU admission to receiving enteral feeds [-] *Time from ICU admission to receiving any feed (any nutrition) [-]	* (6.7 v. 5.4 per 10 patient-days at risk, p = 0.042) * (8.5 v. 6.9 per 10 patient-days at risk, p = 0.02) * (1.61 v. 2.16, p = 0.17) * (1.52 v. 1.85, p = 0.22) *Results only from the appropriately randomised ICUs*	✓ ✓ ✖ ✖
Horbar et al., 2004	*Surfactant treatment in Delivery Room of all Infants (% per group - OR) ↑ *Time to First Dose of Surfactant Administration after Birth (% per group - OR) ↓ *1st Surfactant Treatment more than 2hrs after Birth (minutes per group – median and interquartile range) ↓ #Intubated in the delivery room ↑ #Receive surfactant at any time ↑ #Overall proportions of infants intubated and received conventional ventilation or high frequency ventilation [-]	* 5.38 95% CI: 2.84 -10.20 (adjusted OR and 95% CI), (P < 0.003) * 21 minutes (IQR: 10-128) *v* 78 minutes (IQR:29-410), adjusted HR 1.57 (95% CI: 1.42 to 2.07) * 0.35 95% CI: 0.24 - 0.53 (adjusted OR and 95% CI), (P < 0.001) #1.65, 95% CI: 1.19 - 2.29, p < 0.05 (adjusted odds ratio) #1.55, 95% CI: 1.08 - 2.23, p < 0.05 (adjusted odds ratio) # 1.10, 95% CI: 0.78 - 1.56 and 1.08, 95% CI: 0.65 to 1.80 respectively (adjusted odds ratio) *Results only from the appropriately randomised ICUs*	✓ ✓ ✓ ✓ ✓ ✖
Doig et al.,2008	#Number of patients receiving nutritional support in ICU (%)↑ #Number of patients fed within 24-hours of ICU admission (%)↑ #Mean days to start of Enteral Nutrition ↓ #Mean days to start of Parenteral Nutrition ↓ #Proportion of ICU days fed (fed days /10 patient-days) ↑ #Renal Replacement Therapy (dialysis days/10 patient-days) [-]	# 94.3% vs 72.7%; diff, 22.5%, 95% CI: 18.1% - 25.0%, p = 0.001 #60.8% vs 37.3%; diff, 23.4%, 95% CI: 12.9% - 36.2%, p < 0.001 #0.75 vs 1.37; −0.62, 95% CI: −0.82 to −0.36; p <0.001 #1.04 vs 1.40; −0.35, 95% CI: −0.61 to −0.01; p= 0.04 #8.08 vs 6.90; diff, 1.18, 95% CI: 0.41 - 2.03; p = 0.002 #0.75 vs 0.91; diff, −0.16; 95% CI: −0.38 - 0.16; p = 0.29	✓ ✓ ✓ ✓ ✓ ✖
Scales et al.,2011	*Semi-recumbent positioning ↑ *DVT prophylaxis [-] *Prevention of CRBSI ↓ *Daily SBT [-] *Assessment of decubitus ulcer risk [-] *Early enteral nutrition [-]	*OR 6.35, 95% CI:1.85-21.79; p=.007 *OR 1.28, 95%CI:0.67-2.45; p=0.46 *OR 30.06, 95%CI:11.00-82.17; p<0.001 *OR 1.35, 95%CI: 0.44-4.12; p=0.57 *OR 6.54, 95%CI:0.50-85.63; p=0.14 *OR 1.16, 95% CI: 0.42-3.20; p=0.77	✓ ✖ ✓ ✖ ✖ ✖

Arnold et al.,2011	*Proportion of Inappropriate Frozen Plasm (FP) requests (%) **trend to** ↓ *Proportion FP requests consistent with guidelines (%) [-] *Proportion FP requests appropriate for ICU yet inconsistent with guidelines (%) ↑	*60% vs 46%; p = 0.09 *23% vs 22%; p = 0.86 *17% vs 32%; p = 0.04	✖ ✖ ✓
Acolet et al.,2011	*Surfactant treatment in labour ward **trend to** ↑ *Baby's trunk delivered into a plastic bag ↑ * "Ideal" Resuscitation Team present at Birth **trend to** ↑ *Temperature on admission to NICU ↑	*RR=1.30; 95%CI: 0.99 - 1.70; p = 0.06 *RR=1.27; 95%CI: 1.01 - 1.60; p = 0.04 *OR=1.18; 95%CI: 0.97 - 1.43; p = 0.09 *mean difference=0.29ºC; 95% CI 0.22 - 0.55; p = 0.03	✖ ✓ ✖ ✓
Curtis et al.,2011	*Palliative care Elements: - Family conference, 1st 72 h ↑ - Prognosis discussed, 1st 72 h ↑ - Palliative care consult [-] - Spiritual care provided [-] - Social work assistance ↑ - Avoided CPR in last hour of life [-] - DNR orders at death [-] - Pain assessment [-] - Life support withheld or withdrawn [-]	*OR 0.50, 95% CI: 0.34-0.73; p=0.001 *OR 0.69, 95% CI: 0.48-0.98; p=0.04 *OR 0.52, 95% CI: 0.18-1.5; p=0.23 *OR 1.33, 95% CI:0.91-1.94; p=0.15 *OR 1.73, 95% CI: 1.16- 2.58; p=0.008 *OR 1.64, 95% CI: 0.96-2.80; p=0.07 *OR 1.09, 95% CI: 0.71- 1.67, p=0.68 *OR 1.06, 95% CI: 0.67-1.68, p=0.81 *OR 0.73, 95% CI:0.50, 1.06-0.10, p=0.10	✓ ✓ ✖ ✖ ✓ ✖ ✖ ✖ ✖
Sinuff et al., 2013	*Aggregate site-level guideline concordance (overall mean)↑ *Endotracheal tube with subglottic secretion drainage, % change ↑ *Semi-recumbent position (45°), % change ↑ *Chlorhexidine oral care, % change ↑ *Oral route of intubation (mean) [-] *Closed endotracheal suctioning system (mean) [-] *Frequency of ventilator circuit change (mean) [-] *Frequency of change of endotracheal suctioning system (mean) [-] *Frequency of change of heat and moisture exchange (mean) [-] & heated humidifier (mean) [-] *Initiation of monotherapy for each VAP suspicion, % [-] *8 days of antibiotic therapy for VAP, % [-] *Antibiotic discontinuation if VAP not present, % [-]	* 8.0, 95%CI:2.7–13.3; p=0.007 *22.7, 95%CI: −0.3 to 45.6; p = 0.05 *12.0, 95% CI: 1.4–22.5; p = 0.03 *44.5, 95%CI: 21.0–68.0; p = 0.002 *0.11, 95%CI: −0.14 to 0.36; p = 0.34 *−0.61, 95%CI: −1.51 to 0.30; p = 0.17 *−0.30, 95%CI: −25.3 to 24.7; p = 0.98 *−7.6, 95%CI: −16.6 to 1.5; p = 0.09 *−23.5, 95%CI: −57.2 to 10.1; p = 0.11 & *0.5, 95%CI: −4.1 to 5.2; p = 0.80 *7.2, 95%CI: −22.4 to 36.8; p = 0.60 *11.7, 95%CI: −6.0 to 29.5; p = 0.13 *18.5, 95% CI: −83.0 to 120.0; p = 0.60	✓ ✓ ✓ ✓ ✖ ✖ ✖ ✖ ✖ ✖ ✖ ✖
van der Veer et al., 2013	N/A	N/A	N/A

Table 4.6b Patient-Centred Clinical Outcome Measures and Results *(* - Primary Clinical Outcomes, # - Secondary Clinical Outcomes, shaded light grey areas - studies included in the meta-analysis)*

Author/s and Year of Publication	Patient-Centred Clinical Outcome Measures (↑- increased or ↓- reduced favouring the intervention or stayed the same [-])	Outcome Results (Intervention versus Control Unit)	Favoured the Intervention (✓)
Martin et al., 2004	*Hospital Mortality (deaths in hospital) [-] and ↓	*27% v. 37%, *p* = 0.058 - without inappropriately randomised ICUs * 24% v. 37%, *p* = 0.047 - with inappropriately randomised ICUs included	✗ ✓
	*Length of Hospital stay (mean) ↓	* 25d v. 35d, *p* = 0.003 - without inappropriately randomised ICUs * 25.4d v. 34.3d, *p* = 0.006 - with inappropriately randomised ICUs included	✓ ✓
	*Length of ICU stay (mean) [-]	* 10.9d v. 11.8 d, *p* = 0.7 - without inappropriately randomised ICUs * 10.8d v. 11.7 d, *p* = 0.65 - with inappropriately randomised ICUs included	✗ ✗
	*Total amount of energy (kilojoules)delivered per patient-day [-]	* (5292 v. 4179, *p* = 0.31)	✗
	*Time required to achieve 80% of the calculated energy goal on EN [-]	* (4.80 v. 5.10, *p* = 0.78)	✗
	*Time required to achieve 80% of the calculated energy goal on EN or PN [-]	* (3.34 v. 3.60, *p* = 0.80)	✗
	*Number of days on which 80% of the goal was achieved [-]	* (4.9 v. 4.2, *p* = 0.33)	✗
Horbar et al., 2004	*Mortality (death before discharge from hospital) – (% per group – OR) [-]	*1.01 (95% CI: 0.79 to 1.30), P>0.05	✗
	*Pneumothorax (% per group – OR) [-]	* 0.89 (95% CI: 0.67 to 1.18), P>0.05	✗
	#Severe Intraventricular Haemorrhage (grades 3 or 418) ↓	# 0.70, 95% CI: 0.56 - 0.87, p < 0.05 (adjusted odds ratio)	✓
	#Any Intraventricular Haemorrhage (grades 1 to 418) **trend to** ↓	# 0.80, 95% CI: 0.63 - 1.00, p > 0.05 (adjusted odds ratio)	✗
	#Patent Ductus Arteriosus Risk **trend to**↑	#1.27, 95% CI: 0.96 - 1.67, p>0.05 (adjusted odds ratio)	✗
Doig et al., 2008	*Hospital Discharge Mortality [-]	#28.9% vs 27.4%; diff, 1.4%, 95% CI: −6.3% - 12.0%; *p* = 0.75	✗
	#Hospital Length of Stay [-]	*24.2 vs 24.3 days; diff, −0.08, 95% CI: −3.8 - 4.4; *p* = 0.97	✗
	#ICU length of stay [-]	*9.1 vs 9.9 days; difference, −0.86 [95% CI, −2.6 to 1.3]; *p* = 0.42	✗
	#Organ Dysfunction - Renal dysfunction ↓	# 1.54 vs 2.12 renal dysfunction days/10 patient days; diff, −0.58, 95% CI: −1.0 to −0.04]; *p* =0.04)	✓
	#Mean energy delivered per patient per day (kcal/patient-day) [-]	#1241 vs 1065; diff,177; 95%CI: −51- 457; *p* =0.14	✗
	#Mean energy delivered per fed patient per day (kcal/fed patient-day) [-]	#1265vs 1204; diff, 61; 95% CI: −147- 310; *p* = 0.59	✗

Scales et al.,2011	N/A	N/A	N/A
Arnold et al.,2011	* Hospital mortality (%, proportion) [-] * ICU mortality (%, proportion) [-]	*50%, 46%, 52%; p=0.90 *50%, 46%, 41%; p=0.76	✖ ✖
Acolet et al.,2011	N/A	N/A	N/A
Curtis et al.,2011	*Family-QODD total score and single item score (mean) [-] *Family satisfaction with ICU care (mean) (total, with care, with decision-making) [-] *Nurse-QODD total score and single item score [-] *Number of ICU days before death **trend to** ↑ *Time from admission (ICU days) to withdrawal of mechanical ventilation [-]	*-3.25, 95%CI: -9.82 – 3.33; p= 0.33 and 0.43, 95%CI: -0.49 – 1.36; p=0.36 *1.38, 95%CI: -4.75-7.50; p= 0.66 and 1.49, 95%CI: -4.63 – 7.62; p= 0.63 and 2.04, 95%CI: -4.53-8.61; p=0.54 *0.92, 95%CI: -6.53-8.38; p= 0.81and 0.63,95%CI: -0.31-1.57; p= 0.19 *HR=0.86, 95%CI: 0.73-1.01; p=0.07 *HR=0.97, 95%CI:0.76-1.24; p= 0.81	✖ ✖ ✖ ✖ ✖
Sinuff et al., 2013	#VAP rates ↓ #ICU length of stay (median [Q1, Q3] days) [-] #duration of mechanical ventilation [-] #ICU mortality (%, proportion) [-] #hospital length of stay ↓ #hospital mortality (%, proportion) ↓	#p=0.03, adjusted for age and SOFA score p=0.01 #13.7 [7.4, undefined] days vs. 12.6 [7.4, undefined] days (hazard ratio 1.09; 95% CI 0.95–1.26; p = 0.20) #8.9 [4.6, 45.2] days vs. 8.1 [4.5, 28.3] days (hazard ratio 1.08; 95% CI 0.88– 1.33; p = 0.43) #28.5 % vs. 25.4%, (ARR: 3.0%; 95% CI −2.6% to 8.6%; p = 0.26) #62.0 [21.2, undefined] days vs. 43.5 [18.6, undefined] days (hazard ratio 1.29; 95% CI 1.04–1.60; p = 0.02) #38.2% vs. 30.3% (ARR: 7.9%; 95% CI 1.1%–14.7%; p = 0.03)	✓ ✖ ✖ ✖ ✓ ✓
van der Veer et al., 2013	*ICU LOS and 1year after intervention [-] #time to ICU death [-] #risk of dying in hospital 1 year after intervention [-] #risk of having a glucose measurement outside the range of 40–144 mg/dL [-] #mechanical ventilation [-] #readmission rate [-]	*HR =1.02, 95% CI: 0.92–1.12 post hoc analysis 1 year, HR=1.02 95% CI:0.92–1.13 #HR=0.99, 95% CI:0.75–1.30 #OR=0.96, 95% CI: 0.76–1.23. #OR= 0.88, 95% CI:0.67–1.16 #HR=0.94, 95%CI:0.76-1.15 #OR=0.87, 95% CI: 0.67–1.14	✖ ✖ ✖ ✖ ✖ ✖

4.3.6 Factors Associated with Successful Practice Change Implementation

Only one study included in the review (Scales et al., 2011) reported on factors associated with successful practice change implementation. The authors identified seven potential mechanisms and effect modifiers from the perception of the frontline clinicians. These were according to Scales et al., (2011, p. 370): i) "*performance audit and feedback on a regular basis regular audit including de-identified results from other hospitals was a key improvement driver through 'friendly competition';* ii) *participating in a large quality improvement project tended to increase within- ICU communication and elicit support from hospital leadership;* iii) *telecommunication was a useful education medium, although it was often still difficult for ICU staff to leave the beside to attend sessions;* iv) *direct relationships between ICUs in each group resulting from the telecommunication networking were not as valued or evident;* v) *the focus on process of care measures, rather than outcome measures, was appreciated because of the heterogeneity of patients;* vi) *in some cases, internal improvements had created a higher baseline adoption rate ["We were already working on that when the project started"];* and vii) *direct audit and feedback of process measures, evidence-based summaries, and availability of the central coordinating office."*

4.3.7 Implementation Fidelity

Only one included study (Sinuff et al., 2013), specifically investigated and reported on implementation fidelity. Sinuff et al., (2013) evaluated implementation fidelity using a self-administered paper survey to determine clinician exposure to the VAP recommendations and components of the multifaceted strategy. The evaluation consisted of clinician assessment of the educational materials, indication of changes to content or frequency of the exposure to the educational materials desired. Evaluation of implementation fidelity of clinicians from all ICUs involved in the study was conducted with a total of 473, 420, and 380 guideline implementation assessment surveys for the 6-, 15-, and 24-month periods, respectively. The authors did not calculate a formal response rate. They reported that a formal response rate was not possible as not all of the same staff worked in the units during the survey administration periods. Sinuff et al., (2013) reported that the exposure of ICU staff to any element of the multifaceted intervention and VAP recommendations increased from 6 to 15 months and 15 to 24 months during the trial study. Sinuff et al., (2013), reported a significant increase in the exposure to any element of their multifaceted intervention and VAP recommendations (p = 0.001) between 6 and 24 months. Sinuff et al., (2013) reported that more clinicians were exposed to the guideline recommendations, frequently asked questions, and bedside illustrations than small group

teaching, electronic media (VAP web site and self-administered, web-based self-assessment quiz) and the monthly reminder newsletter. At the end of the Sinuff study trial (24 months), more clinicians reported that the daily reminder checklist was implemented in their ICU compared to the beginning of the study trial.

4.4 Discussion

Multifaceted implementation strategies, which are a combination of single implementation strategies, were estimated to be significantly more effective in changing practice in a complex and dynamic health care environment such as intensive care than single implementation strategies. Education and audit and feedback were the two common strategies used in each of the interventions in the studies included in the meta-analysis (Acolet et al., 2011; Horbar et al., 2004). However, each study used a different third strategy in the multifaceted implementation strategy, namely support (Horbar et al., 2004) and quality improvement team and plan (Acolet et al., 2011). Although we cannot provide clarity on which combination of single strategies must be used to successfully change ICU practice, it seems that education and audit and feedback is the common denominator that should be part of the multifaceted strategy.

The studies included in the meta-analysis had overall a "good' methodological quality and low risk of bias however there was considerable heterogeneity between outcomes. This heterogeneity can be explained by the difference in the process of care indicators measured in the two studies. The outcomes measured by each study are all defined as process of care indicators or measures however the unit of measurements were different and therefore not all studies could be included in the meta-analysis measuring the effectiveness of the implementation strategy on process of care outcome. The process of care measures is different due to the difference in protocols implemented and the outcomes linked to these protocols. Process of care indicators/measures provide a measure of the adherence to the protocols and therefore can indicate practice change.

Even though the two studies that were included in the meta-analysis in this review were conducted in neonatal ICU settings (Acolet et al., 2011; Horbar et al., 2004) the outcome that multifaceted implementation strategies are more effective than single implementation strategies in improving the process of care indicators/measures could be extrapolated to the adult ICU as

processes of care regardless of the type of patient should show improvement following implementation compared to patient-centred/clinical outcomes that is more patient dependent.

Implementation strategies used in the intensive care studies included in this review are consistent with other reviews in which education, audit and feedback and reminders were commonly used to implement guidelines and protocols in hospitals or intensive care settings (Borgert, Goossens & Dongelman, 2015; Sinuff et al., 2013; Dijkstra et al., 2006; Grimshaw et al., 2004). This finding is not surprising though as some studies included in this review reported that their implementation strategy was based on the existing evidence and theory (van der Veer et al., 2013; Curtis et al., 2011; Martin et al., 2004). However, it was noted that the majority of the included studies in this review also included multidisciplinary/quality improvement team and plan as part of their implementation strategy. This is relevant and a noteworthy finding specific to intensive care implementation.

In the intensive care setting, multidisciplinary team work and collaboration is important for patient care. Therefore, the use of multidisciplinary/quality improvement team and plan supports the multidisciplinary team involvement in implementing evidence-based care and changing practices in the intensive care setting for improved outcomes. However, Horbar et al., (2004) did not include a multidisciplinary/quality improvement team and plan as part of their multifaceted implementation strategy but reported effective practice change. This highlights that clarity is still needed regarding which single implementation strategies must be combined in a multifaceted strategy to result in effective practice change. Support in the form of local champions, lead clinicians and system supports (order/request forms) was also used as part of the implementation interventions in some of the included studies. Support was highlighted by participants interviewed in Scales et al., (2011) as a factor for effective change in practices in the intensive care setting. Therefore, these organisational implementation strategies such as multidisciplinary/quality improvement team and plan and local champion, lead clinician or system support must be considered when trying to increase adoption and adherence to best practices in the ICU.

Telecommunication as a means for implementing educational strategies in intensive care units in the study by Scales et al., (2011) was unique. Scales et al., (2011) is one of the first studies to implement this strategy in attempting to change practice. Telecommunication is the exchange

of information over large distances using electronic mechanisms. It creates access to clinical health care and medical services that may not always be readily available in distant rural settings. It can also assist in saving lives in critical care and emergency situations. It also assists in implementation fidelity. It allows the clinician to be exposed to the educational strategy without leaving the ICU (Matusitz & Breen, 2007).

In Scales et al., (2011), the telecommunication intervention consisted of a videoconference-based forum that helped organise a collaborative quality improvement network across geographically dispersed sites. Participants in the study reported that increased within ICU communication and support from hospital leadership in the large quality improvement network made possible by telecommunication was a factor that influenced adoption rates and change in practice. They felt that telecommunication was a useful education medium. However, they did not value the "face to face" communication resulting from the telecommunication strategy and felt that although useful it was still difficult to attend the education sessions. Telecommunication should be further explored in future studies as it is mainly a product of the current century where information sharing is fast paced and instantaneous with the development of new electronic technologies. It may assist in reducing the barriers to implementation and practice change such as attendance, lack of support and communication within ICUs. Its use and effectiveness in resource limited settings is not known however and if possible should be explored.

All studies that included process of care measures as their primary outcomes showed significant improvements in at least one or more of the process of care indicators measured following the implementation process/intervention. No studies showed any significant improvement in primary clinical outcomes measured following the implementation process/intervention. Significant changes in process of care measures indicate that change in practice has occurred. However, these changes in practice do not necessarily translate to improved clinical outcomes as was reported in the included studies. Clinical outcomes are affected by other factors such as APACHE II (severity of illness) that includes patient age, chronic health status, level of consciousness and physiological parameters. Five studies had reported that patients admitted to the units during the trials were severely ill with reported high APACHE scores. Therefore, merely increasing certain care processes will not necessarily change clinical outcome and therefore show no effect of the implementation strategy. Process of care measures are therefore

more beneficial in measuring practice change than clinical outcome measures. This is supported by the qualitative report from participants in the Scales trial who preferred the *"focus on process of care measures rather than outcome measures"* due to the heterogeneity of patients (Scales et al., 2011). Depending on whether process of care indicators measured are high at baseline or not will determine whether there will be significant changes in process of care following the implementation process/intervention. This was substantiated by participants in the Scales trial who reported that they were already working on the specific improvement when the trial started and therefore higher baseline adoption rates were created due to the internal improvements, resulting in a reduced change effect (Scales et al., 2011).

The Scales trial included in this review used a qualitative study design as part of the original randomised control design to evaluate the factors associated with successful practice change implementation (Scales et al., 2011). It is common in recent years for studies to include mixed method designs, however clear documentation of the designs followed should be reported by authors and qualitative designs should be methodologically appraised by reviewers. However, Scales et al., (2011) only reported briefly on the method and main outcomes of this part of their study. Four possibilities to make use of qualitative research in the context of Cochrane Intervention reviews exist according to the Cochrane Effective Practice and Organisation of Care Review Group. These are, when informing, enhancing, extending or supplementing reviews. In this review the qualitative information can be considered as enhancing the review which is the use of qualitative research identified whilst looking for evidence of effectiveness (Noyes J., et al., 2011, Chapter 4).

The information obtained from the qualitative data provided by Scales et al., (2011) highlighted some important factors to consider for successful implementation. Process of care measures were more relevant outcomes to measure considering the heterogeneity of patients and would provide better insight of the effectiveness of implementation processes/interventions. Adoption rates increase further if baseline processes of care are already high and when units are already involved in practice change practices. Implementing practice change interventions in ICU are more effective if implemented in larger projects where within ICU communication can be strengthened and support from hospital leadership can be elicited. Also, performance audit and feedback of performance of other units results in "friendly competition" enforcing increased adoption rate and thus practice change (Scales et al., 2011). Scales et al., (2011) were the first

in using telecommunication as an implementation strategy for changing practice. Although participants in this study reported telecommunication to be a useful education medium, staff still found it difficult to leave the bedside to attend sessions and the direct relationships between ICUs resulting from the telecommunication network were not valued nor evident. This may need to be further explored. Quantitative data reporting the specific factors affecting successful implementation is required.

Implementation fidelity as a measure of effectiveness of CPG or protocol uptake and adherence was identified and described in this review. It was reported in only one of the included studies and provided new insight into the evaluation of implementation processes (Sinuff et al., 2013). Breitenstein et al., (2010) points out that implementation fidelity is critical for successfully translating evidence into practice. They also state that a lack of implementation fidelity during the implementation process/intervention can weaken outcomes and thus lead to faulty conclusions about implementation process/intervention effectiveness (Breitenstein et al., 2010). This lack of implementation fidelity can cause potentially useful implementation processes/interventions to appear ineffective. Implementation fidelity failure has been identified as Type III errors (Breitenstein et al., 2010). If clear and feasible strategies for monitoring and measuring implementation fidelity is delineated prior to the start of an intervention study or dissemination efforts, these errors can be avoided (Breitenstein et al., 2010). Sinuff et al., (2013) was the only study in this review that evaluated implementation fidelity using a paper-based survey in an intermittent time series study design. They measured the exposure of clinicians involved in the implementation process/intervention to the implementation strategies used. They reported high levels of fidelity in general to the implementation process/intervention with reduced exposure to implementation strategies/interventions such as slide presentations, electronic media and monthly newsletters (Sinuff et al., 2013). Implementation studies should evaluate implementation fidelity when applied in real life contexts to determine whether the outcomes yielded in highly controlled trials are the same in the real-life context. And if not, what are the barriers in these real-life settings that affect implementation fidelity? This review also highlighted that no studies included outcomes such as healthcare provider behaviour, knowledge, attitude and self-efficacy towards the implementation process/intervention. There were also no reports of provider satisfaction in any of the studies. This still cannot be determined and remains unknown.

This is the first review synthesizing the evidence of evaluations of implementation processes in intensive care settings using RCT, CCT, CBA, ITS study designs. The databases were searched from inception and no foreign language studies were excluded. Although studies retrieved were only published in developed countries this was not seen as a limitation but rather as a gap in the evidence. Databases such as Africa Wide Studies including studies published in developing countries on the African continent was included in the search but yielded no studies. The latter are some of the strengths of this review. There were few limitations of this review.

4.5 Conclusion

This review highlights that implementation studies in developing countries including South Africa are lacking. Implementation processes conducted in resource constraint ICU environments may provide other insights regarding factors affecting effectiveness of these processes. No study included in the review provided objective measures of healthcare provider behaviour, knowledge, attitude and self-efficacy with regards to the evidence-based practice implemented, and the effectiveness of the implementation strategies used. This remains unknown and needs to be explored. No implementation trial studies implementing and evaluating evidence-based ICU physiotherapy CPGs and protocols have been published. This is a gap in the evidence base and should be addressed. Reviews on implementation of CPGs and protocols using other professional and organisational, as well as financial (provider or patient interventions) and regulatory implementation strategies in the ICU setting is needed. No standardised method of choosing a multifaceted strategy for implementation of interventions in the ICUs were used. Tailoring of implementation strategies for implementation of interventions targeted to specific healthcare professionals in the ICU should be explored as a method of selecting appropriate implementation strategies for implementation processes.

CHAPTER 5: PHASE 3

Tailoring Best-Practice Educational Implementation Strategies for Physiotherapy Protocol Implementation in the ICU using the Nominal Group Technique

5.1 Introduction

Tailoring implementation strategies to targeted healthcare professionals and healthcare organisations has been recommended by implementation researchers (Lewis et al., 2018; Powell et al., 2017; Wensing et al., 2014). The selection and tailoring of implementation strategies should address the contextual needs of practice change initiatives (Powell et al., 2017). Tailoring implementation strategies to address identified barriers can assist healthcare professionals, including physiotherapists, to select a tailored set of implementation strategies to be used in an implementation process to assist and improve the uptake of evidence-based clinical practice guidelines (CPGs) and protocols. This tailoring of implementation strategies could potentially assist to effectively implement evidence into practice and change and improve healthcare professional knowledge and practice (Lewis et al., 2018; Cahill, Murch, Cook, Heyland; Canadian Critical Care Trials Group, 2014; Wensing et al., 2014, Sinuff et al., 2013).

Tailored implementation does show effectiveness, but the effect is heterogeneous and small to moderate (Baker et al., 2015; Baker et al., 2010). A tailored implementation strategy potentially has a positive effect on uptake and implementation of evidence-based CPGs and protocols in healthcare and can result in change in professional clinical practice (http://www.cfirguide.org/imp.html, accessed 30.06.2018; Powell et al., 2017; Baker et al., 2015; Wensing et al. 2014). However, the review did not include any studies on the effect of tailored implementation strategies in the implementation of physiotherapy clinical practice guidelines or protocols in intensive care.

Best-practice implementation strategies for the effective uptake of evidence-based protocols in intensive care have been identified in a systematic review (refer to Chapter 4, Phase 2). Findings from the meta-analysis conducted in this review suggest that multifaceted strategies are more effective in the uptake of evidence-based practices through improved process of care measures resulting in practice change in the intensive care setting (Acolet et al., 2011; Horbar et al.,

2004). These multifaceted implementation strategies included professional implementation strategies such as educational strategies, audit and feedback and reminders (Acolet et al., 2011; Horbar et al., 2004). Trials conducted in the intensive care have used mainly a combination of educational strategies such as didactic lectures, workshop, workshop series, academic detailing, grand rounds/bedside teaching sessions and either or both a paper-based and/or electronic copy of the CPGs/protocols (intervention) combined with one or more other professional and organisational strategies. Reminders was another commonly used strategy in the majority of studies included in the review. As the studies included in the review were mainly conducted by physicians, intensivists, dieticians and nurses or respiratory therapists, it is not known whether the implementation strategies used by these professionals will be effective in physiotherapy implementation processes in the intensive care setting due to the complex and variable nature of physiotherapy services and patient management practices (Bernhardsson et al., 2017). In the systematic review in Chapter 4, Phase 2, only one study included recommended assessment of local barriers to implementation processes and tailoring (Sinuff et al., 2013). However, guidance on how to tailor implementation processes is limited (Powell et al., 2017).

According to the Consolidated Framework for Implementation Research (CFIR) team of researchers an evidence base is not yet established for how to tailor implementation strategies (http://www.cfirguide.org/imp.html., accessed 30.06.2018). A dearth of evidence on the reliability, validity and efficiency of different approaches to tailoring implementation strategies for improving healthcare practices exists (Wensing et al., 2014). In the 2010 and 2015 reviews by Baker et al., it was reported that there was considerable heterogeneity of tailoring methods in the included studies. This suggests that the validity of different methods or approaches to tailoring implementation strategies is not well established (Wensing et al., 2014). How implementation strategies for improving practice are suitably, appropriately and best tailored, is therefore particularly unclear (Baker et al., 2015; Baker et al., 2010). Furthermore, it is not clear from the evidence how implementation researchers develop, select and/or tailor the multifaceted implementation strategies used to implement evidence-based CPGs and protocols specifically into daily intensive care practice including intensive care physiotherapy practice (Lewis et al., 2018; Bernhardsson et al., 2017; Powell et al., 2017).

Wensing et al., (2014) highlights the different ways tailoring can be achieved. Tailoring can range from using a simple group interview with held with clinicians directly involved in

implementation to a systematic stepwise approach, which involves a series of studies that includes the relevant populations (Wensing et al., 2014). Concept and intervention mapping, group model building and conjoint analysis have been identified as methods for matching implementation strategies to identified barriers and facilitators for a particular evidence-based CPG, protocol or process change implemented in given settings (Powell et al., 2017). According to several authors (Gagliardi, Alhabib, & the members of the Guidelines International Network Implementation Working Group, 2015) currently there is no reliable method for choosing implementation strategies that are appropriate for implementing CPGs and protocols facing different barriers. According to Baker et al., (2015) focus group discussions, interviews or surveys of the involved healthcare professionals, and/or through an analysis of the organisation or system in which care is provided, as well as observation and brainstorming are methods that can be used to identify barriers to implementation strategies and practice change. The Delphi and Nominal Group Technique (NGT) are two methods that involve the use of either observation, brainstorming, focus group discussions, interviews or surveys and that are used in healthcare to reach consensus. However, the NGT is used more to explore consumer and stakeholder views whereas the Delphi Technique would be more commonly used in developing guidelines with health professionals. The method of choice is dependent on a number of factors such as the research question, the perception of consensus required, and associated logistics such as time and geography (McMillan, King & Tully, 2016).

The nominal group technique (NGT) is considered a structured brainstorming process (McMillan et al., 2016; Hanekom et al., 2014) that attempts to overcome problems associated with group decision-making processes as it allows all participants to equally share and contribute to the discussion. The NGT has the advantage of being time efficient and cost effective. It allows for a notably large amount of information to be obtained in one (single) session with the availability of outcomes immediately following the session and requires minimal preparation by the participants (Hanekom et al., 2014; Harvey & Holmes, 2012). The NGT is collaborative in nature and allows for an increase in the stakeholders' ownership of the ensuing research or implementation process and therefore the likelihood of changing clinical practice and policy is increased (Harvey & Holmes, 2012).

The NGT, designed by Delbecq & Van de Ven in 1971, is comprised of four key stages: "silent generation", "round robin", "clarification" and "voting" (ranking or rating). There is firstly a

"stimulus question", which is a problem identified that requires a solution from the group. This question can be sent to participants in advance or presented in the session (McMillan et al., 2016). The total time required for the session is approximately one and a half hours as silent generation (quiet individual generation of ideas) requires 20 minutes. The round-robin (each individual in the group sharing ideas) requires about 30 minutes, clarification (the individual or others in the group providing clarity on the ideas generated) about 30 minutes and ranking and voting (ranking each idea according to importance or priority and each individual voting on an anonymous ballot) requiring about 10 minutes. These four stages are described in detail by McMillan et al., (2016) and the reader is referred to their paper or Addendum 18 for further insight into these stages. Although anonymity is not possible during the discussions in the clarification stage, the individual ranking and voting sheets remain confidential (McMillan et al., 2016). The number of sessions required depends on the topic or problem being addressed.

The NGT involves highly structured face-to-face discussions in small groups. This technique allows all participants to be empowered through having their voices heard and opinions considered by other members in the group. The NGT may be a useful method for identifying barriers of and facilitators for implementation strategies and tailoring implementation strategies. The NGT is highly adaptable and stages can be adapted individually. The time and cost-effectiveness of the NGT can provide a prompt result for researchers (McMillan et al., 2016). These characteristics of the NGT, are advantages, that may support the use of this technique for tailoring implementation strategies in "real-world" implementation initiatives.

A tailored multifaceted educational implementation strategy for the effective uptake of a validated evidence-based physiotherapy protocol for the physiotherapeutic management of surgical ICU patients in a resource limited intensive care setting by a targeted group of physiotherapists providing services to this ICU was needed. The identification of barriers and facilitators for the best-practice, educational implementation strategies using the NGT, could guide the selection and tailoring of a multifaceted best-practice educational implementation strategy to the individual and departmental implementation requirements of these physiotherapists. Therefore, the aim of this study was to describe the NGT to tailor best-practice educational implementation strategies needed for implementation of a validated evidence-based physiotherapy protocol for the management of surgical ICU patients. The process of tailoring the implementation strategies forms part of the planning and engaging phase of the planned

implementation initiative (trial) guided by the CFIR. This tailoring process has been recommended to best occur before or pre-implementation of CPGs and protocols (Damschroder et al., 2009).

5.2 Method

5.2.1 Research Design

The Nominal Group Technique (NGT), a structured method that is both a qualitative and quantitative research design using focus groups, was used.

5.2.2 Research Setting

The Physiotherapy Department situated in a central academic hospital in the Western Cape formed the setting for this study.

5.2.3 Population and Sample

The study targeted physiotherapists working in a public sector central academic hospital in the Western Cape, South Africa (SA). These physiotherapists render services both during the week and on weekends to the surgical ICU. Twenty-one physiotherapists formed the population of the study and all were invited to participate in the nominal group technique. This group of physiotherapists would be involved in the implementation process for the implementation of a validated evidence-based physiotherapy protocol in the surgical ICU. A convenient sampling method was used whereby all the physiotherapists were invited and the sample size was based on the number of physiotherapists who attended the nominal group.

5.2.4 Procedure

5.2.4.1 Ethics

Ethical approval for the study was obtained from the Health Research Ethics Committee of Stellenbosch University [S13/09/170] (Addendum 1). All relevant ethics principles for this study was adhered to.

5.2.4.2 Data Collection

A formal email was sent to the Head of the Physiotherapy Department providing information regarding the NGT workshop and inviting all physiotherapists in the department to attend the session. A date, time for the NGT workshop and venue convenient to the physiotherapy

department staff was agreed upon by all staff at a staff meeting and communicated to the Primary Investigator [FK] via email. All participants provided written informed consent to participate, consent for the session to be recorded and signed agreeing to maintain confidentiality of the information shared in the focus group discussions before commencing with the session [Addendum 19]. The participants signed an attendance register [Addendum 20] for continuous professional development (CPD) points and completed a participant profile questionnaire [Addendum 21]. Participation was voluntary and participants could withdraw at any time during the study without consequence.

A focus group discussion using the nominal group technique was conducted by the Primary Investigator [FK], who facilitated the session. The session was conducted on 23 July 2015 between 12h00 and 14h00. The session was audio-taped in order for the Primary Investigator [FK] to have a record of the session for later reference as required for research purposes only. The recorded data was password protected.

5.2.4.3 The NGT Process for Tailoring the Implementation Strategy

The Primary Investigator [FK] (facilitator) explained the purpose of the NGT as part of the process of implementation. The NGT was to identify barriers to best-practice educational strategies to be used to assist the uptake of the physiotherapy protocol and to reach a decision on a tailored set of educational strategies to be used for the implementation process with this group of physiotherapists. The Primary Investigator [FK] chose to describe each round in the process at its specific time to prevent participants forgetting or becoming confused. The participants were introduced to the six best-practice educational implementation strategies identified in the systematic review conducted by the Primary Investigator[FK] (Chapter 4). They were given a description of each of the strategies [Addendum 22] and any discussion and clarification of the definitions of the strategies occurred. Following this, they were provided with the overall stimulus question namely: *"What is the most appropriate set of educational implementation strategies that is best-suited to you and your department for the successful implementation of the validated evidence-based physiotherapy protocol for the management of surgical ICU patients?"*

Participants were informed at the beginning that the strategies they chose would form part of the process of implementation of the physiotherapy protocol. They were informed that the three

strategies that received the most (majority) votes following the group discussion would be selected for the implementation process together with reminders such as pocket cards and posters of the protocol. The rationale for choosing three educational implementation strategies was based on the review (Chapter 4) where on average three best-practice educational implementation strategies were used in the included studies. The introduction section of the NGT took 20 minutes.

i) Silent Generation

In this stage, following the stimulus question, the participants were asked to individually without discussion or consultation with others write down barriers (pink paper post-its) and facilitators (green paper post-its) for each of the six strategies. They were given 20 minutes to complete the task.

ii) Round Robin

Each of the post-its' from each individual for each implementation strategy was placed on the newsprint under the appropriate implementation strategy under either the barriers or facilitators for the specific implementation strategy. This was done in order to save time by not rewriting everyone's comments. In this way the exact information from each individual was presented. Therefore, the round robin process where each person reads out their own ideas was eliminated maintaining anonymity and possibly eliminating the effect of "power play". This task took 10 minutes.

iii) Clarification

Once all post-it pages were placed the Primary Investigator [FK] read out the perceived barriers and facilitators for each implementation strategy. Participants assisted in the grouping of similar barriers and facilitators through the clarification process. They were also invited to seek verbal explanation, further details and clarification about any of the ideas regarding the barriers and facilitators for strategies if these were unclear to them. The person whose idea it was or any other person was allowed to explain or clarify. This further maintained anonymity. They also had the opportunity to describe possible ways to overcome barriers. The group in general was not very participatory in this phase even after the Primary Investigator [FK] attempted to increase engagement with them through questions directed at the barriers and facilitators identified. This session took 45 minutes.

iv) Voting (ranking or rating)

Following clarification of the barriers and facilitators for each strategy, participants were instructed by the Primary Investigator [FK] to silently and individually decide on (vote for) three of the best-practice educational implementation strategies that were best suited (tailored) to them individually and their department as a whole for effective protocol implementation. The participants were each provided with three stickers which would be used to indicate their choice of the three implementation strategies they thought would assist effective uptake of the protocol by the group. Each participant was asked to individually place their three stickers on the sheets under each of the three strategies they chose once they had made their choice. At this point anonymity was not preserved as others could observe placement of stickers but may not necessarily have influenced choices as discussion was not allowed and did not occur during this process.

The stickers were then counted for each strategy by the Primary Investigator [FK] in the presence of the participants. The three strategies with the highest scores were highlighted to the group. Immediate results in response to the question was thus available to participants. At this point the group was given an opportunity to change their choice/s (vote/s) as two of the educational implementation strategies namely academic detailing and workshop (one only) had the same number of votes and were very close to the number of votes for grand rounds. All participants indicated by hand that they did not want to change their votes. This process therefore lacked anonymity. The three strategies were prioritized in order of the votes with a paper or electronic version being provided to the group, followed by the workshop series and then the grand rounds/bedside teaching sessions. The voting and finalisation of the three best-practice educational implementation strategies decided upon took 25 minutes after which the NGT session was concluded.

5.2.4.4 Data Analysis

The participant demographic data was descriptively analysed using frequencies and percentages and means and standard deviations. The data from the voting was descriptively analysed immediately after the session. Results were presented as frequencies and could be calculated immediately in the session. The three best-practice educational implementation strategies that received more than half (majority) of the votes was selected to form part of the multifaceted implementation strategy. The direct quotes relating to the barriers and facilitators that were

provided by the participants for each strategy was typed into a Microsoft word document into individual tables under the headings barriers and facilitators separately for each educational implementation strategy [Addendum 23]. Deductive content analysis was used first and common quotes for barriers and facilitators for each strategy were grouped together. These categories were categorised into common themes using an inductive form of analysis, describing barriers to and facilitators for the use of each educational implementation strategy documented in the results. The Primary Investigator [FK] also kept a short journal entry of the NGT session for use later for research purposes only.

5.2.5 Study Incentive

The participants in the study group received a lunch pack and a Continuous Professional Development (CPD) certificate, accreditation number PPB004-MD121-0025-7-2015, with 2 points in Level 1 for attending the session [Addendum 24].

5.3 Results

Seventeen out of 21 physiotherapists participated in the session. Four physiotherapists were not available to attend as they were not at work on the day due to illness or staff leave.

5.3.1 Demographic Details of the Targeted Group

The demographic details of the participants are tabulated below [Table 5.1]. The physiotherapists were young, early-career physiotherapists. There was only one (6%, n=1/17) male in the targeted group. Only two physiotherapists had post-graduate degrees of which one was specifically in the area of intensive care. There were 10 (59%) Production Level I ("junior" level) physiotherapists. The majority (70%, n=12/17) reported >5-10years and more than ten years of ICU experience. There was a 59% (n=10/17) reported interest in ICU physiotherapy practice.

Table 5.1 Sample Demographic Details

Demographic details	**Mean (SD) and Range/Number (%)**
Age (mean years)	32 +/- 7.4years (range 23-53)
Gender – Number (%)	
Female	16/17(94%)
Male	1/17 (6%)
Years of **general** clinical **experience** (mean years)	9 +/-6.9 years (range 1-30)
Years of **ICU** clinical **experience**	
Less than 1 year	2/17 (12%)
1 year	2/17 (12%)
2-5 years	1/17 (6%)
>5-10 years	8/17 (47%)
More than 10 years	4/17 (23%)
Job Rank - Number (%)	
Community Service	1/17 (6%)
Production Level Grade I	10/17 (59%)
Production Level Grade II	1/17(6%)
Chief Grade II	4/17 (23%)
Assistant Director	1/17 (6%)
Qualification – Number (%)	
BSc Physiotherapy	15/17 (88%)
MSc Physiotherapy	2/17 (12%)
Reported **interest in ICU** practice	
Yes	10/17 (59%)
No	7/17 (41%)

ICU, intensive care unit; SD, standard deviation.

5.3.2 Selected and Tailored Educational Implementation Strategies

The three best-practice educational implementation strategies namely i) hard copy or electronic copy of an educational handbook of the protocol for each staff member, the department staff office and the surgical ICU (82%, n=14/17), ii) workshop series to introduce and educate them on the protocol (65%, n=11/17) and iii) grand rounds/bedside teaching sessions to continue the process of learning through bedside teaching (59%, n=10/17) received the highest votes in this order and would be used as part of the process of implementation of the protocol targeted to this group of physiotherapists [Table 5.2].

Table 5.2 Distribution of Votes per Educational Implementation Strategy

Best-Practice Educational Implementation Strategies	Votes [n /N, (%)]
Academic Detailing	8/17 (47%)
Didactic Lectures	0/17 (0%)
Grand Rounds/Bedside Teaching Sessions	**10/17 (59%)**
Paper and/or Electronic Copy of Educational Handbook [Protocol Information]	**14/17 (82%)**
Workshop [one]	8/17 (47%)
Workshop Series [four over time]	**11/17 (65%)**

5.3.3 Barriers to and Facilitators for the Best-Practice Educational Implementation Strategies

The barriers to and facilitators for the six best-practice educational implementation strategies are presented as three major themes. These were i) personal-related barriers and facilitators with regards to learning styles, ii) organisational-related barriers and facilitators and iii) characteristics of the strategy. The groups of quotes relating to each theme under the categories of barriers and facilitators for each best-practice educational implementation strategy are presented in tables 5.3, 5.4 and 5.5 below.

5.3.3.1 Personal-related Barriers and Facilitators with regards to Learning Styles

The quotes from participants under this theme related to how participants perceived the best-practice educational implementation strategies to either assist or prevent their personal uptake of the protocol information. Table 5.3 includes both positive and negative quotes related to learning styles of individuals or the group in relation to the different educational implementation strategies. The overall feeling or perception of the participants was that academic detailing, workshop (one), workshop series (more than one) and grand rounds/beside teaching sessions would better facilitate uptake of the protocol. There were no reported barriers to learning for the uptake of the protocol for the workshop series strategy. They also described academic detailing and grand rounds/beside teaching sessions as having either no or a few barriers related to learning styles. Therefore, the high proportion of participants who voted for the workshop series and grand round/beside teaching session educational implementation strategies could be explained by the perceptions of the effect of the educational implementation strategies on learning styles and uptake of the protocol described.

Table 5.3 Personal-related Barriers and Facilitators with regards to Learning Styles per Strategy *(n = number of supporting quotes per theme)*

Personal-related Barriers and Facilitators to Learning Styles		
	Barriers	**Facilitators**
Didactic Lecture	**1. Learning Styles (10)** *"Can be difficult to hold people's attention"* *"Once off – nothing to fall back on if you forget* *"Too much information to take in on 1 session; not sufficient time to be well familiar with information; reference"* *"Concepts may not be understood with a single lecture. Information overload"* *"Can lose interest of listeners at times as its passive"* *"Easy to forget info due to single contact"* *"Group setup: concept might get lost or not all topics covered"* *"Will not include practical; What if textbook instructions not understood"*	**2. Learning Styles (11)** *"Educational"* *"Ability to interact with facilitator"* *"Formal, in depth"* *"Follows clear format"* *"Good session to hear questions from other participants and answer from researcher"* *"Ensures that all members receive the same information"*
Academic Detailing	**1. Learning Styles (7)** *"no feedback from other also involve in the study which could have valid points that also affect you"* *"Important info might be left out/ not all concepts covered"* *"Intimidating"* *"Time in contact session is limited, …not enough time for understanding & questions"* **2. No Barriers (3)** *"None"*	**1. Learning Styles (9)** *"Less intimidating to ask questions in one on one session; especially if unable to understand a concept"* *"No distractions comfortable learning environment"* *"More free to ask questions as it is more informal"* *"Individual attention given thus more understanding of protocol; free to ask questions"* *"Can iron out finer details in non- intimidating 1-on-1 session"* *"Informative; concepts maybe better understood in one-on-one interactions"* *"Very in depth, able to answer individual answers; 20 min=short time"* *"In depth knowledge/ training; Good feedback opportunities; Discussions"* *"Easier to understand/ get trainee to understand; better to keep trainee's attention"*
Workshop (one only)	**1. Learning Styles (5)** *"Social interaction ≥ Academic learning experience"*	**1. Learning Styles (11)** *"Easier to concentrate with interaction; Allows for stimulation of ideas due to different opinions"*

	"Round robbing anonymous ideas; thoughts/ ideas of some could be missed if people aren't comfortable sharing in group setting" *"Can be lengthy; Too many irrelevant topics brought up hindering workshop progress"* *round robin anonymous"* *"May need more than one to resolve all issues"*	*"Interaction encouraged which makes it easier to understand or gain as much info as needed"* *"assists & problem solving"* *"We all think/interpret differently – good to share different ideas or learn from one another"* *"Learning from one another; people may feel more comfortable learning in groups"* *"Learning through others in group; Interaction → sharing ideas / concepts → feedback → learning"* *"Interaction, lots of different inputs to stimulate thought process* *"Group activity encouraged; Different opinions given"* *"We all think/interpret differently – good to share different ideas or learn from one another"* *"Learning from one another; people may feel more comfortable learning in groups."* *"Allows interaction between educator + people being educated"*
Workshop Series	**1. No Barriers (3)** *"None"*	**1. Learning Styles (6)** *"More time to engage + resolve all questions"* *"Helpful if needed/ appropriate –will address new info/ concerns"* *"Able to break up info/ workload over sessions to prevent feelings of information overload"* *"Repetitions will make learning process easier; people may understand after few workshops"* *"In detail very educational; good for learning; Group discussions stimulate thought process"* *"Will assist in better understanding of concepts"*
Grand Rounds	**1. Learning Styles (7)** *"Distracting environment at times"* *"Academic detailing might address this need better than a grand round"*	**1. Learning Styles (11)** *"Allows learning & implementation opportunity at bedside"* *"Great learning opportunity; deal with patient specific situations; Get help from facilitator in clinical setting"*

	"stressful if you put on the spot" *"Can feel stressed/under pressure to perform"* *"Intimidating in participation"* *"Stressful"* **2. No Barriers (1)** *"None"*	*"Theory & implementation in one; learn + apply; Development/ improving clinical skills; small groups"* *"Good environment for applying theory into clinical environment; makes it relevant to clinical practice"* *"Educational; Good learning opportunity"* *"Will be more patient specific; More interesting"* *"Theory & practical experience; easier to understand"* *"Physically see how algorithm are applied; 'Monkey see monkey do'"* *"Educational"* *"Educational & informative; various teaching methods learned"* "Different opinions & inputs given; Practical application of Algorithm" **2. No Facilitators (2)** *"None"*
Paper-based and Electronic Handbook	**1. Learning Styles (5)** *"Gives the participants the responsibility of reviewing the data; trustworthy (readers' interpretation)"* *"Might be difficult to understand"* *"Not motivated to read in my own time"* **2. Information Overload (2)** *"If too much information, unlikely to be properly read"* *"Might have high volume of reading which will limit or deter people of reading the study"*	**1. Learning Styles (8)** *"Can read it as you have time available"* *"Time to apply individually"* *"Allows you to go through information in your own time"*

5.3.3.2 Organisational-related Barriers and Facilitators

There were more organisational barriers reported than organisational facilitators. The overall perception was that all the best-practice educational implementation strategies were resource intensive [Table 5.4]. The participants reported that resources such as time, staff or facilitators or educators for implementation for all the strategies, access to information [internet/email] for the electronic copy of the protocol and space and appropriate patients for grand round/ bedside teaching sessions were all resources that were limited in their environment and organisation. Organisational facilitators were mainly related to educational implementation strategies such as the didactic lectures, academic detailing and the paper-based or electronic handbook. These strategies were described as being resource efficient in terms of time. A once off didactic lecture or short 20-minute sessions with individuals (academic detailing) and a handbook for individual reference to be used at times convenient to individuals were therefore seen as facilitators to implementation [Table 5.4]. Therefore, the choice of paper and/or electronic copy of the educational handbook by the majority of the group could be explained by the perception that this strategy would be less resource intensive for participants in their health care setting.

Table 5.4 Organisational-related Barriers and Facilitators per Strategy *(n = number of supporting quotes per theme)*

Organisational-related Barriers and Facilitators		
	Barriers	**Facilitators**
Didactic Lecture	**1. Resources: Time (1)** *"Too time consuming"*	**1. Resource: Time (6)** *"Can organize schedule according to day; less time consuming"; "Once off"*
Academic Detailing	**1. Resources: Time Consuming & Facilitators/Educators (14)** *"Clashes = day –to- day job"* *"Time consuming & many contact sessions"* *"Way too time consuming for whole dept. to go through; unless option for just the 1 therapist"* *"Time consuming if used with a large group"* *"Time consuming for facilitator;"* *"Availability of staff/ educators"* **2. No Barriers (3)** *"None"*	**1. Resource: Time (1)** *"20 min able to fit in during clinical work"*
Workshop (one only)	**1. Resource: Time (7)** *"May not suit everybody @ the same time; Difficult scheduling as people have different routines; Same workshop on more than 1 day"* *"Workshops can get long & stretched out → time consuming"* *"Time consuming – "Can take lots of time (time consuming)"* *"Time consuming of which might directly affect PT time"* *"Possibility of being time- consuming as input is given by all participants"* *"Can be lengthy; Too many irrelevant topics brought up hindering workshop progress"*	**1. Resource: Time (1)** *"…fortunately a once off"*
Workshop Series	**1. Resource: Time (14)** *"Multiple sessions are time consuming could lead to needless repetitions"* *"Time consuming to have regular sessions"* *"Takes longer, but might be best for this outcome"* **2. No Barriers (3)**	**1. Incentive (1)** *"CPD points; knowledge/ feedback; organize day to attend session"*

	"None"	
Grand Rounds/Bedside Teaching Sessions	**1. Resources: – Time, Space and Patients for session (10)** **"***Might not find relevant patients"* *"Availability of patients"* *"Space at bedside which limits amount of people to join"* *"Time consuming; Compete for space in ICU-other rounds"* *"Limit amount of people able to attend round"* *"Too time consuming to cover whole dept. staff for initial training"* *"Have to complete my own workload; No time to attend extra rounds"* **2. Environment (3)** *"Distracting environment at times"* *"Impractical; Infection prevention + control (IPC) issues"* **3. No Barriers (1)** *"None"*	**1. No Facilitators (2)** *"None"*
Paper-based and Electronic Handbook	**1. Access to evidence (5)** *"Electronic copy limits access to pc/printing etc.;"* *"…no access to internet."* *"Except your copy in area of research (in ICU) for immediate access"*	**1. Resource: Time (1)** **"***Less time consuming"* *"Learning at your own time"*

5.3.3.3 Characteristics of the Strategy

A workshop (one only), academic detailing and grand rounds/bedside teaching sessions were described as resource intensive strategies requiring more time from the staff to attend, space for bedside teaching, a number of patients and facilitators/educators for implementation [Table 5.5]. A workshop (one only), didactic lecture, and paper-based and electronic handbook were described as strategies that will not elicit interaction and provide a means for clarification of information for learning and implementation. The handbook, workshop (one only), didactic lecture and academic detailing were described as having resource saving characteristics in that not a lot of time was needed for individuals to attend sessions with less effect on work time. All strategies except the handbook facilitated interaction and clarification of information for learning and implementation [Table 5.5]. Overall however, participants perceived fewer barriers for workshop series and grand rounds/bedside teaching sessions. They perceived there to be more opportunity for feedback and discussion using a series of workshops and practical application through the use of grand rounds/bedside teaching sessions [Table 5.5]. This explains and supports the higher proportion of individuals who voted for the workshop series and grand rounds/bedside teaching sessions educational implementation strategies. The handbook was described as an additional strategy to be added to the implementation process and also as a reference or guide for use before, during and after implementation which also supports the high number of participants who voted for this strategy.

Table 5.4 Characteristics of the Strategy *(n = number of supporting quotes per theme)*

Characteristics of the Strategy		
	Barriers	**Facilitators**
Didactic Lecture	**1. Interaction for Learning (3)** *"No interaction + discussion of problems"* *Does not provide opportunity to address issues/ concerns that may arise* *"Difficulty with communication/ reading facilitator at later time period"* *"Once off lecture, does not address flu questions once had time to process"* **2. Clarification of the Information Process (8)** *"Once off lecture, does not address flu questions once had time to process"* *"No interaction and discussion of problems"* *"Does not provide opportunity to address issues/concerns that may arise"* *"Information over load with single lecture; Not understanding all concepts"* *"Difficulty with communication/ reading facilitator at later time period"*	**1. Resource saving: Time (6)** *"Less time consuming vs. a series of workshops"* *"Once of lecture"* *"Lots of information can be carried over"* **2. Clarification of Information (4)** *"Guidelines clearer when textbook style"* *"Good session to hear questions from other participants and answer from researcher* **3. Interaction (4)** *"Ability to interact with facilitator"* *"Ensures that all members receive the same information"* *"Sharing the current appropriate information for study/ protocol"*
Academic Detailing	*1.* **Resource Intensive: Time (12)** *"Time consuming; Will 20 min time be enough to explain & answer questions"* *"Not enough time to cover certain topics in detail?"* *"Time consuming if used with a large group"* *"Time consuming for facilitator;"* **2. No Barriers (3)** *"None"*	**1. Resource saving: Time (2)** *"Specific issues discussed (not generic) → time saving"* *"Time saving – will a standing on the topic, what's important; convenient"* **2. Clarification of Information (6)** *"good session to ask questions to researcher particular concerns you and get appropriate feedback your scenario"* *"Problems can be solved quickly as sessions are one-on-one"* *"Gives opportunity to clarify areas of uncertainty"* *"Can iron out finer details in non- intimidating 1-on-1 session"* *"Easier to understand/ get trainee to understand"* *"In depth knowledge/ training; Good feedback opportunities; Discussions"* **3. Interaction (7)** *"Good info + time to interact"*

		"good session to ask questions to researcher particular concerns you and get appropriate feedback your scenario" *"Comfortable to ask questions and give feedback with the one on one session"* *"Provides opportunities to address individual concerns"* *"Allows better understanding & openness for questions"* *"Ability to discuss one-on-one problems/ concerns"* *"In depth knowledge/ training; Good feedback opportunities; Discussions"*
Workshop (one only)	**1. Resource Intensive: Time (5)** *"Workshops can get long & stretched out → time consuming"* *"Time consuming – fortunately a once off"* *"Can take lots of time (time consuming)"* *"Time consuming of which might directly affect PT time"* *"Possibility of being time- consuming as input is given by all participants"* **2. Clarification of Information (1)** *"Once off basis won't address concerns that arise during implementation"* **3. Interaction (3)** *"Some people take advantage of the situation and don't partake in discussions; riding others coattails; round robin anonymous"* *"Getting everyone together might be problematic"* *"Some people take advantage of the situation and don't partake in discussions; riding others coattails;"*	**1. Resource saving: Time (4)** *20 min so there is time to get into it* *once-off (time wise)* *Time saving for both parties;* **2. Clarification of Information (3)** *"Good session for gaining information/ feedback from researcher and other participants"* *"More info/ perceptions/ ideas could be shared which could improve the study"* *"Issues discussed by whole group"* **3. Interaction (7)** *"Interaction encouraged which makes it easier to understand or gain as much info as needed"* *"Can engage/ brainstorm as a group;* *"Good interaction + discussion of problems/ queries; allows for discussion and group interaction,"* *"Good interaction opportunity"* *"We all think/interpret differently – good to share different ideas or learn from one another"* *"Learning from one another; people may feel more comfortable learning in groups".* *"Learning through others in group; Interaction, sharing ideas / concepts, feedback, learning"*

Workshop Series	**1. No Barriers (3)** *"None"*	**1. Clarification of Information (7)** *"Gives participants time to implement protocols & gives feedback; better understanding"* *"Continuous feedback"* *"Convenient; follow ups; can resolve unsolved issues"* *"Educational opportunities"* *"Provides opportunity for continued discussions which allows ideas + info to be processed/ understood at a deeper level"* *"chances to address problems/ concerns that may arise"* *"Good knowledge/ feedback; time to discuss barriers and time to discuss overcoming barriers"* **2. Interaction (7)** *"Opportunity to continue discussion re ongoing problems/ issues"* *"Continuous discussions in case issues arises allows improvement in the implementation & participation of trainee's"* *"Provides opportunity for continued discussions which allows ideas + info to be processed/ understood at a deeper level"* *"More time to engage"* *"Allows for group discussion provides opportunity for regular feedback and chances to address problems/ concerns that may arise"* *"Allows for follow up for: questions; process & progress of study/ implementation of study"* *"Allows for updates in actual study or literature; Allows you to build on your knowledge base & to interact with other professionals"*
Grand Rounds/Bedside Teaching Sessions	**1. Resource Intensive: Time, space, patients (5)** *"Availability of patients"* *"Space at bedside which limits amount of people to join"* *"Time consuming; Compete for space in ICU-other rounds"*	**1. Interaction (2)** *"Good discussion; maybe an option for follow-up; unit PT/ discussion in ICU"* *"Different opinions & inputs given"* *"small groups"*

	"Too time consuming to cover whole dept. staff for initial training" *"Limit amount of people able to attend round"* **2. No Barriers (1)** *"None"*	**2. Clarification of Information (3)** *"Get help from facilitator in clinical setting"* *"Theory & practical experience; easier to understand"* *"Physically see how algorithm are applied; 'Monkey see monkey do'"* **3. No Facilitators (2)** *"None"*
Paper-based and Electronic Handbook	**1. Clarification of Information Process (7)** *"No explanation of study process or definitions of jargon if uncertain or confused"* *"Not ideal way to introduce new 'regime'"* *"Concepts difficult to understand thus people not using hardcopies"* **2. Interaction for Learning (6)** *"No interaction cannot ask questions"* *"Problematic may need clarification/ explanation; No platform to discuss/ advice/ question"* *"Who to ask if you have question/ wants more info"* *"No-one to explain difficult concepts"*	**1. Additional Strategy (1)** *"Maybe to hand out before workshop to have to engage with it at own time"* **2. Resource saving: Time (1)** **"***Less time consuming"* *"Learning at your own time"* **3. Reference or guide to refer back to when needed (9)** *"Good reference guide if user friendly"* *"Good way to re-inforce info given during different methods of education; can always refer back to it"* *"Fall back on if needed"*

In summary, the choice of implementation strategies for the uptake of the physiotherapy protocol in the ICU for this targeted group depended on the strategies being able to provide theory and practical knowledge of the protocol through active interaction, discussion and feedback, clarification, practical application and being resource efficient in terms of time needed to attend and participate in the implementation process.

5.4 Discussion

The nominal group technique proved to be a useful method for tailoring implementation strategies for a group of physiotherapists involved in a practice change initiative in intensive care. The technique was time and cost efficient in terms of supplies and refreshments for participants. The session facilitated group decision-making and provided instantaneous results with regards to identifying a set of educational implementation strategies appropriate and tailored for this targeted population. The technique also provided a means for identifying barriers and facilitators for the educational implementation strategies specific to a group of physiotherapists providing services to a surgical ICU and targeted for an ICU practice change initiative in a resource limited health care setting. The barriers and facilitators identified explained and supported the quantitative outcome of the NGT. The educational implementation strategies selected for facilitating the uptake of the physiotherapy protocol was supported by the barriers and facilitators identified by the group which allowed for the selection of a multifaceted best-practice educational implementation strategy tailored to their need for interaction, discussion and feedback, clarification, practical application and a reference manual.

The tailored best-practice multifaceted educational implementation strategy including a paper-based and electronic handbook, workshop series and grand rounds was supported when examining the barriers and facilitators highlighted by the target group. The workshop series and grand rounds were described as resource intensive. However, the characteristics of these strategies such as group interaction for information sharing, clarification of concepts and no or minimal barriers to personal learning styles seemed to have an overriding effect on the groups' choice of these strategies for the implementation process. Evidence for the effectiveness of active educational implementation strategies versus passive educational implementation strategies exist. It has been documented that a passive educational implementation strategy such as distribution of educational material via email or hard copies are only moderately effective in

translating evidence into practice and changing clinician behaviour (Riis et al., 2016; Acolet et al., 2011, Grimshaw et al., 2006). In this group of physiotherapists there was a preference for the paper and electronic educational handbook on the protocol which is a passive strategy. This passive strategy was perceived by the group to be less time consuming, a good reference or guide and a strategy allowing learning in their own time. However, the barriers reported, such as not being motivated to read on their own or struggling with clarification of concepts without facilitation, may infer a potential lack of use of this passive strategy which could influence protocol uptake. These barriers may affect the implementation of the protocol and limit practice change as it has been reported that passive educational strategies allow only superficial processing of information and attitude changes that may be short lived (Fischer, Lange, Klose, Greiner & Kraemer, 2016). But yet these passive strategies should not be disregarded as it offers an inexpensive and more feasible approach that may still be effective in implementing evidence-based practices (Fischer et al., 2016) especially in a resource limited setting (Pantoja et al., 2017).

The nominal group technique was found to be highly reproducible in its methodological design as each step can be retraced to obtain similar outcomes. The technique is easily adaptable and modifiable to the needs of this tailoring process. These benefits have been reported in the literature (McMillan et al., 2016; Hanekom et al., 2014). The use of the nominal group technique in this study is "novel". This is the first study known to the Primary Investigator [FK] using the NGT with a group of physiotherapists to identify their unit-specific needs regarding a multifaceted educational implementation strategy for the uptake and implementation of a validated evidence-based physiotherapy protocol for the management of surgical ICU patients in a surgical intensive care setting in SA. This innovative method of tailoring implementation strategies for a group of physiotherapists providing ICU services in a resource limited setting has not yet been explored in implementation studies in health care. This study therefore describes relevant insights and provides recommendations for the use of this methodological design in tailoring implementation strategies for implementation research globally, contributing to the current evidence base on tailored implementation that is still being developed (http://www.cfirguide.org/imp.html., accessed 30.06.2018; Powell et al., 2017).

More than 70 percent of the participants agreed on using the paper-based and electronic handbook on the protocol as a strategy for the process of implementation. The votes for this passive strategy reached the level of consensus or agreement [≥ 70%] (Hanekom et al., 2014). Consensus decision-making processes results in agreement between all members of a group. In consensus decision-making, the group needs to find solutions that everyone actively supports, or at least can live with. A simple vote for an item and having the majority of the group getting their way means that not everyone actively supports the decisions made. This was identified as a potential limitation of the decision-making process in this group whereby a majority vote and not a shared decision (consensus) was used to decide on the tailored best-practice multifaceted educational implementation strategy and could affect "buy in" into the implementation process.

In this study, the round robin and clarification phase were adapted and allowed for anonymity during the entire session. Ideas were collected from each person and put up on the board without direct identification of whose ideas were whose. Anyone in the group or possibly the particular individual whose idea it was, was encouraged to clarify ideas unclear to the group and thus anonymity was maintained. Traditionally, in the nominal group technique, individual participants read out and clarify their own ideas until all participants have shared their ideas (Harvey & Holmes, 2012). It is therefore reported that this method gives a voice to all participants. However, in this study, since the individuals did not read out their own ideas and clarify ideas individually, the latter may have been minimized or lost, although anonymity was maintained. This adaptation however was due to limited time allocated for the session by the group according to their availability and did not seem to affect the decision-making process.

It was possible to tailor strategies for the group in a two-hour session. However, it is suggested that more time be given to unpack the ideas around barriers and facilitators for the strategies. It is suggested that a group be allowed to reflect on the barriers and facilitators individually in their own time and regroup for another session for further discussion before a final decision or vote is made. This could potentially provide the facilitator and target group with a more in-depth analysis of the use and effect of each strategy in the implementation process that would follow. Due to limitations in time and the availability of all members of the group to participate again due to workload issues raised, this allowance for reflection was not possible. Reflection and regrouping could also affect the outcome and prolong the process of implementation due

to internal discussion, interaction and power-play that could affect voting. Thus, the two-hour session was an advantage for the tailoring process in this context. A suggestion would be to complete the tailoring of the strategies in one group meeting and allow extra time (more than two hours) for more in depth discussion of the barriers and facilitators before final voting.

The Primary Investigator [FK], facilitating the group was known to some of the group participants and this collegial relationship could have affected the responses within the group. However, as the nominal group technique is dependent on decisions made by the group only, the facilitator is eliminated in the decisions made and is not necessarily able to affect outcomes. This is a perceived strength of the technique used. Grimshaw et al., (2006, p. S14, "Abstract Conclusion", Line 3) stated that: *"Decision makers need to use considerable judgment about how best to use the limited resources they have for quality improvement activities."*. The time and cost efficiency characteristics of the nominal group technique allows for its use in the process of tailoring implementation strategies for practice change initiatives for implementation researchers and decisions-makers in resource limited environments. This study has contributed to implementation research by addressing the gap on how to tailor implementation strategies for the uptake of evidence-based CPGs and protocols as part of a practice change initiative targeted at physiotherapists providing ICU services in a resource limited setting.

5.5 Conclusion

This is the first study using the NGT to identify barriers to and facilitators for best-practice educational implementation strategies for the tailoring of a multifaceted implementation strategy to a group of physiotherapists for use in an implementation trial in an ICU. Overall, the nominal group technique provides an effective and efficient method of tailoring implementation strategies for the targeted population or organisation. Future implementation processes and practice change initiatives should include tailoring implementation strategies before implementing CPGs and protocols in health care. Tailored implementation strategies for CPG or protocol implementation may differ depending on the healthcare professionals and organisations involved in implementation initiatives. The motivation and willingness of the target population to participate in the process may differ and the organisational structure, resources, learning styles, climate and culture may affect the outcomes of the tailoring process. Therefore, tailoring should be carried out for individual groups of healthcare professionals and

their organisations targeted for practice change initiatives as each tailored strategy for an implementation process may be different depending on the targeted healthcare professional group and their specific setting. Implementation researchers now have a method that could assist this process of tailoring implementation strategies for each targeted group and can use the nominal group technique. Going forward, the effectiveness of the tailored best-practice multifaceted implementation strategy identified for this group of physiotherapists must now be evaluated for its effectiveness in the uptake and adoption of the validated evidence-based ICU physiotherapy protocol for the physiotherapeutic management of surgical ICU patients in a surgical ICU in SA.

CHAPTER 6: PHASE 3

A Tailored Best-Practice Multifaceted Strategy for the Implementation of a Physiotherapy Protocol for the Management of Surgical ICU Patients: A Controlled Before and After Trial

6.1 Introduction

A wealth of implementation trial studies conducted in health care exist. Implementation trial studies in intensive care is also growing. Implementation trial studies evaluate the effects of implementation on the uptake of and adherence to evidence-based clinical practice guidelines (CPGs) and protocols. In intensive care, available implementation trial studies mainly focus on other healthcare disciplines such as intensivists/physicians, nurses, respiratory therapists and dieticians. Very little is known about the implementation of physiotherapy CPGs and protocols in the intensive care setting. (Wilkinson et al., 2018; Kumar, 2015; van der Wees et al., 2008).

In 2008, van der Wees et al., conducted a systematic review that included randomised controlled trials, clinical controlled trials, controlled before and after studies, and interrupted time series studies investigating the implementation of evidence-based CPGs by physiotherapists treating any type of patient. They were only able to identify three separate trials reporting the effects of implementation of only whiplash and low back pain CPGs in physiotherapy at that time. Bernhardsson et al., (2017) presented six cases of implementation of physiotherapy CPGs in Sweden, Australia and the Philippines but none of these cases implemented intensive care physiotherapy evidence into intensive care clinical practice. The ICU is a complex and dynamic environment in which the physiotherapist is an important part of the ICU multidisciplinary team (Skinner et al., 2015). Since, the role of physiotherapists in the ICU is complex and diverse (Bernhardsson et al., 2017) and includes team work and communication, it is not known whether implementation strategies used to implement CPGs and protocols documented in the current literature would be appropriate and effective for ICU physiotherapy practice change. Since it is not clear how CPGs and protocols can be implemented by physiotherapists in the ICU, there is a growing need for new, “real world” implementation trials to improve and increase evidence-based practice in intensive care physiotherapy (Kumar, 2015; Damschroder et al., 2009; van der Wees et al., 2008) including trial studies conducted in resource limited, developing countries such as South Africa (SA).

In recent years there has been an exponential growth in intensive care physiotherapy clinical research that has shown to improve quality of care and patient outcomes and reduce costs, which calls for effective and efficient methods to translate these research findings into intensive care physiotherapy clinical practice. (Bernhardsson et al., 2017). In SA, Hanekom et al., (2013), developed a validated evidence-based physiotherapy protocol for the management of surgical ICU patients. This protocol consisted of five clinical algorithms that includes the management of pulmonary dysfunction (PDF) and early mobility in patients admitted to a surgical ICU. In addition, specific adaptation of the PDF and early mobility algorithms were made for patients presenting with thoracic injuries, abdominal surgery and adult respiratory distress syndrome (ARDS). The algorithms were developed through a systematic and rigorous process including both academic and clinical intensive care physiotherapy experts and can be accessed through the website at http://www0.sun.ac.za/Physiotherapy_ICU_algorithm/.

The protocol by Hanekom et al., (2012) was implemented in an adult surgical ICU in a public sector central university-affiliated hospital in the Western Cape, SA. The protocol care provided by the research physiotherapists who provided a "dedicated" service was compared to the usual care provided by the physiotherapists working in the unit (Hanekom et al., 2012). The findings of the study trial by Hanekom et al., (2012) showed that protocol physiotherapy care resulted in improved patient outcomes and reduced cost of care. However, Hanekom et al., (2013) concluded that before implementing evidence-based CPGs and protocols in intensive care, it is necessary that unit-specific implementation strategies be developed and funded to ensure optimal implementation. According to Hanekom et al., (2013) without the co-operation from team members, practice change cannot be successfully incorporated in the ICU. Therefore, unit-specific implementation strategies developed through personalisation or tailoring are required due to the recognised difficulties experienced in changing existing practice in intensive care physiotherapy. (Powell et al., 2017; Wensing et al., 2014; Hanekom et al., 2013).

Tailored implementation strategies have been reported to facilitate the effective uptake of evidence-based CPGs and protocols into clinical practice (Baker et al., 2015; Cahill et al., 2014; Wensing et al., 2014; Sinuff et al., 2013). Moreover, implementation frameworks have been developed to guide the process and evaluation of implementation efforts. The Consolidated Framework for Implementation Research (CFIR), a pragmatic meta-theoretical framework synthesized from nineteen previously developed frameworks (Breimaier et. al, 2015;

Damschroder et al., 2009) is one such framework. The pragmatic nature of the framework allows for "real world" implementation and change in practice that could be potentially useful in implementation in intensive care physiotherapy. Very few studies that use the CFIR to guide implementation trials in the intensive care are available except for one by Balas et al., (2013) implementing the Awakening and Breathing Coordination, Delirium monitoring/management and Early exercise/mobility (ABCDE) bundle. A paucity of evidence exists for the implementation and evaluation of a tailored best-practice multifaceted implementation strategy for the implementation of evidence-based CPGs and protocols in intensive care physiotherapy in both developed and developing countries (Bernhardsson et al., 2017; van der Wees et al., 2008).

Therefore, in an effort to improve quality of care and patient outcomes we used a tailored best-practice multifaceted implementation strategy (referred to hereafter as the intervention) to implement the validated evidence-based physiotherapy protocol developed by Hanekom et al., (2013) for the physiotherapeutic management of surgical ICU patients in a surgical ICU in a public sector central university-affiliated hospital in the Western Cape, SA. We aimed to evaluate the effectiveness of the intervention on "real life" daily ICU physiotherapy practice, using the physiotherapy protocol as the vehicle for change in practice, by measuring economic, process of care indicator and patient-centred clinical outcomes.

The implementation process and evaluation in this study was guided by the CFIR (Balas et al., 2013; Damschroder et al., 2009) using the constructs of the process domain. These constructs involved "*engaging"* with the target population (the physiotherapists), "*executing"* the intervention and objectively "*evaluating*" the intervention in the uptake of the validated evidence-based physiotherapy protocol. The reader is referred to Chapter One, p. 8-11 and the CFIR website (www.cfir.org) for further details regarding the framework. We hypothesized that the intervention would translate to improved economic, process of care and patient-centred clinical outcomes in the experimental surgical ICU in both the implementation and post-implementation phase when compared to the pre-implementation phase and the control surgical ICU receiving no intervention.

6.2 Method

6.2.1 Research Design

A pragmatic controlled before and after study design was conducted.

6.2.2 Design Overview

The design consisted of a pre-, implementation and post-implementation phase [Figure 6.1]. The pre-implementation phase started in March 2015 and lasted 5 months with no intervention in either of the units. The implementation phase consisted of the intervention (tailored best-practice multifaceted implementation strategy), implemented with the group of physiotherapists working in the experimental Unit A compared to no intervention with the physiotherapists working in the control Unit B. This implementation phase started in August 2015 and lasted 6 months. The post-implementation phase (decay monitoring phase), started in February 2016, lasted 5 months and consisted of no intervention in either of the units. The study trial therefore lasted 16 months.

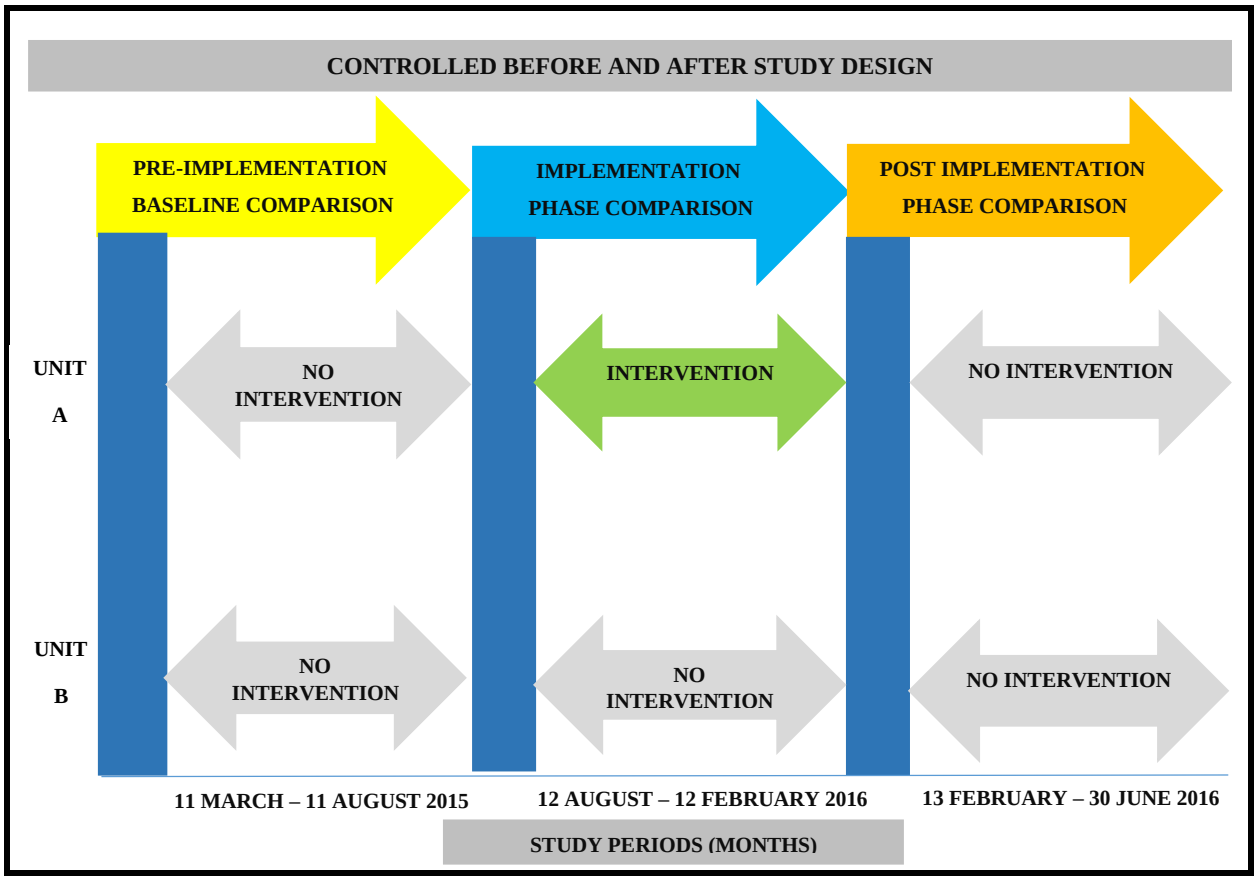


Figure 6.1 Overview of the Controlled Before and After Study Design

6.2.3 Research Setting and Participants

6.2.3.1 Unit Profiles

Two adult level I public sector surgical intensive care units based in central university-affiliated hospitals in the Western Cape, SA formed the setting for this study. These units were conveniently selected as they have a similar case mix and are both governed by the Provincial Administration of the Western Cape. One unit is based in the northern suburb and the other in the southern suburb of Cape Town in the Western Cape. The implementation intervention was allocated to the unit in which a pilot trial of the evidence-based protocol was conducted due to potential contamination. This unit is referred to as Unit A (experimental unit). The other unit was purposively selected as the control unit and is referred to as Unit B. Unit A (experimental unit) is a 10 to 14-bed ICU and Unit B (control unit) is an 8-bed unit. Both are closed Level I units. In a closed ICU, ICU patient care is transferred to an intensive care physician who is trained in intensive care medicine and has no clinical responsibilities outside the ICU (van der Sluis, Slagt, Liebman, Beute, Mulder, & Engel (2011). Closed units have a dedicated medical director and 24-hour dedicated medical staff coverage (Mathiva, 2002). The experimental unit admits patients who are first managed in a resuscitation unit and discharges patients directly to the wards whereas, the control Unit B admits patients directly and have step down facilities where surgical ICU patients with specific conditions such as neurology, respiratory, spinal cord or cardiac conditions are discharged to before discharge to a ward. The intensivist of Unit A closed 4 beds during March 2016 to December 2016 due to staff shortages [V, Ticha; H, Daries, personal communication, May 30, 2016]. Although anecdotal, there seems to be high staff turnover in Unit A especially between the nurses and doctors whereas in Unit B staff turnover seemed to be more stable.

6.2.3.2 Multidisciplinary ICU Teams

Both the experimental Unit A and control Unit B has an intensivist, operational nursing manager, dietician and a unit physiotherapist who also has ward duties and an occupational therapist and social worker that are referred to when required. Other specialist doctors for orthopaedics, neurology, internal medicine and trauma are consulted as required in both units.

6.2.3.3 The ICU Physiotherapists

The physiotherapist/s working in each unit were young, with varied years of ICU work experience and had only basic undergraduate qualifications. [Table 6.1]. The physiotherapists

allocation to the unit and services provided varied somewhat with regards to referral policy, weekend and on-call services and workload. In Unit A (experimental unit), the physiotherapist rotated out of the unit for approximately two months of the implementation phase and two months of the post-implementation phase, while the physiotherapist in Unit B, the control unit worked in the Unit for the duration of the trial [Table 6.1]. The physiotherapists in Unit A covered more beds (n=10-14) than Unit B (n=8).

Table 6.1 Physiotherapy Services in the Experimental and Control Units

ICU Physiotherapy	**Unit A (Experimental)**		**Unit B (Control)**
Physiotherapist Profile	**Profile 1**	**Profile 2**	**Profile 1**
Age (years)	35	33	30
Gender	Female	Female	Female
Qualification	BSc Physiotherapy	BSc Physiotherapy	BSc Physiotherapy
Years of Experience (years) *General* *ICU*	 13 years 13 years (primarily surgical ICU)	 8 years 1 year (4 three-month rotations in paediatric, neurosurgical, cardiothoracic and resuscitation ICU then rotation to the surgical ICU)	 9 years 8 years (primarily surgical ICU)
Allocation to Unit			
Period of Trial Worked in Units	11 March – December 2015, May – June 2016	1 January – April 2016	Stayed in the Unit throughout the study trial.
Workload			
Number of ICU Beds	10-14	10-14	8
Additional Ward Duties	Yes	Yes	Yes
Daily Physiotherapy Service			
Weekday	08h00 - 11h00 13h00 - 15h00 The physiotherapist will return to see the patient in the ICU on the day if a patient is referred later. Students also work in this unit between these hours.		7h30 - 10h00 mainly The physiotherapist will return to see the patient in the ICU on the day if a patient is referred later. Students also work in this unit between these hours.
Weekday On-Call Duty	16h00 -7h29 on a rotation basis off-site		16h00 - 7h29 on a rotation basis off-site
Weekend Duty (includes time spent on ward patients)	07h30 - 11h00 on rotation basis, students also work in the unit on the weekend.		7h30 - 13h00 on rotation basis, students also work in the unit on the weekend
Weekend On-Call Duty	11h00-07h29 on rotation basis off site		13h00-07h29 on a rotation basis off site
Referral policy			
Weekday **Weekend -** referral by unit physiotherapist and/or doctor	Yes Only 4 patients		Yes Only 2 patients

The Physiotherapists in each unit were allocated to both the respective surgical ICUs and other wards in the hospitals, affecting their workload. The physiotherapists in both units provided on-call and weekend services to each of the units, together with ward work, on a rotation basis [Table 6.1].

6.2.3.4 Patient Population

All patients admitted to the each of the included adult surgical ICUs during the study period formed the population.

6.2.3.5 Patient Sample

i) Sampling method: Purposive sampling was used. Only adult patients admitted to the included ICUs from 11 March 2015 to 30 June 2016 were included. All patients <18years old admitted to the units during the study trial was excluded.

ii) Sample Size Calculation: The primary outcome of this trial was the TISS-28unit day score. Based on the pilot trial results (Hanekom et al., 2013; Hanekom et al., 2012; Hanekom et al., 2010) the study was statistically powered (80%) to detect a two-point difference in the daily TISS-28unit day score (p=0.05). Therefore, 140 patients with TISS-28unit day scores were needed per time period. The TISS-28unit day score can only be calculated for patients who remain in the unit for at least 24-hours. In order to account for these short stay patients, data was collected until 140 patients with TISS-28unit day scores per phase for each unit were obtained.

6.2.4 Evidence-based Physiotherapy Surgical ICU Management Protocol Characteristics

The validated evidence-based physiotherapy protocol for the physiotherapeutic management of surgical ICU patients developed by Hanekom et al., (2012) described in the Introduction to this Chapter was tailored for use in the experimental surgical ICU by the target population following a discussion with the unit intensivist, physiotherapist and two senior operational ICU nurses at three individual face to face meetings. A package with the protocol and the points of discussion for the meetings were provided to the unit intensivist, physiotherapist and two senior operational ICU nurses a week prior to the meetings for their perusal and preparation for the discussion.

The Protocol Characteristics domain of the CFIR includes constructs such as the ICU staff perceptions of the source of the protocol, evidence strength and quality, relative advantage of the protocol implemented in the unit, adaptability, trialability, complexity for implementation and design, quality and packaging of the protocol for use and its cost-effectiveness was discussed (Addendum 25).

The unit intensivist reported that manual hyperinflation was done by the doctors in the unit as the physiotherapists did not have appropriate equipment to do the technique safely. Thus manual hyperinflation was not included in the pulmonary dysfunction algorithm of the protocol for physiotherapy management of the surgical patient with pulmonary dysfunction as this would be done by the doctor/s in the unit. The unit physiotherapist and unit nurses were already sharing the roles of positioning and mobilisation of patients out into a chair in order for the physiotherapists to manage and prioritise their workload in the unit. The unit physiotherapist reported having intermittent positive pressure breathing (IPPB) devices that were used in the unit and could apply this breathing technique which is in the pulmonary dysfunction and abdominal surgery algorithms. Due to the multidisciplinary nature of patient care in the unit, the physiotherapist reported that application of the components of the protocol such as positioning in bed and mobilisation to the chair may be influenced by patients being repositioned by radiographers and nurses for specific procedures and patients going out of the unit for diagnostic tests or theatre, influencing the application of physiotherapy care regardless of protocol care. The availability of physiotherapists in the unit especially on weekends where services were limited as physiotherapists work on a rotation basis and only see four patients in the ICU per weekend day, was a shared concern that may affect protocol implementation.

There were no other concerns based on the protocol characteristics for it being implemented in the unit. The unit intensivist (local champion) approved and supported the safe use of the protocol in the unit following appropriate training of the physiotherapists. There were no reported concerns regarding the source, evidence strength and quality, design and packaging, trialability or costs of implementing the protocol in the unit.

6.2.5 Components of the Best-Practice Tailored Multifaceted Implementation Strategy

The tailored best-practice multifaceted implementation strategy was decided upon by the targeted group of physiotherapists, working in the experimental surgical ICU, during a

workshop held with them prior to implementation. The Nominal Group Technique (NGT) was used to identify barriers and facilitators of each best-practice educational implementation strategy and a majority vote was taken for three best-practice educational implementation strategies best-suited to their physiotherapy department and the individual physiotherapists (Chapter 5). The three best-practice educational implementation strategies namely an educational handbook (paper and electronic copy), a workshop series and grand round/bedside teaching sessions and two reminder strategies namely pocket cards and posters of the protocol was used to implement the physiotherapy protocol. The aim, setup and duration, content, and attendance of each component of the tailored best-practice multifaceted implementation strategy and the time frames in which the strategies were applied, as requested by the targeted group of physiotherapists, are described in Table 6.2.

The Primary Investigator [FK] delivered the tailored best-practice multifaceted implementation strategy (intervention) to the targeted physiotherapists to facilitate protocol uptake and implementation. A paper and electronic version of an educational handbook as well as four 2-hour workshops as part of a workshop series introducing implementation and the three algorithms of the protocol, were delivered to the targeted group of physiotherapists. Each intervention was implemented every two weeks as requested by the group [Table 6.2]. The physiotherapists worked independently with the protocol for a period after the completion of the workshop series that was then followed by a reminder consisting of pocket cards of the protocol for use in the surgical ICU. The four 1-hr grand rounds/bedside teaching sessions were delivered to groups of four to five physiotherapists following the reminder [Table 6.2]. The Primary Investigator [FK] included training on the use of the pocket cards [Addendum 26] on the grand rounds/bedside teaching sessions. Patients in the unit were used by the Primary Investigator [FK] as examples of how to apply the protocol with the help of the pocket cards. Reminders in the form of posters [Addendum 27] were put up in each of the intensive care patient units for use by the physiotherapists [Table 6.2]. The posters are fully visible from each patients' bed. A poster was also provided for the Physiotherapy Department. The physiotherapists were made aware of these posters and requested to refer to it as regularly as it was required, to maintain evidence-based practice in the ICU.

Table 6.2 Tailored Components of the Implementation Intervention.

Implementation Strategy	Description	Time Period of the Intervention	Attendance
Educational Strategies	**Paper and electronic version of an educational handbook** Aim: for individual physiotherapists to read and familiarise themselves with the protocol content. Setup and Duration: a copy for each physiotherapist, the staff room, Head of Department office and ICU Content: included 1. published articles on the protocol, 2. importance of practice change, 3. evidence for ICU practice change 4. early mobilisation and other evidence-based physiotherapy practices and 5. a copy of the full surgical ICU physiotherapy protocol including the published algorithms for abdominal surgery, pulmonary dysfunction and rehabilitation. 6. Additional relevant published guidelines and evidence for implementation of evidence-based CPGs and protocols to improve patient outcome.	11 August 2015	100% received -
	Workshop Series (4 workshops) **Workshop 1:** Aim: to introduce evidence-based practice, the process of implementation and the protocol. Setup and Duration: interactive discussion within whole group (2-hours). Content: 1. importance of evidence-based practice, 2. current evidence from a Conference attended on early mobilisation and evidence-based physiotherapy in the ICU and outcomes, 3. need for practice change and the benefits for patients and improvement in quality of care, 4. brief introduction to the handbook and how to use it, 5. summary of the protocol development, validation, cost-effectiveness, effectiveness on patient outcome 6. and sharing the information gained from the unit intensivist, senior ICU nurses and unit physiotherapist (local champions) with regards to tailoring of the protocol for the surgical ICU.	03 September 2015	18/21 (86%)
	Workshop 2: Aim: To introduce the Abdominal Surgery Algorithm Setup and Duration: interactive discussion within whole group followed by four groups of 4 to 5 physiotherapists for paper-patient case presentations (2 hours). Content: 1. Pre-reading: Abdominal Surgery Algorithm, 2. Presentation and interactive discussion regarding the Abdominal Surgery Algorithm, **3.** Group work using four patient cases related to the algorithm. Patient cases were obtained from patients that were admitted to the surgical ICU. Each group worked	16 September 2015	17/21 (81%)

	through a case and presented it to the entire group facilitated by the Primary Investigator [FK].		
	Workshop 3: Aim: To introduce the Pulmonary Dysfunction Algorithm Setup and Duration: interactive discussion within whole group followed by four groups of 4 to 5 physiotherapists for paper-patient case presentations (2-hours). Content: 1. Pre-reading: Pulmonary Dysfunction Algorithm 2. Presentation and interactive discussion regarding the Pulmonary Dysfunction Algorithm, 3. Group work using four patient cases related to the algorithm. Patient cases obtained from patients that were admitted to the surgical ICU. Each group worked through a case and presented it to the entire group facilitated by the Primary Investigator [FK].	29 September 2015	17/21 (81%)
	Workshop 4: Aim: To introduce the Rehabilitation Algorithm Setup and Duration: interactive discussion within whole group followed by four groups of 4 to 5 physiotherapists for paper patient case presentations (2 hours). Content: 1. Pre-reading: Rehabilitation Algorithm 2. Presentation and interactive discussion regarding the Rehabilitation Algorithm, 3. Group work using four patient cases related to the algorithm. Patients cases obtained from patients that were admitted to the surgical ICU. Each group worked through a case and presented it to the entire group facilitated by the Primary Investigator [FK].	13 October 2015	17/21 (81%)
	Grand Rounds/Bedside Teaching Sessions 1 & 2 Aim: for practical application of the algorithms at the bedside. Set up: 1. Two groups of four to five physiotherapists per day over two days (1 hour/group). 2. Using two different patients in the unit per group respectively in the unit per day. Content: 1. Bedside theoretical and practical teaching and interactive discussion and application of the Pulmonary Dysfunction, Abdominal and Rehabilitation Algorithms using the Reminder pocket cards for the evaluation and treatment planning for the selected patients in the surgical ICU. The grand round was facilitated by the Primary Investigator [FK].	10 and 11 February 2016	16/21 (76%)
Reminder Strategies	Aim: To serve as a reminder for the use of the protocol and adherence to best-practice. Content and Setup: 1. Pocket Cards of the Protocol for each Physiotherapist 2. Posters of the Protocols for each room in the ICU and the Physiotherapy Department	 18 January 2016 11 February 2016	100% received -

6.2.6 Study Incentive

The physiotherapists who attended the implementation process completed an attendance register [Addendum 28] for each session and received Continuous Professional Development (CPD) certificates [PPB004-MD121-0024-2-2017] and points for each implementation session totalling 10 CPD points [Addendum 29].

6.2.7 Baseline Patient Data

Experimental and control groups were compared at baseline with regards to age, gender, severity of illness as measured by APACHE II score, admission diagnosis (elective or emergency surgery, traumatic injury or none (poisoning or other non-surgical or non-traumatic condition) and infective status. Additional baseline data such as patient co-morbidity, surgical status prior to ICU and mode of ventilation on admission was also documented and is presented separately in Addendum 30.

6.2.8 Outcome Data

In this trial study, primary economic and secondary process of care, clinical, safety and implementation fidelity outcomes were measured for comparison between the experimental and control unit within phases and within the units between phases.

6.2.8.1 Economic Outcome: Therapeutic Index Scoring System-28 (TISS-28unit day score)

The TISS-28 has been proposed as a valuable tool for analysing the utilisation of ICU resources (Graf, Graf, Koch, Hanrath & Janssens, 2003). The TISS-28 records 28 therapeutic interventions related to nursing care in the ICU [Addendum 31]. A TISS-28unit day is defined as the 24-hour period between 07:00 to 06:59 the following day that a patient is in the unit. Therefore, patients that are in the unit for less than 24-hours did not obtain a TISS-28unit day score and would not be included in the TISS-28unit day score analysis. Reliability and validity of the instrument in a surgical ICU has been reported (Muehler, Oishi, Specht, Rissner, Reinhart & Sakr, 2010). Kisorio, Schmollgruber & Bekker (2009) reported a content validity index of 0.93 for the TISS-28 and a significant intra-class correlation of 0.99; p=0.0001. These authors support the feasibility of the TISS-28unit day score for use in South African ICUs. The TISS-28 was used to determine the effectiveness of the physiotherapy protocol in the experimental surgical ICU in a pilot trial conducted by Hanekom et al., (2012) who reported that the TISS-28 is sensitive to detect a change in the physiotherapy service (process of care) provided. The

TISS-28 is correlated with the APACHE II (severity of illness score). A decrease in the TISS-28 score is indicative of patient improvement (Hanekom et al., 2012). The raw TISS-28unit day score for each patient for each TISS-28unit day they remained in each of the units was calculated manually by the data assistant and checked by the Primary Investigator [FK] for accuracy. Each TISS-28 unit is equivalent to 10.6minutes of nursing care. Raw scores (TISS-28units) were used in the analysis and not the time in minutes or hours per nursing shift. The TISS-28unit day scores are expected to decrease as the patients' condition improves. The TISS-28unit day score should decrease when the process of care has been implemented by the physiotherapist/s (Hanekom et al., 2012).

6.2.8.2 Process of Care Indicators

The process of care indicator outcomes was used to measure whether the protocol was adhered to. The three physiotherapy process of care [POC] indicators analysed were i) time (in hours) from ICU admission to first physiotherapy contact [POC1], ii) time (in hours) from ICU admission to first mobilisation of the patient out into a chair by the physiotherapist [POC2] and iii) time (in hours) from the time of extubation to the time the patient was treated by the physiotherapist after extubation [POC3] (Hanekom et al., 2012). An additional process of care indicator outcome, the time from ICU admission to first mobilisation by the nurse was included as nurses also mobilised patients out into a chair [POC4]. These indicators were measured in hours.

6.2.8.3 Clinical Outcomes

The clinical outcomes included hospital and ICU length of stay (LOS), ventilation data and hospital and ICU mortality.

i) Length of stay: Hospital and ICU length of stay (LOS) was calculated in days from hospital and unit admission to hospital and ICU discharge/death respectively.

ii) Ventilation Data: Three ventilation-related outcomes were calculated. These included time on the ventilator; ventilation proportions and proportion of failed extubations (re-intubation). These outcomes were defined for the purpose of this trial as follows:

Time on the ventilator (MVT): was calculated as the total time (in hours) a patient spent on the ventilator during their stay in the unit. This time was calculated as a sum of individual ventilation episodes. A ventilation episode was defined as the time from intubation to

extubation. If a patient was admitted to the unit already intubated and ventilated, the unit admission time was used as time of intubation. This decision was necessary due to incomplete patient records previously reported (Hanekom et al., 2012; Hanekom et al., 2010).

Ventilation proportions: The number of patients who were intubated within each phase was expressed as a proportion of the number of patients admitted during that phase.

Proportion of failed extubations: An extubation was defined as failed, when the patient was re-intubated 24-hours after extubation (Hanekom et al., 2012; Hanekom et al., 2010). The number of failed extubations was expressed as a proportion of the number of extubations within each phase.

iii) Mortality: Unit and hospital mortality were reported for all patients included in the trial. The proportion of ICU and hospital deaths were calculated for each phase of the trial.

6.2.8.4 Safety of physiotherapy intervention

i) Adverse events: Adverse events related to protocol implementation specifically relating to mobilisation of patients out into a chair included unplanned extubation, dislodgement of lines, hemodynamic instability, pulmonary instability, falls and other that were defined based on the pilot trial by Hanekom et al., (2012).

6.2.8.5 Implementation Fidelity

Implementation fidelity in this study refers to the individual physiotherapists' exposure to each of the individual implementation strategies in the implementation process. An attendance register [Addendum 28] was used to determine implementation fidelity.

6.2.9 Study Procedure

6.2.9.1 Ethics

Ethics clearance was obtained from the Research Ethics Committee of Stellenbosch University [S13/09/170 –Addendum 1], the Western Cape Department of Health, Hospital Chief Executive Officers (CEOs) and Research Ethics Committees of the included hospitals [Addendum 32 & 33]. Permission was obtained from:

- the Superintendent of the hospital in which the unit that received the evidence-based protocol physiotherapy is based and nursing authorities to complete the project in the hospital,

- the Superintendent and Medical and Medico-Legal Records Departments of the hospital in which the control unit is situated to collect baseline data for comparison,
- the physiotherapy department management teams of the hospitals.
- the unit managers and nursing authorities responsible for management of the units.

All aspects pertaining to ethical conduct during the study trial was strictly adhered to.

6.2.9.2 Data Collection

Data Assistant: Two data assistants were trained by the Primary Investigator [FK] in study conduct and data collection procedures for the study. The Primary Investigator [FK] also collected data when data assistants were unable to do so. **Pilot:** Training on the use of the TISS-28 scoring system was conducted by the Primary Investigator [FK] prior to data collection, [see training power point – Addendum 34]. Consensus regarding rating of items was reached between the data assistants *a priori.* Data reliability of the TISS-28 was established *a priori.* Data was extracted using the ICU bed charts from any three days of any three admitted patients that stayed in the unit for 24-hours each day. Interrater reliability was calculated using the kappa statistic. The interrater reliability between the data assistants was 0.75 which is a good agreement.

Blinding and Bias: The data assistants were blind to group allocation and were not aware of the scheduled implementation process or specific outcome data that was analysed. Although the researcher was involved in data collection, since data were objective measures of time and procedures performed in the unit, bias of the results could safely be eliminated.

Data collection process: Data was collected retrospectively as data for all patients were collected following admission to the unit and for every 24-hours the patient spent in the unit. Data for patients in the experimental unit was collected in the unit every second day and weekend patient data was collected on the Monday. Data in the control unit was collected following patient discharge. The patient folders and bed charts for patients admitted to the control unit were obtained from medical and medico-legal records for collecting the data.

Data Source: The Admission/Statistics Book was used as the Gold Standard for patients admitted to each of the Units. This book was used to collect the list of patients admitted daily to the respective units in order to identify patients for data collection for the period of the trial.

The baseline and outcome data was extracted from the patient folders and bed charts. APACHE II completed on admission by the unit intensivist was extracted from the APACHE II scoring sheets kept by the intensivist in the control unit and the unit clerk in the experimental unit. The hospital database for the respective hospitals was used to obtain hospital discharge/death dates for all ICU patients in the study.

Data Extraction Forms: Three data extraction forms were used by the data assistants and Primary Investigator [FK] to capture all the data extracted per patient as follows:

i) ICU Patient Admission Data Extraction Sheet, completed once for each ICU admission, including patients readmitted to the unit who were seen as a new admission [Addendum 35]. This form provided the baseline and clinical patient data.

ii) Daily Physiotherapy and Ventilation Management Data Extraction Sheet: completed for each day the patient was in the unit [Addendum 36]. This sheet was used to extract the data related to the physiotherapy and nurse process of care indicators, adverse events relating to mobilisation into a chair and medical and nursing management procedures related to ventilator support.

iii) Standardised TISS-28unit day Data Scoring Sheet: completed for patients staying in the respective units for each 24-hour TISS-28unit day the patient stayed in the unit and was based on the ICU procedures [Addendum 31].

All data collection procedures were established and standardised *a priori*.

6.2.9.3 Data Capturing

A data administrator assisted in capturing the data collected on a weekly basis. Data was entered by the data administrator into a Microsoft Excel database pre-designed by the Primary Investigator [FK].

6.2.9.4 Data Encryption

The Microsoft Excel databases were password protected and patients were coded using folder numbers combined with a unique numeric code. Only the data administrator and primary investigator [FK] had access to the password therefore maintaining anonymity and confidentiality of the data.

6.2.9.5 Data Verification

The Primary Investigator [FK] checked for any errors and omissions in the data captured and that data captured was accurate by checking random patient folders. The unit admission/statistics record book was used to check whether all patients admitted to the two units were accounted for in the study database. A list of missing patient data was made for the experimental unit. The missing patient data was retrieved from the patient folders and bed charts retrieved from the ICU patient records kept in a locked room in the experimental unit. The data from these folders were extracted in the same manner described under 6.2.9.2 by the research assistant or Primary Investigator [FK]. However, not all patient folders and bed charts could be located and these patients were therefore regarded lost to follow-up. Data collected for the control unit was extracted from the patient folders and bed charts kept at the medical or medico-legal records departments following patient discharge in the same manner described under 6.2.9.2 by the research assistant or Primary Investigator [FK]. Therefore, patient folders and bed charts not stored in the medical or medico-legal records departments could not be located and were not traceable and were also regarded lost to follow-up.

Patients Lost to Follow-up and Missing Data: All patients whose folders were not available for data collection were regarded as patients lost to follow-up [Figure 6.2]. Only the age, gender, ICU and hospital LOS for these patients could be obtained from the unit admission/statistics record book or the respective hospital electronic databases and all other data for these patients were regarded as missing data. Data that were not recorded in patient folders and bed charts that should have been recorded and where parts of the patient folders and bed charts were missing and therefore the data not available, were also regarded as missing data. The patients who stayed in the units for less than 24-hours would not have TISS-28 scores, patients who were not seen by the physiotherapists (first contact after ICU admission), not mobilised to the chair by the physiotherapist or nurse, not intubated (therefore no extubation recorded) or died before extubation (therefore no extubation recorded) were not classified as missing patient data. There were patients lost-to follow-up in each of the units in each of the phases of the trial [Figure 6.2]. The outcomes and some baseline data such as APACHE II, admission diagnosis, infective status, co-morbidities, surgical status on admission, intubation status, mechanical ventilation time, extubation and mode of ventilation were therefore missing for these patients lost to follow-up.

6.2.9.6 Data Analysis

Data was imported from the Microsoft Excel database into STATA version 15 for statistical analysis by a Biostatistician from the Biostatistics Unit at Tygerberg Medical Campus, Stellenbosch University. The Biostatistician was blinded to group allocation throughout the analysis. Descriptive statistical analysis of the baseline and outcome data was conducted using frequencies, proportions presented as percentages for categorical data and medians and interquartile ranges for numerical/scale data not normally distributed. Inferential statistical analysis was used to compare baseline and outcome data between units within each phase and within units between each phase. All results were significant at a p value of 0.05 two sided.

Baseline Data: Continuous variables such as age, APACHE II, ICU and hospital LOS and time on the ventilator were analysed using the independent samples Mann-Whitney U test for differences between units and the Kruskal-Wallis independent samples t-test for difference between phases. Categorical variables such as gender, admission diagnosis, infective status, mortality, ventilator proportion and proportion of failed extubations were compared using the Pearson Chi-square test for unit and phases.

Process of Care Outcomes: The proportion (percentage) of patients receiving each process of care (POC) [stated as an event for the purpose of statistical description] were compared between units using the Pearson Chi-square test. A logistic regression for having the POC (event) or the POC being applied was modelled for both the main effects of unit and interaction effect of unit and phase on the proportion of patients receiving each process of care (event) while adjusting for the confounding variables gender, APACHE II, traumatic injury, emergency surgery and infective status determined *a priori*. Since there was no interaction between unit and phase we present the results from the analysis using the main effects of unit model for this outcome. The time scale values of each of the POC indicators were measured in hours and analysed using medians and interquartile ranges as this data was skewed and not normally distributed. The Kruskal-Wallis independent samples t-test was used to determine the effect of the intervention (implementation strategy) on the time to the POC (event) between units within phases and between phases within units. These tests provided a crude analysis of the effect of the intervention on the process of care indicator (POCI) outcomes and further analysis was conducted adjusting for confounders. We used Kaplan-Meier survival estimates for time to POC (event) differences between units ($p<0.0001$) and log rank tests for univariate cox

regression for difference between phases (p=0.02) which were found to be significant. Then, a cox proportional hazards model was used to establish the hazard ratio (HR) for time to each POC (event) comparing the two units and three phases to determine differences between units and differences between phases, and analysed for an interaction between phase and unit whilst adjusting for confounders in the model determined *a priori*. The interaction effect became non-significant with the addition of confounders; therefore, we reported this outcome based on the analysis of the main effects model, adjusted for confounders, for unit and phase.

TISS-28 Outcome: The proportion of patients who had and did not have (<24hours in the unit and lost to follow-up patients combined) TISS-28unit day scores were analysed descriptively and presented as percentages in a table. A logistic regression analysis clustering for patients by identity codes was done to test the for the likelihood of patients having no TISS-28unit scores due to less than 24hour unit stays and patients lost to follow-up combined, between units. Six thousand and fifteen TISS-28unit day scores were recorded over the study period for both Unit A (4218) and B (2097). A total number of 5062 TISS-28unit observations were included in the analysis and the standard error adjusted for 888 clusters in patient identity column in the logistic regression analysis. One TISS-28 point represents 10.6 minutes of nursing activity per patient per 8-hour shift. For the analysis of the TISS-28 outcome the phase variable (pre, implementation and post-implementation phase) was reclassified based on the actual TISS-28 date rather than the admission date of the patient. The TISS-28-day scores were grouped in these phases based on the date of each actual TISS-28-day score regardless of when a patient was discharged or admitted. TISS-28 weeks were generated as weeks from the start of the trial 11.03.2015. Generalized linear models for the Gaussian family of distributions and using an identity link were constructed with interaction between unit and phase while adjusting for gender, APAHCE II, emergency surgery and infective status. The rate of change in weekly TISS-28unit day scores was analysed by testing for the effects of unit (experimental vs control) and phase while adjusting for age, gender, APACHE II, emergency surgery. An interaction between phase and unit was established with a significant effect of phase and unit on TISS-28unit outcome. We used the interaction between unit and phase to estimate the rate of change of TISS-28unit day scores of improvement over the phases in the intervention unit vs the control unit and over the phase within units and found a significant interaction between unit and phase. We therefore report on the TISS-28unit outcomes based on the interaction effects model.

Clinical Outcomes: We analysed the categorical (binary) clinical data namely mechanical ventilation (intubated) proportion, proportion of failed extubations and proportion of ICU and hospital deaths (mortality) using a logistic regression analysis with main and interaction effects between unit and phase and adjusting for confounders such as APACHE, gender, emergency surgery and traumatic injury determined *a priori*. As there was no significant interaction between phase and unit we used the main effects models adjusted for confounders to describe these outcomes.

6.3 Results

There was a total of 1574 ICU admissions from 11 March 2015 to 30 June 2016 [Figure 6.2]. Unit A (experimental) had more patient admissions to the unit during the trial than Unit B (control). Following exclusion of patients <18years old, a total of 870 and 639 patient admissions in Unit A and Unit B respectively were included in the analysis totalling 1509 patient admissions [Figure 6.2]. The number (n) of patient admissions per phase for each Unit are presented in Figure 6.2. There were more patients lost to follow-up in the post-implementation phase in both Unit A and Unit B [Figure 6.2]. Age, gender, hospital and ICU length of stay (LOS) were available for all (N=1509) patients admitted to the two units. APACHE scores were only available for 82.4% (n=717/870) and 82 % (n= 524/639) of patients in Unit A and B respectively.

The results of the analysis are described as follows: i) the baseline comparisons, ii) process of care indicator [POCI] outcomes, iii) economic outcome [TISS-28unit day score] and the iv) clinical outcomes, compared between units per phase and between phases within units, v) safety of the physiotherapy intervention, adverse events related to physiotherapy mobilisation out into a chair and lastly vi) implementation fidelity.

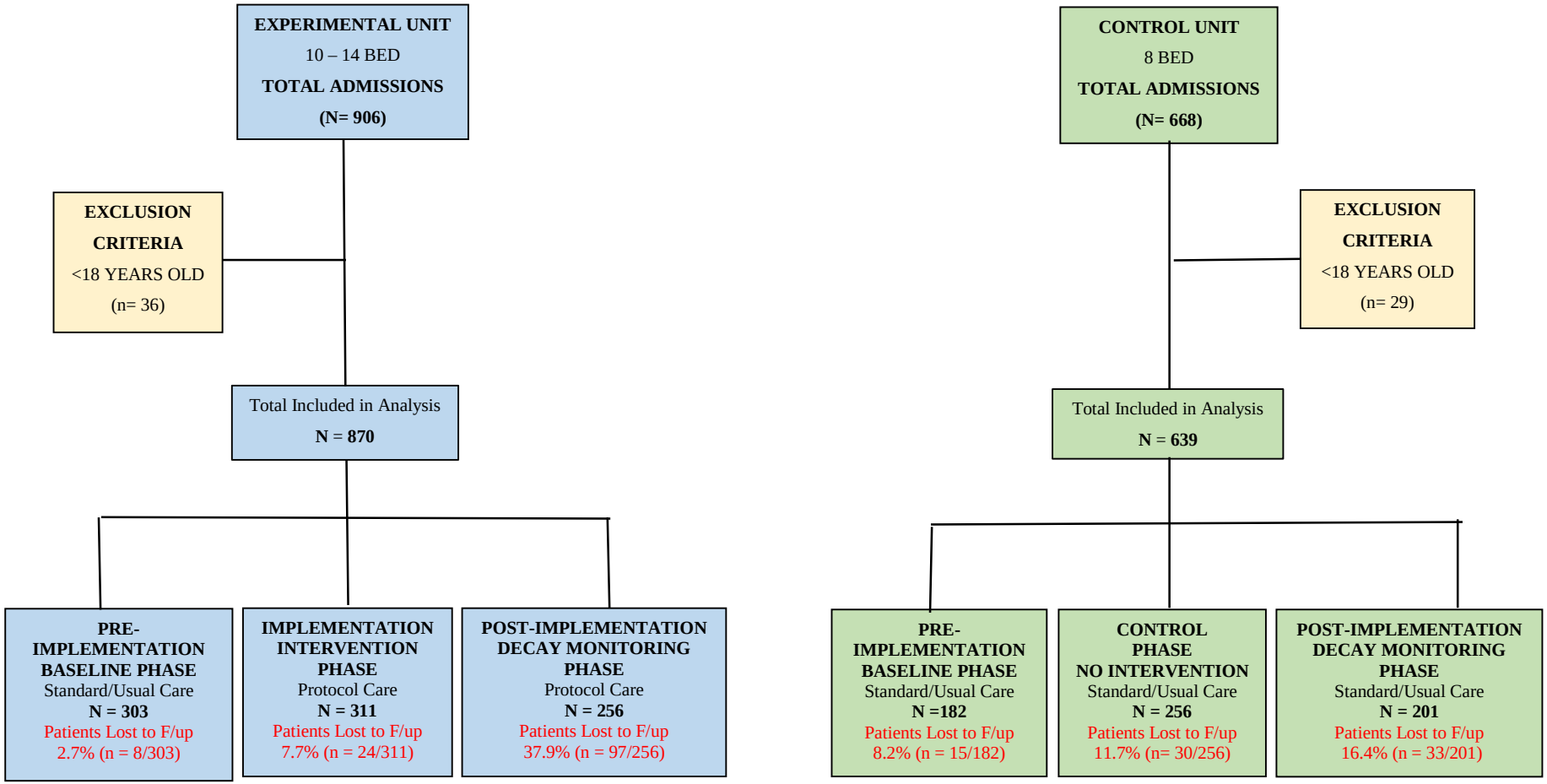


Figure 6.2 Study Flow and Patient Sample *(red – Patients Lost to Follow-up (F/Up) – no folders and bed charts available)*

6.3.1 Baseline Data

6.3.1.1 Between Units

There were statistically significant baseline differences between the units within each phase except for emergency surgery and infective status in the post-implementation phase [Table 6.3]. However, in the post-implementation phase there were a substantial amount of missing patient data that must be considered. The patients admitted to experimental unit A were significantly older but less severely ill (lower APACHE Score) than those admitted to control unit B. Unit A had significantly more females than Unit B. There were fewer emergency surgery cases in Unit A in the pre-implementation and implementation phase than unit B that had more emergency and traumatic surgery cases in these phases. Infective status of patients was also significantly different between units in the pre-implementation and implementation phases of the trial with Unit A having significantly fewer infective patients than Unit B [Table 6.3]. Additional descriptive results for the co-morbidities, surgical status prior to ICU admission data and mode of ventilation on admission is described in Addendum 30.

6.3.1.2 Between Phases within Units

Unit A: In experimental Unit A, there were significantly fewer males admitted in the post-implementation phase that the pre-implementation phase [Table 6.4]. The proportion of elective surgery patients admitted were significantly less in both the implementation and post-implementation phase compared to the pre-implementation phase. There was a borderline significant trend for more emergency patients to be admitted in the implementation and post-implementation phases. Following an analysis between each phase, there was an increase in the significant trend with a lower proportion of emergency surgery patients admitted in the pre- compared to the implementation ($p=0.07$) and post-implementation ($p=0.06$) phase. There was a significantly higher proportion of infective patients admitted in the pre-implementation phase compared to the implementation and the post-implementation phases. All other variables were equal across phases in unit A [Table 6.4].

Unit B: In control Unit B, there were significantly fewer elective surgery patients admitted to the pre- compared to the implementation and post-implementation phases and significantly more traumatic injury patients admitted in the pre- compared to the post-implementation phase. All other variables were equal across phases in Unit B [Table 6.4].

Table 6.3 Comparison of Baseline Data Between Unit A and Unit B

Variables per Phase	Unit A (Experimental)	Unit B (Control)	p-value
PRE-IMPLEMENTATION PHASE	***N=303***	***N=182***	*Between Units*
AGE (median, IQR)	44 (32-58)	38 (29-51)	0.005
GENDER (proportion, %)			
Male	63% (n=191)	74% (n=135)	
Female	37% (n=112)	26% (n= 47)	0.011
APACHE II (median, IQR)	9 [6-12.7] (n=260)	12 [8-18] (n=142)	<0.0001
ADMISSION DIAGNOSIS (proportion, %)			
Elective Surgery (Y)	56% (n=165/296)	16% (n=26/166)	<0.0001
Emergency Surgery(Y)	27% (n=81/296)	48% (n=80/166)	<0.0001
Traumatic Injury(Y)	4% (n=11/296)	56% (n=93/166)	<0.0001
None (Y)	1% (n=2/296)	14% (n=24/166)	<0.0001
INFECTIVE STATUS (proportion, %)			
Infective	6% (n=19/296)	17% (n=29/166)	<0.0001
Not Infective	87% (n=256/296)	80% (n=132/166)	
Not Applicable	7% (n=21/296)	3% (n=5/166)	
IMPLEMENTATION PHASE	***N=311***	***N=256***	*Between Units*
AGE (median, IQR)	47 (30-60)	37.5 (27.5-51.5)	<0.0001
GENDER (proportion, %)			
Male	59% (n=182)	71% (n=181)	
Female	41% (n=129)	29% (n= 75)	0.003
APACHE II (median, IQR)	9 [5-13] (n=256)	11 [7-19] (n=215)	<0.0001
ADMISSION DIAGNOSIS (proportion, %)			
Elective Surgery(Y)	45% (n=130/286)	22% (n=49/225)	<0.0001
Emergency Surgery(Y)	35% (n=99/286)	47% (n=105/225)	0.005
Traumatic Injury(Y)	4% (n=11/286)	45% (n=102/225)	<0.0001
None(Y)	1% (n=2/286)	13% (n=30/225)	<0.0001
INFECTIVE STATUS (proportion, %)			
Infective	8% (n=22/286)	16% (n=37/225)	0.008
Not Infective	90% (n=257/286)	80% (n=181/225)	
Not Applicable	3.14% (n=9/286)	3.11% (n=7/225)	
POST-IMPLEMENTATION PHASE	***N=256***	***N=201***	*Between Units*
AGE (median, IQR)	48.5 (32-62)	41 (29-59)	0.013
GENDER (proportion, %)			
Male	52% (n=134)	65% (n=131)	
Female	48% (n=122)	35% (n= 70)	0.006
APACHE II (median, IQR)	9 [6-13] (n=201)	13 [8-19] (n=167)	<0.0001
ADMISSION DIAGNOSIS (proportion, %)			
Elective Surgery (Y)	39% (n=62/161)	27% (n=45/169)	0.023
Emergency Surgery(Y)	36% (n=58/161)	44% (n=75/169)	0.111
Traumatic Injury(Y)	1% (n=1/161)	38% (n=64/169)	<0.0001
None(Y)	0% (n=0/161)	13% (n=22/169)	<0.0001
INFECTIVE STATUS (proportion, %)			
Infective	14% (n=23/161)	11% (n=18/168)	0.185
Not Infective	82% (n=132/161)	88% (n=148/168)	
Not Applicable	4% (n=6/161)	1% (n=2/168)	

Table 6.4 Comparison of Baseline Data Between Phases in Unit A and B *(*significance level)*

EXPERIMENTAL UNIT A				
Variables per Phase	Pre -Implementation Phase	Implementation Phase	Post –implementation Phase	p-value
	N=303	***N=311***	***N=256***	Between Phases
AGE (median, IQR)	44 (32-58)	47 (30-60)	48.5 (32-62)	0.2
GENDER (proportion, %)				
Male	*63% (n=191)	59% (n=182)	52% (n=134)	*0.04
Female	37% (n=112)	41% (n=129)	48% (n=122)	
APACHE II (median, IQR)	9 [6-12.7] (n=260)	9 [5-13] (n=256)	9 [6-13] (n=201)	0.31
ADMISSION DIAGNOSIS (proportion, %)				
Elective Surgery (Y)	*56% (n=165/296)	45% (n=130/286)	39% (n=62/161)	*0.001
Emergency Surgery(Y)	*27% (n=81/296)	35% (n=99/286)	36% (n=58/161)	*0.09
Traumatic Injury(Y)	4% (n=11/296)	4% (n=11/286)	1% (n=1/161)	0.12
None (Y)	1% (n=2/296)	1% (n=2/286)	0% (n=0/161)	0.574
INFECTIVE STATUS (proportion, %)				
Infective	*6% (n=19/296)	8% (n=22/286)	14% (n=23/161)	0.008
Not Infective	87% (n=256/296)	89% (n=255/286)	82% (n=132/161)	
Not Applicable	7% (n=21/296)	3.14% (n=9/286)	4% (n=6/161)	
Control Unit B				
Variables per Phase	Pre-implementation phase	Implementation phase	Post-implementation phase	p-value
	N=182	***N=256***	***N=201***	Between Phases
AGE (median, IQR)	38 (29-51)	37.5 (27.5-51.5)	41 (29-59)	0.18
GENDER (proportion, %)				
Male	74% (n=135)	71% (n=181)	65% (n=131)	0.15
Female	26% (n= 47)	29% (n= 75)	35% (n= 70)	
APACHE II (median, IQR)	12 [8-18] (n=142)	11 [7-19] (n=215)	13 [8-19] (n=167)	0.26
ADMISSION DIAGNOSIS (proportion, %)				
Elective Surgery (Y)	*16% (n=26/166)	22% (n=49/225)	*27% (n=45/169)	*0.05
Emergency Surgery(Y)	48% (n=80/166)	47% (n=105/225)	44% (n=75/169)	0.81
Traumatic Injury(Y)	*56% (n=93/166)	45% (n=102/225)	*38% (n=64/169)	*0.004
None (Y)	14% (n=24/166)	13% (n=30/225)	13% (n=22/169)	0.926
INFECTIVE STATUS (proportion, %)				
Infective	17% (n=29/166)	16% (n=37/225)	11% (n=18/168)	0.23
Not Infective	80% (n=132/166)	80% (n=181/225)	88% (n=148/168)	
Not Applicable	3% (n=5/166)	3.11% (n=7/225)	1% (n=2/168)	

6.3.2 Outcome Data

The process of care indicator outcomes is presented before the primary economic outcome TISS-28unit day score as any change in practice (implemented process of care) would have an effect on the TISS-28 outcome (Hanekom et al., 2012).

6.3.2.1 Process of Care Indicator Outcomes

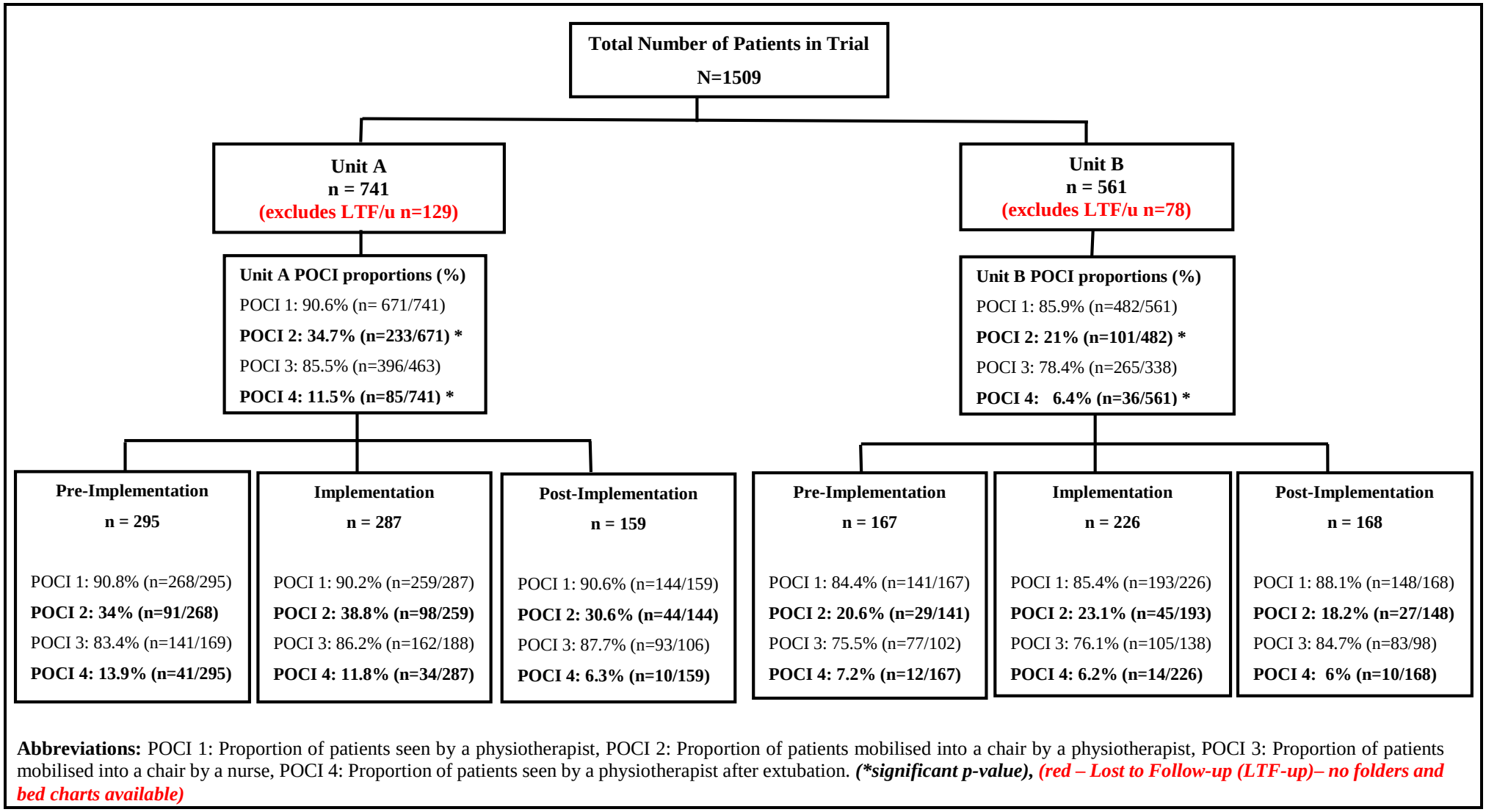
The proportion of patients receiving each process of care and the effect of the intervention on the likelihood of receiving the process of care compared between units within phases and within units between phases is described. This is followed by a description of the time to process of care and the effect of the intervention on time to process of care.

i) Process of Care Indicator (POCI) Proportions:

Difference in POCIs Between Units: Figure 6.3 presents the POCI proportions per unit per phase. There was no difference in the proportion of patients who received physiotherapy after ICU admission (POCI 1, p=0.44) and after being extubated (POCI 3, p=0.12) between Unit A and B [Figure 6.3]. The majority (>85%) of patients received physiotherapy in both Units. A significantly higher proportion of patients in experimental Unit A (34.7%) were mobilised to the chair by the physiotherapists (POCI 2, p<0.0001) and (21%) by the nurses (POCI 4, p=0.003) than in Control Unit B. Almost double the amount of patients were mobilised by the physiotherapists and nurses in Unit A compared to Unit B [Figure 6.3].

ii) Effect of the Intervention on POCI Proportions:

Patients admitted to experimental unit A were 1.6 times (95%CI: 1.03 - 2.6, p=0.04) more likely to have contact with the physiotherapists after ICU admission (POCI 1), 1.8 times (95%CI: 1.2 - 2.5, p=0.002) more likely to be mobilised into a chair by the physiotherapists (POCI 2) and 2.1 times (95% CI: 1.6 - 2.9, p<0.0001) more likely to receive physiotherapy after extubation (POCI 3) than those admitted to Unit B at baseline (pre-implementation) after adjusting for confounders. The likelihood of patients being mobilised to a chair by the nurse (POCI 4) in the experimental unit A (adj. OR: 1.1, 95% CI: 0.67 - 1.81, p=0.71) was the same as unit B at baseline (pre-implementation) after adjusting for confounders.



Abbreviations: POCI 1: Proportion of patients seen by a physiotherapist, POCI 2: Proportion of patients mobilised into a chair by a physiotherapist, POCI 3: Proportion of patients mobilised into a chair by a nurse, POCI 4: Proportion of patients seen by a physiotherapist after extubation. ***(*significant p-value), (red – Lost to Follow-up (LTF-up)– no folders and bed charts available)***

Figure 6.3 Process of Care Indicator Proportions per Unit per Phase

There was however, no effect of the intervention on the likelihood of patients receiving physiotherapy after ICU admission in the implementation [adj. OR 0.9, 95%CI: 0.6 - 1.5, p = 0.76] and post implementation [adj. OR 0.9, 95%CI: 0.5 - 1.5, p = 0.62] phase regardless of Unit after adjusting for confounders. There was also no effect of the intervention on the likelihood of patients receiving physiotherapy mobilisation into a chair after ICU admission in the implementation [adj. OR 1.1, 95%CI: 0.8 - 1.5, p = 0.53] and post implementation [adj. OR 0.8, 95%CI: 0.6 - 1.2, p = 0.40] phase regardless of Unit after adjusting for confounders. The intervention had no effect on the likelihood of patients receiving physiotherapy after extubation in the implementation [adj. OR 1.3, 95%CI: 0.98 - 1.7, p = 0.07] and post implementation [adj. OR 1.3, 95%CI: 0.94 - 1.8, p = 0.11] phase and no effect on the likelihood of patients being mobilised to a chair by the nurse in the implementation [adj. OR 0.9, 95%CI: 0.6 - 1.4, p = 0.72] phase regardless of Unit after adjusting for confounders. However, there was a higher likelihood of patients in unit A (adj. OR 0.5, 95% CI: 0.3 - 0.9, p=0.03) being mobilised to a chair by the nurse than in Unit B in the post implementation phase after adjusting for confounders. The intervention did not result in a change in physiotherapy practice in the experimental Unit A in the implementation phase compared to baseline and the control unit B after adjusting for confounders.

iii) Process of Care Indicators

The POCIs are presented as medians (50^{th} percentile) and interquartile ranges (IQR) in units of time in hours. We present the crude analysis of the time to process of care (POC) showing the median hours (IQR) for time to process of care between phases within units without adjustment for unit and phase nor adjustment for confounders [Table 6.5]. In experimental Unit A, the median time from ICU admission to first physiotherapy contact (POCI 1) was significantly higher in the post-implementation compared to the implementation phase. The intervention had no effect on the other time to process of care outcomes in the implementation and post-implementation phase compared to the pre-implementation phase in experimental Unit A. There was no change in processes of care during the study trial in control Unit B [Table 6.5].

Table 6.5 Process of Care Indicator Outcomes for Unit A and B ***(*significant p-value)***

Experimental Unit A				
Phase **Outcome** Time in Hours (median and IQR)	**Pre-Implementation** (median and IQR)	**Implementation** (median and IQR)	**Post-Implementation** (median and IQR)	**p-value**
POCI 1: Time to first physiotherapy contact	19 (14.1-30.8)	17.8 (13.5-22.3)	*****19.8 (14.7-39.7)	***0.025**
POCI 2: Time to first physiotherapy mobilisation to chair	83.2 (42-159)	83.5 (42.4-191.8)	134.4 (60-257.7)	0.12
POCI 3: Time to first physiotherapy contact after extubation	20.3 (4.5-23)	19.7 (8.4-23.2)	19 (3.8-22.5)	0.65
POCI 4: Time to first nurse mobilisation to chair	106.2 (39.3-251)	90.2 (41-182.7)	52.5 (41.5-86.8)	0.34
Control Unit B				
Phase **Outcome** Time in Hours (median and IQR)	**Pre-Implementation** (median and IQR)	**No Implementation** (median and IQR)	**Post-Implementation** (median and IQR)	**p-value**
POCI 1: Time to first physiotherapy contact	16 (11.7-30)	15.5 (11.5-23)	14.5 (11.2-23.8)	0.18
POCI 2: Time to first physiotherapy mobilisation to chair	86.5 (52.5-209.75)	77.3 (44.1-136)	60 (34-113.7)	0.34
POCI 3: Time to first physiotherapy contact after extubation	20.7 (18-22.1)	19.7 (16.5-21.8)	20.8 (16.8-22.1)	0.39
POCI 4: Time to first nurse mobilisation to chair	78.5 (44.3-190.5)	78 (37.6-141.5)	35.5 (23.5-51)	0.08

iv) Effect of the Intervention Process of Care Indicators (effect on waiting time):

Patients in Unit A waited a significantly longer time for their first physiotherapy contact after ICU admission (POCI 1) than patients in Unit B at baseline (pre-implementation phase) [Table 6.6]. Being in the experimental unit in the implementation phase (phase 2) resulted in a significantly longer time to first physiotherapy contact (POCI 1) following ICU admission compared to the pre- implementation phase (phase 1) in Unit A and the pre- and implementation (phase 2) phases in control Unit B [Table 6.6]. Patients in experimental Unit A in the post-implementation phase (phase 3) had a significantly longer time from ICU admission to first nurse mobilisation to the chair (POCI 4) compared to baseline and patients in control unit B in all three phases [Table 6.6]. There was no change in time from ICU admission to first physiotherapy mobilisation into a chair (POCI 2) and extubation (POCI 3) to physiotherapy contact post-extubation regardless of unit and phase [Table 6.6]. The intervention therefore did

not result in change in physiotherapy practice in the surgical ICU with regards to the timing of process of care indicators after ICU admission.

Table 6.6 Effect of Implementation Process on Time to Process of Care

Main Effects Model					
Process of Care Indicators (n = observations)	**Variable**	**Hazard Ratio**	**Robust Standard Error**	**95% Confidence Interval**	**p-value**
POCI 1: Time to first physiotherapy contact **(n=1153)**	Unit A (phase 1)	0.8	0.05	0.7 - 0.9	**<0.0001**
	Phase 2	1.2	0.08	1.0 - 1.4	**0.02**
	Phase 3	1.1	0.08	0.9 - 1.3	0.37
POCI 2: Time to first physiotherapy mobilisation to chair **(n=334)**	Unit A (phase 1)	0.8	0.10	0.7 - 1.0	0.11
	Phase 2	0.9	0.11	0.7 - 1.1	0.19
	Phase 3	0.9	0.13	0.6 - 1.2	0.32
POCI 3: Time to first physiotherapy contact after extubation **(n=661)**	Unit A (phase 1)	0.9	.07	0.8 - 1.1	0.16
	Phase 2	1.0	0.09	0.9 - 1.2	0.83
	Phase 3	1.1	0.11	0.9 - 1.3	0.45
POCI 4: Time to first nurse mobilisation to chair **(n=120)**	Unit A (phase 1)	0.8	0.16	0.5 - 1.2	0.21
	Phase 2	1.0	0.21	0.7- 1.6	0.84
	Phase 3	2.5	0.69	1.4 - 4.3	**0.001**

6.3.2.2 Economic Outcome Therapeutic Index Scoring System 28

The TISS-28 analysis included the data of all patients admitted to each unit during the three phases of the study who remained in the unit for at least 24-hours. Patients included on the last day of the trial were followed up until discharge from the unit and therefore had all their TISS-28unit day scores recorded for the total ICU length of stay. The percentage (%) and number (n) of patients with TISS-28unit day scores and those patients without due to < 24-hour unit stays and patients lost to follow-up (missing TISS-28 scores) is presented in Table 6.7. presents. The calculated sample size of n=140 for each phase of the trial required for statistical power (80%) was obtained except in the control Unit B in the post-implementation phase (n=133) due to patients lost to follow-up [Table 6.7]. Unit A had more patients with TISS-28unit day scores than Unit B but, more patients lost to follow-up (missing TISS-28 scores) in the post-implementation phase than Unit B.

Table 6.7 Categories of TISS-28unit day Scores per Unit per Phase

Category	Unit A			Unit B		
	Pre-Implementation N=303	Implementation N=311	Post-Implementation N=256	Pre-Implementation N=182	Implementation N=256	Post-Implementation N=201
TISS-28 Score	86.1% (n=261)	83.9% (n=261)	55.9% (n=143)	77.5% (n=141)	66% (n=169)	66.2% (n=133)
<24-hours No TISS-28 Score	12.2% (n=37)	10% (n=31)	16% (n=41)	13.7% (n=25)	19.5% (n=50)	22.9 % (n=46)
Patients Lost to Follow-up	1.7% (n=5)	6.1% (n=19)	**28.1%** (n=72)	8.8% (n=16)	**14.5%** (n=37)	10.9% (n=22)

i) TISS-28unit Day Score Proportions:

Between Units: Unit A was 30 % less likely to have patients with no TISS-28unit day scores due to < 24-hour unit stays and patients lost to follow-up combined ($p<0.001$) than Unit B.

ii) Within Experimental Unit A between Phases: In the implementation phase (phase2) Unit A was 23% more likely ($p=0.05$) to have patients with no TISS-28unit day scores due to <24-hour unit stays and patients lost to follow-up combined than the pre-implementation (phase 1). Unit A was 114% more likely ($p<0.001$) to have patients with no TISS-28unit day scores due to <24-hour unit stays and patients lost to follow-up combined, in the post-implementation phase (phase 3) than the pre-implementation (phase 1).

ii) Effect of the Intervention on TISS-28 Unit Outcomes

The adjusted TISS-28unit day score increased on average by 0.05 units per week from the pre-implementation phase starting on 11.03.2015 [Table 6.8]. Being in Unit A in the implementation (phase 2) and post-implementation (phase 3) phase resulted in an average of 2.3 TISS-28units (24.9minutes; $p=0.004$) and 3.9 TISS-28units (41.3minutes, $p<0.001$) higher than the pre-implementation (phase 1) phase in Unit A and all phases in control Unit B [Table 6.8]. Therefore, there was no effect of the intervention on the TISS-28unit outcome with no reduction in nursing workload in experimental unit A.

Table 6.8 Effect of the Implementation Process on TISS-28unit Day Scores

Interaction Effects Model				
Variable	**TISS-28 unit Co-efficient**	**Robust Standard Error**	**95% Confidence Interval**	**p-value**
TISS-28 week	0.05	0.03	-0.005 - 0.1	0.08
Unit A (phase 1)	-2	0.6	-3.2 – [-0.7]	0.002
Phase 2	-0.6	0.8	-2.3 - 1.1	0.47
Phase 3	-2.9	1.4	-5.6 – [-0.1]	0.04
A unit#				
A#2	2.3	0.8	0.7- 3.8	0.004
A#3	3.9	0.9	2.2 - 5.6	<0.0001
Gender: Male	0.8	0.4	0.1 - 1.5	0.02
APACHE II	0.2	0.02	0.1 - 0.2	<0.0001
Emergency: Yes	0.8	0.4	0.07 - 1.5	0.03
Infective: 2	-1.1	0.5	-2.2- [-0.09]	0.03
3	-0.02	0.8	-1.6 - 1.6	0.98

6.3.2.3 Clinical Outcomes

i) Between Units: Experimental Unit A had a significantly longer hospital LOS, fewer failed extubations and lower ICU mortality at baseline (pre-implementation) when compared to control Unit B [Table 6.9]. Unit A also had a significantly longer ICU LOS and lower ICU mortality when compared to Unit B in the implementation phase. However, in the post-implementation phase Unit A had a significantly longer ICU and hospital LOS but a significantly lower proportion of mechanically ventilated patients and lower ICU and hospital mortality when compared to Unit B [Table 6.9].

Table 6.9 Clinical Outcomes: Difference between Units per Phase

Variables per Phase	Unit A (Experimental)	Unit B (Control)	p-value
PRE-IMPLEMENTATION PHASE	***N=303***	***N=182***	
OUTCOMES			
• *ICU LOS* (median days)	3.8	2.9	0.11
• *Hospital LOS* (median days)	16.9	14.4	0.04
• *MV Proportion* (proportion, %)	67.3% (n=204/303)	72.5 % (n=132/182)	0.23
• *MV Time* (median days)	5.7 (n=169)	5.5 (n=102)	0.54
• *Proportion of Failed Extubations*	12.4% (n=23/169)	24.5% (n=25/102)	0.01
• *ICU Mortality* (proportion, % Y)	5% (n=15/303)	15.4% (n=28/182)	<0.0001
• *Hospital Mortality* (proportion, % Y)	4.2% (n=12/288)	7.8% (n=12/154)	0.11
IMPLEMENTATION PHASE	***N=311***	***N=256***	
OUTCOMES			
• *ICU LOS* (median days)	3.9	2.7	<0.0001
• *Hospital LOS* (median days)	16.2	14.7	0.08
• *MV Proportion* (proportion, %)	67.5% (n=210//311)	66.8% (n=171/256)	0.85
• *MV Time* (median days)	6.9 (n=188)	6.6 (n=138)	0.53
• *Proportion of Failed Extubations*	17.6% (n=33/188)	16.7% (n=23/138)	0.83
• *ICU Mortality* (proportion in % Y)	5.1% (n=16/311)	14.1% (n=36/256)	<0.0001
• *Hospital Mortality* (proportion, % Y)	5.5% (n=17/311)	6.3% (n=16/256)	0.50
POST-IMPLEMENTATION PHASE	***N=256***	***N=201***	
OUTCOMES			
• *ICU LOS* (days)	3.1	2.6	<0.0001
• *Hospital LOS* (days)	18.6	12.1	0.0003
• *MV Proportion* (proportion, %)	49.2% (n=126/256)	61.7% (n=124/201)	0.008
• *MV Time* (days)	4.4 (106)	4.2 (98)	0.46
• *Proportion of Failed Extubations*	10.4% (n=11/106)	11.2% (n=11/98)	0.85
• *ICU Mortality* (proportion, % Y)	5.5 % (n=14/256)	16.9% (n=34/201)	<0.0001
• *Hospital Mortality* (proportion, % Y)	2.3% (n= 6/256)	5.5% (n=11/201)	0.04

ii) Between Phases within Units:

Unit A: The proportion of patients intubated on ICU admission did not change significantly from the pre- to implementation phase of the trial in this unit [Table 6.10]. However, in the post-implementation phase there was a significant reduction in the proportion of patients intubated. There was a significantly higher proportion of failed extubations in the implementation phase than the post-implementation phase in this unit [Table 6.10]. There was no difference in ICU and Hospital LOS and mortality between the phases in Unit A and therefore no effect of the intervention on these outcomes [Table 6.10].

Table 6.10 Clinical Outcomes: Difference between Phases within Units *(*significant p-value)*

Experimental Unit A				
Variables per Phase	Pre-Implementation Phase	Implementation Phase	Post-Implementation Phase	p-value
OUTCOMES	***N=303***	***N=311***	***N=256***	
• *ICU LOS* (median days)	3.8 [2-7.2]	3.9 [2.1-7.4]	3.1 [1.9-7.6]	0.28
• *Hospital LOS* (median days)	16.9 [10.1-28]	16.2 [9.8-29.8]	18.6 [9.9-31]	0.48
• *MV Proportion* (proportion, %)	67.3%	67.5%	*49.2%	<0.0001
• *MV Time* (median days)	1.72 [0.8-3.7]	1.56 [0.6-3]	0.95 [0.6-4]	0.18
• *Proportion (%) of Failed Extubations*	13.6%	*17.6%	10.4%	0.02
• *ICU Mortality* (proportion, % Y)	5%	5.1%	5.5 %	0.96
• *Hospital Mortality* (proportion, % Y)	4.2%	5.5%	2.3%	0.17
Control Unit B				
Variables per Phase	Pre-Implementation Phase	Implementation Phase	Post-Implementation Phase	p-value
OUTCOMES	***N=182***	***N=256***	***N=201***	
• *ICU LOS* (median days)	2.9 [1.8-7]	2.7 [1.5-5.7]	*2.6 [1.4-4.7]	*0.02
• *Hospital LOS* (median days)	14.4 [6.8-27.6]	14.7 [7.8-30.7]	12.1 [6.2-24.8]	0.52
• *MV Proportion* (proportion, %)	72.5%	66.8%	*61.7%	*0.08
• *MV Time* (median days)	1.65 [0.7-3.4]	1.39 [0.6-2.8]	1.12 [0.6-1.9]	0.11
• *Proportion (%) of Failed Extubations*	24.5%	16.7%	*11.2%	*0.02
• *ICU Mortality* (proportion, % Y)	15.4%	13.6%	16.9%	0.70
• *Hospital Mortality* (proportion, % Y)	7.8%	6.3%	5.5%	0.92

Unit B: ICU LOS, proportion of mechanically ventilated patients and proportion of failed extubations were significantly lower in the post-implementation phase than the pre-implementation phase with no difference between the implementation and post-implementation phase [Table 6.10].

Effect of the Intervention on Clinical Outcomes:

The likelihood of hospital mortality (deaths) in experimental Unit A (adj. OR 0.7, 95%CI: 0.4 - 1.3, p=0.21) was the same as the likelihood in control Unit B, with no difference in the implementation (adj. OR 1.1, 95%CI:0.6 - 2, p = 0.78) and post-implementation phase (adj. OR 0.6, 95%CI: 0.3 - 1.3, p=0.20) after adjusting for confounders.

Patients in the experimental Unit A were less likely (adj. OR 0.07, 95%CI: 0.03 - 0.20, p<0.0001) to die in the ICU than patients in control unit B at baseline (pre-implementation) while adjusting for confounders but, there was no difference in the likelihood of dying in the ICU between Unit A and control Unit B in the implementation (adj. OR 1.22, 95%CI: 0.59 - 2.52, p=0.59) and post-implementation (adj. OR 1.5, 95%CI: 0.72 - 3.14, p=0.28) phase while adjusting for confounders.

Patients in the experimental unit A were more likely to be intubated (adj. OR 1.8, 95%CI: 1.3 2.6, p<0.0001) than those in control Unit B, with no difference in the likelihood of being intubated during the implementation (adj. OR 1.1, 95%CI: 0.8 - 1.5, p=0.68) and post-implementation (adj. OR 1.2, 95%CI: 0.8 - 1.7, p=0.39) phase while adjusting for confounders.

There was no difference in the likelihood for extubated patients failing extubation in experimental unit A (adj. OR 0.9, 95%CI: 0.5 - 1.6, p=0.74) than control Unit B and similarly in the implementation (adj. OR 1.2, 95%CI: 0.8 – 2, p=0.39) and post-implementation (adj. OR 0.6, 95%CI: 0.3 - 1.2, p=0.15) phases while adjusting for confounders.

The intervention therefore, did not have an effect on these clinical outcomes of the patients.

6.3.3 Safety of Physiotherapy Intervention

6.3.3.1 Adverse events

No adverse events related to unplanned extubation, dislodgement of lines, hemodynamic instability, pulmonary instability, falls and other events during physiotherapy mobilisation of patients into a chair was documented in any of the physiotherapy notes for the entire sample of patients mobilised into a chair (n=334) by the physiotherapists in both units.

6.3.4 Implementation Fidelity

The attendance of physiotherapists to the implementation sessions was overall very good and thus exposure to each of the implementation strategies and the protocol was high [Table 6.2, p 137-138]. Although 100% of the physiotherapists received the paper-based and electronic copy of the handbook, pocket cards and had access to the posters displayed, it is not known how many physiotherapists used these resources and the frequency of use. The majority (81-86%) of the physiotherapists attended the workshops and 76% attended the grand rounds/bedside

teaching sessions [Table 6.2, p140-141]. Therefore, the majority of physiotherapists were exposed to the implementation process and each of the implementation strategies and therefore the protocol. Reasons for those who did not attend the workshops or grand rounds/bedside teaching sessions were sick leave, staff leave, community service physiotherapist who was no longer with the department at the time of the grand rounds/bedside teaching sessions and administrative meetings that could not be cancelled.

6.4 Discussion

The tailored best-practice multifaceted educational implementation strategy combined with reminders (intervention) achieved a high level of fidelity in the group of physiotherapists targeted to implement the validated evidence-based physiotherapy protocol in the experimental ICU. The majority of targeted physiotherapists completed the implementation process, but the intervention was not effective in facilitating uptake of and adherence to the protocol and change in physiotherapy practice within the experimental surgical ICU. There was no effect of the intervention on the process of care outcomes, TISS-28unit day scores nor clinical outcomes in the implementation and post-implementation phases when compared to the pre-implementation (baseline) phase in the experimental unit and all the phases in the control unit.

The findings of this trial does not correlate with other studies that indicate that multifaceted implementation strategies are more effective in improving process of care indicators in the ICU (Scales et al., 2013; Acolet et al., 2011; Horbar et al., 2004). The reported benefits of tailoring implementation strategies suggested to facilitate the effective uptake of evidence-based CPGs and protocols into clinical practice by Baker et al., (2015); Cahill et al., (2014); Wensing et al., (2014) and Sinuff et al., (2013) was not achieved in this study trial. Therefore, factors affecting the effectiveness of the tailored best-practice multifaceted implementation strategies on process of care, TISS-28unit day scores and clinical outcomes in this study trial must be explored. There is a need to understand why the tailored best-practice multifaceted implementation strategy, implemented in this group of physiotherapists providing services and patient care to the experimental ICU, was not effective in the uptake of and adherence to the protocol.

The surgical ICUs included in this trial were not randomised. The experimental unit was conveniently allocated to the intervention due to possible contamination of the experimental unit. A pilot trial of the ICU physiotherapy protocol was conducted in this unit in 2010 by

Hanekom et al. In this pilot trial, the mean time to first physiotherapy contact had improved following protocol care and was significantly less ($p<0.001$) in the protocol phase than the usual care phase. The mean time to first physiotherapy contact after ICU admission in the usual care phase provided by the ICU physiotherapy staff ("real world") was 27 (SD +/-20) hours versus 14 (SD +/-7) hours in the protocol care phase administered by research physiotherapists. In this CBA trial median time to process of care was reported due to the skewed distribution of this data. The findings of the CBA trial suggested that there was a non-significant decrease in median time from unit admission to first physiotherapy contact from pre- to implementation phase but a significant increase from implementation to post-implementation phase.

It could be argued that the improvement in the pilot trial by Hanekom et al., (2012) may have been sustained resulting in a higher baseline rate for the time to first physiotherapy contact after ICU admission process of care indicator measured in the experimental unit at the start of the CBA trial. Therefore, any change in time to first physiotherapy contact in the implementation phase would not show any significant change and therefore no effectiveness of the intervention. Therefore, it must be taken into account that the standard of care may have improved and that already high baseline adoption rates of the process of care indicators could result in minimal effect of change following implementation. This explanation is substantiated by Sinuff et al., (2013) and Scales et al., (2011, p.370) who reported that "internal improvements had created a higher baseline adoption rate". Study participants in the qualitative study by Scales et al., (2011) reported that they were already working on improving the particular care processes when the project had started. Therefore, any effect of change would not show any significance (Sinuff et al., 2013; Scales et al., 2011).

The effect of "a rising tide" or a "positive secular trend" reported by Chen, Hemming, Stevens & Lilford (2016) could also be a plausible reason for the null effect of the intervention explaining the CBA trial findings. Chen et al, (2016) explains this effect, where changes are occurring simultaneously due to pressures in health systems to change practice, while research studies with similar aims are being conducted results in a null effect of the intervention. Another factor that must be taken into account, is the Hawthorne effect. The physiotherapists awareness of being observed and evaluated in the control unit, may have altered their behaviour and improved their overall practices and standard of care during the trial period, that could influence the findings of the CBA trial.

Physiotherapy in the intensive care is safe and effective and can improve patient outcomes such as physical function and quality of life (Green, Marzano, Leditschke, Mitchell, & Bissett, 2016). A noteworthy finding of the CBA trial was that >85% of patients in both units had physiotherapy contact after ICU admission. A one-day point prevalence study conducted in Germany by Nydahl et al., (2014) reports that a total of 24% of 783 patients admitted to 116 ICUs were mobilised (sitting over the edge of the bed or higher levels of mobility). Nydahl et al., (2014) reported 8% of intubated (endotracheal tube) patients, 39% with tracheostomies and 53% with non-invasive ventilation were mobilised in these units. In Australia and New Zealand, they reported 0% of intubated (endotracheal tube) patients being mobilised (Green et al., 2016; Berney et al., 2013). In the current CBA trial, almost 35% of the patients seen by the physiotherapists in the experimental unit were mobilised out into a chair that was significantly almost twice as many patients mobilised by the physiotherapists in the control unit. Although there was a 4% increase in the proportion of patients mobilised to the chair by the physiotherapists from pre- to implementation phase in the experimental unit, this difference was not significant with no effect of the intervention. This again supports the argument that the experimental unit was already functioning at a "high" level and possibly working on improving quality of care before the start of the CBA trial thus negatively affecting the effectiveness of the intervention (Chen et al., 2016). Although patients in both the units were mobilised to sit over the edge of the bed we did not document this level of mobilisation by the physiotherapist. The proportion of or time to sitting over the edge of the bed following ICU admission could have provided a more discriminative measure for physiotherapy practice change due to the timing of different levels of mobilisation activities that can improve patient outcome over time. Therefore, it can be argued that there may have been changes in patient management and outcome that was not or could not be measured (Chen et al., 2016) that may have influenced the trial findings and effectiveness of the intervention positively.

There was no effect of the intervention on time from ICU admission to first physiotherapy or nurse mobilisation to a chair and time from extubation to physiotherapy treatment after extubation. In the "real world" public sector surgical ICU settings included in this CBA trial, the organisation, structure and functioning of the two surgical intensive care units and ICU physiotherapists may have had an effect on the clinical presentation of the patients and standard of care in each of the units. The latter could have had an effect on the CBA trial outcomes. Patients in the experimental unit are admitted following stabilization and care in a resuscitation

unit versus patients in the control unit who are admitted directly to the unit. Patients in the experimental unit are discharged to the ward only once stable whereas, the control unit discharges patients to step down units then wards. These factors can affect time to particular process of care measures such as whether short stay (<24-hours) patients are able to be seen by the physiotherapist before discharge to other units or wards, whether patients are mobilised in either the ICU or other units or wards due to early discharge or discharge to step-down facilities therefore reducing the proportion of patients mobilised to the chair by the physiotherapist in the ICU.

Physiotherapists working in the units included in this trial are not exclusively allocated (no ward duties) or "dedicated" to the surgical intensive care as were the physiotherapists employed in the protocol phase of the pilot trial by Hanekom et al., (2012), but also have ward duties that increases their workload. This can affect the adoption of evidenced-based care processes that may be perceived as time consuming by the physiotherapist, opting for usual (standard) care instead. Stability of staff, specifically in the experimental unit may have affected the standard of physiotherapy care in the units as the physiotherapist in the experimental unit rotated during the implementation and post-implementation periods. The ICU physiotherapist in the experimental unit was replaced by a physiotherapist with minimal (one) years of ICU experience who worked in the experimental unit during part of the implementation and post-implementation phase of the trial. It has been reported that younger staff struggle to adjust to a new and demanding workplace, communicate with the healthcare team and advocate change or evidence-based practices due to a lack of skills, knowledge or experience (Price & Reichter, 2017). The control unit showed no change in the majority of outcomes over the trial phases and outcomes remained stable throughout the phases implying stability in the standard of care provided. The physiotherapist in the control unit worked in the unit throughout the period of the trial and therefore may have eliminated variation in practice resulting in this observed stability.

Staff rotations through the units on the weekend and the unit referral guidelines for patients seen on weekends could also potentially affect time to first physiotherapy contact and mobilisation following ICU admission and time to physiotherapy following extubation. Some patients may be missed by the physiotherapist due to patients being admitted and discharged over the weekend period outside of the times the physiotherapists are available. These patients

may only then be seen and treated in the ICU following the weekend or seen in the ward if ICU stay was <24-hours. Student physiotherapists work in both units as part of their academic training and were not exposed to the protocol in either unit that may have negatively impacted on the effect of the intervention. Therefore, organisational factors such as physiotherapy staff and student allocation to the ICU, workload and availability of ICU physiotherapy services could have affected uptake of and adherence to the protocol and should be explored through a post-implementation reflection described as a construct the process domain of the CFIR. Balas et al., (2013) implemented the ABCDE bundle in a tertiary ICU setting targeting the interdisciplinary ICU team. They evaluated factors affecting adherence using focus groups, online surveys and an educational evaluation (Balas et al., 2013). Balas et al., (2013) findings indicated that performing daily, interdisciplinary rounds, engaging key implementation leaders, educational efforts that are diverse and sustained and the quality and strength of the ABCDE bundle implemented were facilitators for adherence to the bundle. Balas et al., (2013) identified intervention related issues such as "*timing of trials*" and "*fear of adverse events*", *"communication and care coordination challenges"*, *"knowledge deficits"*, *"workload concerns"*, and *"documentation burden"* as barriers to bundle adherence. These factors may support the CBA trial findings and a reflection via qualitative exploration of the perception of the physiotherapists involved in the implementation process is recommended, to identify which of these factors may have influenced uptake of and adherence to the ICU physiotherapy protocol.

The primary outcome TISS-28unit day score was chosen based on the findings of the pilot trial conducted by Hanekom et al., (2012). Improved process of care should result in a reduction in nursing workload as measured by the TISS-28unit day score (Hanekom et al., 2012). The current study was sufficiently powered to detect a 2point difference in the TISS-28unit day scores as we were able to obtain more than 140 patients per phase of the trial except in the post-implementation phase in Unit B. The TISS-28unit day score however, did not show any significant improvements in nursing workload in the experimental unit during the implementation and post-implementation phase when compared to baseline (pre-implementation) and when compared to all phases of the control unit. The nursing workload in the experimental unit was significantly higher in the implementation and post-implementation phase compared to all phases in the control unit. Therefore, the intervention was not effective in reducing nursing workload in the experimental unit. This finding could be attributed to the

lack of adherence to process of care indicators in the experimental unit that affects nursing workload negatively through increased time being spent on patients in the ICU per 8hour shift. Therefore, it is argued that a lack of adherence to the protocol or minimal change in the adoption of process of care indicators could have resulted in a minimal effect on TISS-28unit day scores in the experimental unit with a null effect of the intervention.

According to Hanekom et al., (2012) shorter waiting time to physiotherapy after ICU admission and early mobility is linked to earlier removal of chest drains. Deep breathing exercises and increased mobility improves the management of secretions which reduces mechanical ventilation time therefore reducing the nursing workload with regards to managing mechanically ventilated patients (Hanekom et al., 2012). In the CBA trial conducted, the intervention did not affect the time to physiotherapy mobilisation into a chair and to physiotherapy after extubation (process of care indicators). Therefore, the longer waiting time would negatively affect patient outcome (reduced mobility, prolonged chest drains in situ and increased mechanical ventilation) and would thus influence the TISS-28unit day score and nursing workload in the experimental unit (Hanekom et al., 2012). Although severely ill (APACHE II) patients admitted to the experimental unit could explain the increased the TISS-28unit day scores in this unit, the APACHE II for the patients in the experimental unit were lower than the control group and does not provide this alternative explanation for our findings.

The effectiveness of the ICU physiotherapy protocol has been evaluated and has shown to improve clinical outcomes such as reduced intubation after ICU admission and a lower risk of failed extubations (Hanekom et al., 2012). It was found that the experimental unit was significantly more likely to have fewer intubations after ICU admission and failed extubations than the control at baseline (pre-implementation). Therefore, this already low intubation and failed extubation rate could explain the reduced effects of our intervention on these clinical outcomes with no significant change observed in the implementation (phase) within and between units. This does not elude to the ineffectiveness of the protocol but rather the lack of behaviour change even following the acquisition of new knowledge and skills. van de Veer et al., (2013) showed no improvements in clinical outcomes measured following implementation of a multifaceted implementation strategy in intensive care and supports the CBA trial findings. However, other studies conducted in intensive care show improvements in some clinical outcomes (Martin et al., 2004) and clinical outcomes specifically related to the clinical

guideline or protocol being implemented (Horbar et al., 2004) while other studies did not measure clinical outcomes (Acolet et al., 2011). Therefore, clinical outcomes may not be a reliable measure for evaluating the adoption of new practice and therefore practice change due to the heterogeneity of patients and protocols implemented, but rather process of care indicators that indicates adherence to the protocol and clinician performance. The use of process of care indicators is supported by Scales et al., (2011). Participants in the implementation study by Scales et al., (2011) reported that process of care measures were more appreciated than outcome measures because of the heterogeneity of patients.

The cost of the implementation process in this CBA trial (including workshop facilitator, educational materials, travel, stationary and food) were modest. However, the investment in time to partake in the implementation process for both implementer and targeted physiotherapists in a resource limited setting was questioned. The investment in implementation processes alone versus providing resources such as more staff or an exclusively allocated ICU physiotherapist to the ICU in order to facilitate change in practice and improved quality of care in a resource limited intensive care setting is therefore questioned. Lastly, professional behaviour in healthcare professionals is complex and is underpinned by social and behavioural frameworks (Johnson & May, 2015). Professional behaviour of healthcare professionals could affect implementation processes and change in practice (Johnson & May, 2015). Factors affecting professional behaviour in this group of targeted physiotherapists, who did not seem to adhere to the protocol and change practice, needs to be explored.

6.5 Conclusion

This is the first “real-world” physiotherapy implementation controlled before and after trail conducted in a public sector surgical ICU in SA. A tailored best-practice multifaceted implementation strategy (intervention) including an educational handbook on the protocol, workshop series, grand round/bedside teaching sessions and reminders was not effective in the uptake of and adherence to the protocol with no change in ICU physiotherapy practice in the experimental unit. Contextual factors affecting the implementation process, adherence to the protocol and therefore the effectiveness of the intervention needs exploration. Reflection on the implementation process by the targeted physiotherapists an activity of the process domain of the CFIR should be explored. An in depth qualitative enquiry of the perceptions of the physiotherapists of the “real world” implementation of the protocol, their perception of the

implementation process using the tailored best-practice multifaceted implementation strategy and factors affecting professional behaviour and adherence would be beneficial in further explaining and understanding the findings of this CBA trial. The latter may provide further insight to improve ICU implementation initiatives especially in ICU physiotherapy in ICUs in SA.

CHAPTER 7

Project Discussion

7.1 Preface

The study achieved its overall aim to implement and evaluate the tailored best-practice multifaceted implementation strategy to facilitate the uptake of a validated evidence-based physiotherapy protocol in a surgical ICU guided by the CFIR. The study was conducted in three phases with five study aims presented as five chapters in the dissertation. The findings of each study provided information that could be used to build the evidence-base for implementation research in ICU physiotherapy in a resource limited, transforming healthcare system and contribute to the overall understanding of the objective findings of the controlled before and after (CBA) trial study. Two additional objectives of phase three of the study project were addressed by Masters' students under the supervision of the Primary Investigator [FK] and are presented as addenda. These studies also contributed valuable information relating to the overall understanding of the objective findings of the CBA trial. An integrated discussion of the findings as they relate to the implementation of a physiotherapy protocol in a public sector ICU in SA is outlined in three parts according to the three study phases, highlighting new contributions to the body of knowledge on ICU physiotherapy and implementation science in a developing country.

7.2 Describing Physiotherapy in Public Sector Hospitals and ICUs in SA

7.2.1 Public Sector Physiotherapists

A 70% response rate, equally distributed across the provinces to the physiotherapy survey (Chapter 2) was obtained, limiting the bias of the survey results. It can be reported with confidence that the survey results are reliable and generalisable to public sector physiotherapists in SA that is a major strength of the survey. Public sector physiotherapy departments do exist in central, regional and tertiary hospitals that house ICU facilities which require physiotherapy services. The public sector physiotherapy departments are organised and run by qualified physiotherapists themselves which is believed to support and preserve the autonomy of the profession in the public sector. These departments are organised in a hierarchal manner using the traditional departmental model (Fischer et al., 2012). It has been reported in the literature that this particular model is more expensive using more resources due to a multi-level management system which was evident in the top down management style and ranking of

physiotherapy posts such as production level I ('junior') and II (senior"), Chief and Assistant Director reported in the survey. The departmental model of service delivery also increases the workload, with physiotherapists in the public sector having higher patient loads (Fischer et al., 2012). This has implications for optimum service delivery levels and quality of patient care with not all patients necessarily being able to receive physiotherapy daily (Fisher et al., 2012). Although the traditional departmental model allows for decision-making and quality assurance focussed on the best interests of the department as a whole (Fisher et al., 2012), the public sector physiotherapists should consider other service delivery models to improve services, patient care and outcomes.

Process-oriented programme management models described in the literature are associated with lower costs, clinical productivity that is higher than in departmental models and improved staff role integration as the model provides opportunities to expand leadership roles and promotes healthcare professional communication (Fisher et al., 2012). The process-oriented programme management model therefore could be considered as part of the restructuring of physiotherapy services to meet the healthcare demands in the resource limited healthcare setting in an attempt to save costs while providing and maintaining quality care (Fischer et al., 2012). In this model, physiotherapists would become part of the multidisciplinary team in the areas in which they provide services for example, the intensive care multidisciplinary team (Fisher et al., 2012) in which they would be able to lead and communicate among the ICU healthcare professionals and focus on the specific area of ICU care. Currently, there seems to be a fragmented service delivery system and lack of continuity of care where the public sector physiotherapists are allocated to multiple wards that may affect the timing of care provided to patients and also rotate through work areas quarterly which can contribute to variations in practice.

No previous studies have identified the ratio of physiotherapists to hospital beds in SA. In this physiotherapy survey 429 physiotherapists from the responding departments were identified which amounts to a physiotherapist to bed ratio of 1:69. This high ratio has implications for the availability and quality of services these public sector physiotherapists can provide. The 'Planning for Key Health Professional Categories' produced by the Department of Health in 2011 highlighted that the ratio of nurses to other categories, can enable reliable planning of the human resources for health for the country, based on evidence (Uys & Klopper, 2013). The latter can be applied to the physiotherapists working in the public sector as well. The findings

of the physiotherapy survey can be used by the public sector physiotherapists to present the current situation and needs of public sector physiotherapists to the healthcare managers, policymakers, and funders in SA in order to plan physiotherapy human resources and services more appropriately for improved provision of physiotherapy care to patients in SA.

The physiotherapists in the public hospitals are South African trained, young early-career physiotherapists, mainly in production ("junior') level posts, and mainly have Bachelor degrees and minimal or post-graduate training in intensive care physiotherapy. Research in nursing shows that young early-career healthcare professionals such as nurses need support and mentoring (Price & Reichert, 2017) while gaining experience to develop knowledge and skills especially in the public sector that is overburdened with patients who cannot afford private health care services (Unicef, South Africa, 2017). The nurses also reported that they considered that health care environments that provide or improve accessibility to continuing professional development (CPD) opportunities to ensure continuous growth in the nurses' practice and ability to provide optimal quality care for patients as a factor contributing to a healthy health care work environment (Price & Reichert, 2017). The latter may be true for the young early-career public sector physiotherapists as well and should be explored in order to address any requirements they have to grow in their practice and provide optimal quality care for patients as the survey findings indicate that minimal CPD activities are attended and post-graduate training is lacking.

7.2.2 Public Sector ICU Physiotherapists

The ICU physiotherapy survey in this study (Chapter 3) is different to the South African surveys conducted by van Aswegan & Lottering, et al., (2016) and van Aswegan & Potterton, et al., (2005). The findings of the current ICU survey provided a clear panoramic view of ICU physiotherapists working in the public sector. The current ICU physiotherapy survey was targeted to the physiotherapists providing services to the specific ICUs at the time of the survey regardless of years of ICU work experience and CPRG SASP society membership that was used as sampling criteria by van Aswegan & Lottering, et al., (2016) and van Aswegan & Potterton, et al., (2005). van Aswegan & Lottering, et al., (2016) and van Aswegan & Potterton, et al., (2005) included both public and private ICU physiotherapists with results not always clearly differentiated between the two sectors of ICU physiotherapists. The current ICU physiotherapy survey provided additional information on service provision, including time

spent in the ICU, patient care and prescription of patient care as well as the use of evidence-based CPGs and protocols and outcomes, discharge planning and follow-up not included in the South African surveys (van Aswegan & Lottering, et al., 2016; van Aswegan & Potterton, et al., 2005) nor some international surveys (Sigera et al., 2016, Malone et al., 2015, Kumar et al., 2007; Norrenberg & Vincent, 2000). Similar to the South African surveys, a low response rate of 34% was obtained but in contrast to those surveys, the current survey obtained responses from all provinces in the country (van Aswegan & Lottering, et al., 2016; van Aswegan & Potterton, et al., 2005). The response rate from the current ICU physiotherapy survey was higher than some international studies, for example 29% by Malone et al., (2015) and 22% by Norrenberg & Vincent, (2000).

The lack of knowledge, skills and expertise are factors influencing physiotherapy activity in ICUs and can contribute to variations in practice and patient outcome (Malone et al., 2015; Kumar et al., 2007; Norrenberg & Vincent 2000). The ICU Physiotherapists working in the public sector were early-career physiotherapists, with mainly Bachelor degrees. They had minimal years (1-5years) of ICU work experience and minimal to no ICU post-graduate training yet, had to provide services to these complex and dynamic units, to critically ill patients. These findings were similar to the public sector ICU physiotherapists in Sri Lanka, a developing country (Sigera et al., 2016). There is clearly a need to upskill and train these young ICU physiotherapists in order to improve knowledge and skills through post-graduate ICU training and specialisation. However, only providing such training does not necessarily address the problem. The reason for the lack of attendance of ICU CPD and post-graduate training courses by the South African public sector ICU physiotherapists needs to be explored as the reasons may be more complex than just the availability of ICU CPD and post-graduate training courses.

Another area requiring exploration is the use of available evidence-based ICU outcome measures. The majority of ICU physiotherapists in the public sector do not use evidence-based functional or HRQoL outcomes and rely on physiological measures such as lung auscultation and saturation of oxygen levels in the blood. As early as 2007, Hanekom, Faure & Coetzee, reported that critical care specialists recognise outcomes research as i) "*a cost-effective method of determining what works in the real world"* and that ii) *"outcomes measured must be relevant to patients, families, and funders"*. Hanekom et al., (2007) stated: "*Outcomes research is a method that has been used to obtain evidence for the medical and respiratory management of*

patients in ICU." and *"Outcomes research provides researchers with the tools to define the role of the physiotherapist in the critical care environment.*" The findings of our survey, ten years later still indicate the inclusion of physiological outcomes as the primary outcome of interventions rather than patient-centred functional and HRQoL outcomes by ICU physiotherapists in the public sector in SA therefore, lacking support for their role in the ICU (Kumar, 2015; Gosselink et al., 2008). The reasons for the lack of use of evidence-based patient-centred outcomes in the public sector need to be explored and should be addressed through improved knowledge, training in the use of these outcomes and any other reliable methods to improve this area of ICU physiotherapy practice.

While the findings of the ICU physiotherapy survey indicated variations in public sector ICU physiotherapy services and practice, they are on par with some international ICUs in both developed and developing countries (Sigera et al., 2016; Malone et al., 2015; Yeole et al., 2015; Kumar et al., 2007; Norrenberg &Vincent, 2000). Public ICU physiotherapy services vary with regards to staff rotations through the ICU which are mainly quarterly while some are biannually or yearly. While an average of one physiotherapist to eight beds were calculated based on the survey responses, the physiotherapists also had ward patients to cover. Malone et al., 2015 reports 5.4 to 7.5 physiotherapists per one hundred ICU beds amounting to 1:18/1:14 physiotherapists to ICU bed ratio. While few ICU physiotherapists assess and treat all ICU patients, the majority work on a referral basis from the doctor influencing the autonomy and first line practitioner status of South African physiotherapists in this area (Unger, 2010). However, in Australia, most physiotherapists initiate assessment and treatment without referral from the medical and/or nursing staff (Berney et al., 2012). While some ICU physiotherapists in SA provided weekend and "on call/call out" services, others provided none due to reduced or no remuneration for these services as reported by the ICU physiotherapists. Some ICU physiotherapists were exclusively allocated to the ICU (with no ward duties), while others had to provide physiotherapy services to the ward and in some ICUs a variety of physiotherapists worked in the unit on a daily basis. These differences in workload allocations can contribute to the lack of time available to spend on patient treatment in the ICU. The majority of physiotherapists reported spending less than 25% of their time in the ICUs in the week and on weekends and on average see patients once a day. Although the frequency of patient treatments is on par with most international findings, (Sigera et al., 2016; Malone et al., 2015; Kumar et al., 2007; Norrenberg & Vincent, 2000), the amount of time spent in the ICU treating patients

seems inadequate although, there are no surveys that included the proportion of time spent in the ICU and wards to compare our findings to.

Evidence for early assessment and treatment of ICU patients using early mobilisation and rehabilitation has proven to be safe and reduce ICU–acquired muscle weakness and mechanical ventilation thus reducing the complications related to prolonged ventilation (Stiller, 2013). Although the majority of ICU physiotherapists reported using evidence-based mobilisation and rehabilitation protocols in the intensive care setting they spent less than half (<50%) of their time performing these activities. Information on the proportion of time spent on mobilisation and rehabilitation activities is not available in the current literature. These findings have implications for best-practice physiotherapy patient care and outcomes. Unlike other developed and developing countries (Sigera et al., 2016; Malone et al., 2015; Kumar et al., 2007; Norrenberg & Vincent, 2000), public sector ICU physiotherapists in SA are minimally involved in ventilatory activities such as manual hyperinflation, incentive spirometry, weaning and controlling ventilator settings. Whether this is due to a lack of knowledge and skill or availability of equipment needs to be explored in order to improve physiotherapy services and care. The survey also highlighted that the physiotherapists input into discharge planning is lacking, that implies a lack of involvement in team decisions around patient care and needs to be addressed as physiotherapists should have the skills to determine readiness of the ICU patient for discharge to the ward or home. The finding highlights the lack of role definition of the ICU physiotherapist in the ICU team in the public sector ICUs in SA.

In summary, the findings of the ICU physiotherapy survey suggested that the public sector physiotherapists may not be able to effectively implement and adhere to evidence-based CPGs and protocols due to the nature of the organisation and structure of physiotherapy services, workload, training, experience and skills that support the findings of the CBA trial where a lack of adherence to the ICU physiotherapy protocol was identified. There is a need to improve human resources for physiotherapy in the South African public health care sector as evidence has shown physiotherapy to improve patient clinical, functional and HRQoL outcomes and reduced costs. A ‘dedicated’ ICU physiotherapist (exclusively allocated with no ward duties) with non-specific ICU training adhering to protocol or best-practice care has been shown to provide improved patient outcomes and reduce costs in a resource limited surgical ICU in SA (Hanekom et al., 2012) and must be advocated strongly by public sector physiotherapists in

order to improve service delivery, patient outcomes and cost-effectiveness in the public sector ICUs in SA.

7.3 The Effectiveness of Implementation Strategies in the ICU

The review is one of the first reviews synthesizing the evidence for evaluations of implementation processes in intensive care settings using RCT, CCT, CBA, ITS study designs. The evidence provided from the review is useful to implementation researchers and ICU healthcare professionals and can be used to implement CPGs and protocols into ICU practice. Few ICU implementation trials are available and only 9 trails were included in the review. These included trials were recently published between 2000 and 2013 highlighting that the use of implementation strategies in ICU experimental trials is a somewhat recent development. No controlled before and after trials were available in the retrieved studies. Furthermore, the review yielded no implementation trials conducted in resource limited ICUs in developing countries and studies available were limited to ICU healthcare professionals such as physicians, nurses, respiratory therapists and dieticians with no ICU physiotherapy implementation trials, highlighting a gap in the evidence.

The strategies identified in the included studies such as education, audit and feedback, reminders, support, local opinion leaders and champions implemented in the ICU were similar to those reported in other implementation studies in other health care settings (Sinuff et al., 2009; Grimshaw et al., 2006; Grimshaw et al., 2004). Additional implementation strategies not highlighted in other areas of implementation research were clinical multidisciplinary/quality improvement team and plan and communication and case discussion such as telemedicine used to create a network of ICUs implementing six different practices. This unique implementation strategy using "telecommunication" described by Scales et al., (2011), was found to be a useful educational medium however, it was still difficult for the ICU healthcare professionals to attend the education sessions. This type of strategy may be useful in our setting where ICUs spread across the country can network however, in our resource limited public health care sector a telecommunication setup may take time to develop and was not practical for our study trial.

In the ICUs, different protocols were implemented with different outcomes linked to these protocols. Using different outcomes to measure the overall effectiveness of implementation strategies makes comparisons challenging. The majority of studies used process of care

indicators as a measure of outcome and practice change as clinical outcomes differed due to the heterogeneity of patients and many studies therefore reported no effect of the implementation strategy on clinical outcome. A measure of overall effectiveness of implementation strategies used in the ICU studies could be provided. The meta-analysis indicated that multifaceted strategies were more effective in improving process of care indicators than single implementation strategies. Only two studies could be included in the meta-analysis but they both had strong methodological designs with minimal risk of bias. Therefore, the meta-analysis provides robust information with regards to the strategy most effective in changing process of care indicator outcomes. However, a high percentage of heterogeneity which could be explained by the differences in process of care indicators measured needs to be noted.

Although it is now known that multifaceted strategies are more effective than single implementation strategies in improving process of care outcomes in the ICU, it is still not known which particular combination of single strategies will effectively facilitate uptake of and adherence to the CPGs or protocols and change practice. Education and audit and feedback however, seems to be the common denominator and was used in the studies included in the meta-analysis however, the third strategy of their multifaceted implementation strategy differed still providing some uncertainty around effectiveness of implementation strategies. The review highlighted measures of implementation fidelity in evaluating implementation processes in the ICU. No measures of the cost of implementing the strategy nor cost-effectiveness of implementing the CPGs and protocols in the ICU was indicated in the included studies.

Implementation fidelity as a measure of the exposure to the targeted healthcare professionals to the implementation strategies or the CPGs or protocol contributed a new aspect to outcomes in implementation research and was not highlighted in reviews by Grimshaw et al., (2006), and Grimshaw et al., (2004) and was an important finding for use in our implementation trial. None of the studies in the review measured and evaluated objective outcomes of healthcare provider behaviour, knowledge, attitude and self-efficacy and this is a gap in the evidence that requires further study. This review also highlighted the use of qualitative findings in a RCT supporting the use of mixed method studies in which objective findings can be explained and understood that is an important aspect in implementation research. Qualitative evidence of potential factors modifying the effects of implementation process/strategy in the study by Scales et al., (2011) substantiated some of the objective findings in our controlled before and after ICU

physiotherapy implementation trial. None of the studies included in the review used any implementation frameworks although implementation frameworks are available in the literature and should be considered when implementing CPGs and protocols.

The review conducted formed part of the planning phase of the broader overall study for the implementation and evaluation of an implementation process for the uptake of and adherence to an ICU physiotherapy protocol in a surgical ICU. Using the findings of the review, informed decisions with regards to implementation strategies for the implementation of the ICU physiotherapy protocol in a surgical ICU could be made. However, it was questioned whether the implementation strategies would be appropriate for ICU physiotherapists implementing change in practice. The way physiotherapy services to the ICU are delivered, the complexity of ICU physiotherapy treatment and management and the multidisciplinary nature of ICU patient care may influence the strategies for implementation and adherence to physiotherapy CPGs and protocols in the ICU. Therefore, unit-specific tailoring of implementation strategies recommended in the literature was considered. Until evidence for the most effective combination of implementation strategies (multifaceted) can be found, other methods including tailoring can be explored by implementation researchers and healthcare professionals to improve the effectiveness of implementing evidence into ICU practice and changing ICU practice.

7.4 Physiotherapy Protocol Implementation guided by the CFIR in a Surgical ICU in SA

7.4.1 Use of the CFIR in ICU Physiotherapy Implementation

This “real world” ICU physiotherapy implementation trial guided by the CFIR is one of the first studies conducted in SA, a developing country with limited health care resources. It is significant in light of the planned implementation of the NHI in the country that intends to use CPGs and protocols to guide the provision of healthcare. Therefore, the findings of this implementation trial highlights what needs to be considered if CPGs and protocols are to guide health care provision specifically related to intensive care physiotherapy service provision in SA. New knowledge to the existing CFIR database in which no studies on ICU physiotherapy implementation studies using the CFIR in a developing country can be found to date is provided.

The CFIR presented a framework that could guide the implementation of the ICU physiotherapy protocol which was used as a vehicle for changing ICU physiotherapy practice. The use of the CFIR in the ICU has been minimally explored and this study provides evidence for its use in a resource limited ICU setting, in a developing country. The development, implementation and evaluation of the implementation process for the uptake of the ICU physiotherapy protocol in the surgical ICU was mapped out and structured using the domains of the CFIR including the activities of the process domain of the CFIR namely planning, engaging, execution, evaluation and reflection.

The domains of the CFIR were addressed in this study through determining the characteristics of the protocol for implementation in the targeted ICU and the identification and tailoring of the implementation strategies (inner setting) to the targeted unit as part of the planning and engaging activities. This process helped contextualize the implementation process for protocol implementation in the unit by determining the barriers and facilitators to implementation prior to implementation. The implementation of the protocol through the execution of the tailored best-practice multifaceted implementation strategy addressed the executing and evaluation activities of the process domain. The evaluation of the tailored best-practice multifaceted implementation strategy following the trial, addressed the summative evaluation described by the CFIR looking at specific objective measures. In order to improve the understanding of the objective findings of the trial, the reflection activity of the process domain using qualitative methods of enquiry provided information on the patient perceptions of physiotherapy care (outer setting construct patient needs and resources) and most importantly the perceptions of the physiotherapists of the implementation process addressing the 'characteristics of the individuals' domain of the CFIR

There are minimal studies that have used all the CFIR domains to address implementation processes and their outcomes compared to our CBA trial. The review by Kirk et al., (2016) highlighted that trials conducted in other health care settings, including one ICU-related trial, used the CFIR to determine barriers and facilitators to implementation among participants who already adopted and implemented CPGs and protocols thus identifying determinants of or factors affecting implementation post-hoc (Kirk et al., 2016). Therefore, this ICU trial adds a new perspective of using the CFIR both pre-, during and post- protocol implementation compared to those included in the review by Kirk et al., (2016) that mainly used the CFIR post-

implementation with minimal use of the CFIR during implementation and none pre-implementation. The use of the CFIR domains and constructs in the pre-implementation phase provides additional evidence to the body of CFIR research evidence. Using the CFIR in the pre-implementation phase allows barriers and facilitators to be addressed before the start of the implementation process. Although some of the barriers to the protocol and implementation strategies could be addressed through tailoring, it was not possible to change organisational structure and function of the physiotherapy department nor ICU and therefore the study presents implementation of the protocol in the "real world" setting.

The CFIR was found to facilitate logical and consistent terminology in the implementation process and allows information to be compared between studies through the use of consistent terminology. The latter has been identified as a problem in implementation research and was also noted in the review (Chapter 4) where it was found that implementation terminology was being used interchangeably in the included studies. This study supports the CFIR as a planning and evaluative framework for guideline implementation in the ICU setting.

7.4.2 Tailoring as part of the Planning and Engaging Activity

Tailoring the protocol and implementation strategies formed a part of our planning and engaging phase of the process domain of the CFIR and the characteristics of the protocol (Chapter 6) and inner setting (Chapter 5) domain respectively. The perception of the characteristics of the protocol was addressed in the implementation trial prior to implementation which is unique compared to other studies that evaluate this domain mainly post-implementation (Kirk et al., 2016; Balas et al., 2013). Only the unit intensivist, senior nurses and unit physiotherapist of the experimental ICU was included in this discussion regarding their perception of the characteristics of the protocol for implementation in the ICU, as part of the planning and engaging phase of the process domain of the CFIR. In hindsight, the entire physiotherapy unit should have been included in the exploration of their perception of the protocol. This realisation stemmed from the finding of the qualitative study on the perceptions of the protocol (Addendum 5). Physiotherapists perceived the protocol to be either a recipe or guideline and reported limitations to the application of some treatments such as mobilisation and rehabilitation due to workload and organisational issues and were not clear about the strength of the evidence and benefits of the protocol on patient outcome. However, it can be argued that this information may not have been provided pre-implementation as the protocol

was not yet known to all physiotherapists and would not have been applied prior to the implementation process, limiting their perception of the characteristics of the protocol pre-implementation.

In the experimental unit, in the CBA trial, the physiotherapists did not perform manual hyperinflation techniques as they were deemed to lack skill, nor have the correct and safe equipment for this procedure. The unit intensivist requested that this management technique be left to the doctors unless a trained and skilled physiotherapist who has time to stay with the patient throughout and after the procedure and has the correct equipment to provide this treatment modality safely would be made available. This information was supported by our survey findings (Chapter 3) indicating a lack of use of manual hyperinflation techniques by physiotherapists in the public sector ICUs and needs exploration. In international ICUs, physiotherapists are actively involved in the application of this technique (Sigera et al., 2016; Malone et al., 2015). The unit physiotherapist in the trial pointed out that due to workload and weekend referral guidelines the protocol may not be applied to all patients, all of the time. Therefore, the latter was an organisational limitation from the start of the implementation trial. Organisational factors therefore need to be addressed to improve physiotherapy implementation in the intensive care setting in the public sector, in SA.

The tailoring of the implementation strategies (Chapter 5) addressed the inner setting domain of the CFIR, described in our trial as tailoring unit-specific implementation strategies according to the structural characteristics of the physiotherapy department, their existing networks and communication, as well as implementation culture. Tailoring unit-specific implementation strategies was described in the literature (Baker et al., 2015; Wensing et al., 2014). Although, different methods were suggested, the methods available for tailoring implementation strategies for ICU implementation were not all tested, explored or synthesised with no ‘gold standard’ method for tailoring implementation strategies. This is one of the first studies using the nominal group technique (NGT) to explore the barriers to and facilitators for the best-practice educational implementation strategies for the development of a tailored best-practice multifaceted implementation strategy specific to a group of public sector physiotherapists (Chapter 5).

The findings from the NGT provides new insight as to the barriers and facilitators for the educational implementation strategies as perceived by the physiotherapists working in a limited resource setting. In the focus group session, the group was able to reach consensus for the paper-based and electronic handbook on the protocol as a strategy for the process of implementation, as more than 70 percent of the physiotherapists agreed on its appropriateness for use in their setting. This passive strategy has a variety of limitations for the uptake of evidence-based CPGs and protocols that were also identified in the NGT session. These limitations included no time to read the educational material, using ones' own understanding of the protocol with no input from the facilitator for clarification, lack of interaction and practical application of the protocol. The educational handbook was however perceived to be a time saving strategy as individuals could read through the protocol on their own time and was seen as a reference for future use and reminder. However, whether individuals had actually read the manual was questioned as it was reported that individuals may not read the manual. Therefore, evaluation of its use through strategies such as quizzes or online practical application of the theoretical material to test implementation fidelity to the educational material and protocol may be an option to evaluate fidelity and is recommended for use when implementing this passive educational strategy. The use of educational material has been reported to be possibly more beneficial in terms of cost-effectiveness and effectiveness for the uptake of CPGs and protocols in resource limited settings whereas, more expensive strategies with minimal effectiveness producing no effect would be counterproductive (Sinuff et al., 2009; Grimshaw et al., 2006; Grimshaw et al., 2004).

The workshop series and grand rounds/bedside teaching sessions selected by the group were perceived to provide interaction, communication between the facilitator for clarification of aspects of the protocol and to include practical application. This highlights how identification of barriers and facilitators can assist in developing a unit-specific implementation strategy. It is however questionable whether other groups of healthcare professionals, in particular physiotherapists in other public healthcare settings, would come to the same conclusions and chose similar implementation strategies for implementation. Thus, a tailoring process for each group targeted for implementation is recommended. Lastly, a contribution to the evidence for the NGT session to facilitate "buy-in" into the implementation process which was reported by the physiotherapists in the qualitative study (Addendum 5) has been made. Physiotherapists felt that the NGT session made them feel valued and appreciated as they were part of the decision-making process positively affecting "buy-in" into the implementation process. However, it must

be taken into account that some physiotherapists felt unsure about the purpose of the NGT and some were not aware that the NGT session was to decide on which implementation strategies would be suitable for their unit and that the implementation strategies based on their decisions would be used to implement the protocol. Therefore, they did not take into account their needs and organisational structure. Some also reported that the implementation strategies they chose were not part of the final strategy. The latter could therefore affect the implementation plan and process and an attempt should be made to avoid this in future planning studies. Evidence of tailoring implementation strategies in a group of physiotherapists targeted for implementation, using the NGT as a method for tailoring as part of implementation planning is now available. This information can be used by organisations, healthcare professionals and implementation researchers to plan future implementation initiatives.

7.4.3 The Controlled Before and After ICU Physiotherapy Implementation Trial

The controlled before and after trial conducted in the "real world" setting, evaluated the implementation process using a tailored best-practice multifaceted strategy (intervention) consisting of educational material (handbook), workshops (series), grand rounds/bedside teaching sessions and reminders such as pocket cards and posters (Chapter 6). There was a high level of implementation fidelity (exposure) to the implementation strategies and therefore exposure to the protocol. Regardless of identifying best-practice implementation strategies, unit-specific tailoring of the implementation strategies and high level of implementation fidelity, there was no effect of the intervention on the economic TISS-28unit day scores, process of care and clinical outcomes. Although, our CBA trial was sufficiently powered (80%) and 80% of patient data was obtained, we were unable to detect any significant change in the primary TISS-28 outcome in the intervention (implementation) phase compared to baseline in both the experimental and control unit.

The findings of the trial did not concur with the studies (Acolet et al., 2011; Horbar et al., 2004), identified in our review (Chapter 4) although, differences in study design, randomisation of units, different patient case mix as well as available resources in these ICUs in developed countries could explain the difference in our findings. The lack of improvement in clinical outcomes in our CBA trial however, are supported by some of the included review studies (Sinuff et al., 2013; van der Veer et al., 2013; Arnold et al., 2011). The CBA trial findings also did not concur with the findings from the pilot trial conducted by Hanekom et al., (2012)

previously in the experimental surgical ICU. Hanekom et al., (2012) found that the mean TISS-28unit score improved therefore reducing nursing workload and cost of care, with a reduced waiting time for first physiotherapy contact after ICU admission during the protocol care phase. However, protocol care was provided by research physiotherapists who were "dedicated" to the surgical ICU providing a 24-hour service to the unit, whereas the physiotherapists working in the experimental unit are also allocated to wards, have administrative duties and rotate through the unit on weekends and when "on call" as supported by the survey findings (Chapter 3). This suggested that other organisational and structural factors influencing implementation of and adherence to an ICU physiotherapy protocol in a public sector surgical ICU exists.

Structural indicators have been described in the literature (Damschroder et al., 2009; Mainz, 2003). These structural indicators describe what resources and the amount of resources that are used by the health system or organisation to provide programs and services (Damschroder et al., 2009; Mainz, 2003). The structural indicators refer to the presence or number of staff, patients, monetary resources, beds, supplies and buildings (Mainz, 2003). The characteristics of the health system is referred to as the structure (Mainz, 2003) also identified in the inner setting domain of the CFIR (Damschroder et al., 2009). These characteristics of the health system affect the health systems' ability to meet the health care needs of individual patients (Mainz, 2003) and can affect the ability of healthcare professionals to adhere to best-practices influencing quality of care and patient outcomes negatively. Although structural indicators, were not measured in our implementation study, findings from the surveys (Chapter 2 and 3) support the effect of structural indicators on implementation and protocol adherence in the ICU.

Explanations such as "high baseline adoption rates" (Scales et al., 2011), "the rising tide effect" (Chen et al., 2016), the "Hawthorne effect", or not being able to measure outcomes that could have shown significant effects of implementation for the objective findings, namely no effect of the intervention, were provided. However, the formative (subjective reflection) evaluation as guided by the CFIR framework (Addendum 5), provided a significant and valuable contribution to understanding the factors affecting implementation and adherence to the protocol in the "real world" setting. More than just a set of tailored best-practice multifaceted implementation strategies and implementation fidelity is required to implement best-practice and change practice.

The perception of the physiotherapists regarding the implementation process and "real world" implementation of the protocol addressing the characteristics of the individuals' domain of the CFIR was part of the reflection activity of the Process domain. The physiotherapists perceived that adherence to the protocol was limited due to increased workloads as they were allocated to both the ICUs and wards, the majority were not specifically allocated to the experimental surgical ICU and worked in the unit mainly weekends or when "on call" and therefore did not always apply the protocol. According to the physiotherapists, it was not possible to adhere to the protocol on weekends as weekend physiotherapy services were limited with only four patients being referred for physiotherapy in the experimental surgical unit due to a lack of remuneration. The ICU physiotherapy survey (Chapter 3) results confirm that physiotherapy services to ICUs in the public sector are based on referrals, weekend ICU physiotherapy being dependant on availability of funds for remuneration and allocation of a "dedicated' physiotherapist to the ICU is lacking. The latter suggests a fragmented service delivery system and lack of continuity of care in the ICU. The physiotherapists also explained that the implementation strategies were beneficial for those who were not aware of the protocol and for others attending the implementation sessions was just a confirmation of what they were already doing in ICU practice. Physiotherapists perceiving that the protocol information was not new could be due to the pilot trial conducted previously and the fact that the protocol has been published. Factors such as individual resistance to change, lack of "buy-in" in the protocol and questions about the need for change, explain the lack of adherence to the protocol. The primary investigator [FK] was perceived as an external change agent with a possible vested interest in the implementation process and outcome. Therefore, the use of trained local opinion leaders and champions are suggested to implement CPGs and protocols in future implementation trials.

A positive finding, was that some physiotherapists attended the implementation process as they felt they would benefit from the information and personally gain from it, and also reported that it changed their thinking and gave them confidence in their decision-making process in the ICU. Other physiotherapists also reported using parts of the protocol in the wards with surgical patients therefore applying the new knowledge into practice. These findings indicate that the healthcare professional behaviour, attitude and knowledge influenced adherence to the protocols in this setting and must be further explored. However, improving ICU physiotherapists protocol adherence may not be generalisable, as the barriers in one setting may not be present in another and needs to be addressed individually.

Regardless of the objective findings and the perceptions of the physiotherapists, the patients' perceptions of the physiotherapists and their care in the experimental surgical ICU were overall, generally positive. The patient perception and satisfaction with physiotherapy care addressed the outer setting construct, patient needs and resources of the CFIR and was part of the reflection activity of the Process domain (Addendum 4). The patients in the ICU reported on the use of chest physiotherapy techniques and sitting out in a chair and found the physiotherapy care to be beneficial to their wellbeing, within and following ICU care. Communication between the physiotherapist and patient played a major role in the patients care and willingness to participate in the treatment. They also reported the physiotherapists to be knowledgeable, professional and friendly. While some looked forward to the physiotherapy treatments others did not due to pain and fatigue or exhaustion. However, even though they found mobilisation to be painful or tiring, they understood the need for it to improve function and activities of daily living. They viewed the physiotherapist as a "battery charger" giving them new energy to function, highlighted communication as a key factor for satisfaction with care and supported the role of the physiotherapist in the ICU. This information is valuable in that it provides support for the role of the physiotherapist in the ICU.

Investing in implementation strategies or processes only, in a resource limited setting, is alone not effective for improving physiotherapists adherence to the protocol and patient outcomes in the ICU. Resources would be better spent on improving physiotherapy service delivery through planning and restructuring by addressing workload allocations, staff shortages, lack of incentives and support. Improving the implementation culture and climate at an organisational level may also be effective in implementing and sustaining ICU physiotherapy practice change in order to improve quality care through best-practice, improve patient outcomes and reduce healthcare costs in SA.

7.5 The Overall Methodological Design

The use of a phased or multipronged research design to answer our aims and use of an implementation framework was a major strength of the overall study or project. Quantitative and qualitative data was collected using five different methodological designs. This included a survey (Chapters 2 and 3), a systematic review (Chapter 4), a nominal group technique using a focus group discussion providing both quantitative and qualitative data (Chapter 5), a controlled before and after experimental implementation trial (Chapter 6) and semi-structured, individual,

face to face qualitative interviews (Addendums 4 and 5). It has been reported that the use of multiple methods, using both qualitative and quantitative research methods and frameworks to "triangulate" the effects of implementation strategies or processes have been suggested as a useful strategy in order to generate more robust conclusions of causality (Agboola, Hale, Masters, Kvedar & Jethwani, 2014; Lilford, Foster & Pringle, 2009). The qualitative, subjective data was used to substantiate objective findings from the implementation trial. This method of qualitative subjective data to substantiate the quantitative objective findings of the trial can be seen as part of an explanatory sequential mixed methods design (Subedi, 2016) which allowed for triangulation of the sources of information in Phase 3 of the study. Therefore, it can be confidently said that other contextual factors affected the implementation process and therefore the tailored best-practice multifaceted implementation strategy alone may not have been the only cause for lack of uptake, adherence, change in practice and improved outcomes in our CBA ICU physiotherapy implementation trial.

7.6 Study Limitations

Limitations for the studies conducted as part of this research project exist and should be taken into account when interpreting the findings. The limitations are discussed below.

7.6.1 Limitations to the Survey Studies

There was a lack of access to an available computer, internet and email reported by the public sector physiotherapy departments. Some physiotherapy departments reported having only one computer that was shared among staff and others reported a lack of time to complete the survey due to ward and administrative duties to attend to that may have resulted in the limited survey response rates. Although the survey allowed for physiotherapists to go back to complete the surveys once started and start where they had left off, the physiotherapists did not do so. This limited our completion rates. The low response rate to the ICU physiotherapy survey therefore limits the interpretation and generalisability of the survey results. The results may also be influenced by self-reporting bias as ICU physiotherapists reported on their own current practices and HODs were proxies for physiotherapy profile that could affect the accuracy and fidelity of the data depending on how they sourced the data.

A skip logic setup for having to answer the section on qualifications, job rank, years of working experience and academic training was used. Therefore, only physiotherapists who selected the

option of working exclusively (no ward duties) in the units were taken to the latter questions. This was a limitation of the survey in that all physiotherapists working in an ICU should have been asked to respond to this question in order to better understand their qualifications and training. Gender was not recorded in the survey as it was not an original objective of the study and was considered a minor limitation as it is documented in the literature that there are more female physiotherapists than male physiotherapists in the country. Another minor limitation related to ethics was that there was no brief explanation of the study and what the data will be used for on the actual survey as well besides the information sheet and consent and also no online indication of acceptance prior to completion accept a statement that completion implied consent. This would be included in future survey studies.

Attendance of ward rounds and communication with the MDT were not investigated. The availability of equipment for use in the ICU for example manual hyperinflation bags, spirometers, suction equipment and intermittent positive pressure breathing devices was also not investigated. The Chelsea Physical Assessment tool (CPAx) which is a relatively new physical functioning tool validated between 2012 and 2014, was not included in the section on physical functioning. Therefore, it's not clear if and how the latter information contributes to the profile and current practice of ICU physiotherapists in public sector ICUs in South Africa.

7.6.2 Limitations of the Systematic Review

There were minimal limitations of the systematic review. The review search was however, limited to professional and organisational implementations strategies and did not include financial and regulatory implementation strategies to facilitate the uptake of CPGs and protocols in the ICU that may provide further insight into implementation strategies and their effectiveness in ICU implementation.

7.6.3 Limitations to the Tailoring of the Implementation Strategies

Consensus decision-making processes results in agreement between all members of a group. In the NGT used in this study to tailor the implementation strategies a majority vote was used to decide on the tailored best-practice multifaceted educational implementation strategy. The use of a majority vote instead of using consensus or agreement [≥ 70%] (Hanekom et al., 2014) which is a shared decision by the group, was identified as a potential limitation of the decision-making process. The physiotherapists interviewed in the qualitative study (Addendum 5) in

which their perceptions of the NGT were explored highlighted that the lack of consensus in the decision-making process was perceived as a limitation and influenced "buy-in" into the process as some physiotherapists had chosen other strategies to those ultimately combined through a majority vote. The vote for the paper and electronic educational handbook reached consensus with 82% voting for this strategy. However, the workshop series and grand round/bedside teaching sessions was selected by 65% and 59% respectively which is not considered consensus and can be considered a limitation to the study.

Traditionally in the NGT, individual participants read out and clarify their own ideas until all participants have shared their ideas in the round robin and clarification phases (Harvey and Holmes, 2012). It is reported that this method gives a voice to all participants. However, in this study, the individuals did not read out their own ideas. Written ideas were put on a board and read out by the Primary Investigator (facilitator) [FK]. This process minimised each individual reading and clarifying their ideas. Thus, providing the voice to each participant may have been minimised or lost in the clarification process, although anonymity was maintained. This adaptation was made due to limited time allocated for the session by the group according to their availability and was perceived to affect the decision-making process as some physiotherapists reported that the implementation strategies they chose were not selected and was perceived as their ideas not being valued or appreciated.

7.6.4 Limitations of the Controlled Before and After Implementation Trial

It was not possible to randomise the surgical ICUs and therefore a controlled before and after study design was used. EPOC reviews include controlled before and after study designs based on three methodological criteria. As this control before and after study only included one intervention and one control unit instead of two respectively it is a limitation for inclusion in EPOC reviews but presented no other methodological limitation in its design. Since the protocol was previously piloted in the experimental unit, there may have been contamination which presented a limitation to the findings. As data had to be collected regularly, the Primary Investigator [FK] had to assist with data collection if and when a research assistant was unavailable and could be seen as a limitation. However, the data collected were based on processes occurring in the units and thus bias could be eliminated. Record keeping procedures are not standardised between the two hospitals and surgical ICUs and storage of patient medical records differed and were regularly misplaced and/or missing in both settings. This hampered

the data collection process. This was a limitation to the trial and resulted in a group of patients lost to follow-up in each phase of the study. Due to patients lost to follow-up in both units, we could not calculate a mean TISS-28unit day score for the units as the mean is calculated for all patients admitted to each unit for each eight hour nursing shift and a mean score cannot be calculated if patients are lost to follow-up. Some data such as patient APACHE scores were not available for all patients. Adverse events to mobilisation were not well reported in any of the available physiotherapy patient records. This is a limitation of the "real world" nature of the study as the Primary Investigator [FK] did not intervene in the normal daily record keeping processes of the units and storage of medical records. Although the latter was a limitation to the trial and must be taken into account when interpreting the trial results the study was sufficiently powered as we were still able to retrieve data for 80% of all patients admitted to the ICUs. With regards to the intervention the physiotherapists reported that they wanted more 'hands-on" demonstration of the use of the protocol with an ICU patient on the grand round/bedside teaching session similar to simulation training which was a limitation of the implementation process and must be considered in future. Although we addressed all the domains of the CFIR and constructs of the Process domain, we did not fully utilise the spiralling nature of the CFIR in terms of the process of feedback following identification of barriers to implementation and addressing all barriers to the process that was seen as a limitation to the way in which the framework can be used. The process domain is cyclical and spirals through each domain of the CFIR where continuous planning, engaging, executing, evaluating and reflecting happens in a forward and backward direction (spiral as depicted by the purple arrows in Figure 1.2, p.10 in the Introduction) within each domain throughout the implementation process.

7.7 Recommendations

The recommendations are outlined in two sections namely general recommendations and recommendations for future study.

7.7.1 General Recommendations

i) A physiotherapy database containing profile and organisational information for the public sector physiotherapists should be developed and consistently updated in order to conduct regular needs analysis for and audits of services available, training and upskilling required by the profession. The National SASP should endeavour to do this regardless of whether physiotherapists are registered with the Society or not. The same is recommended for the private

sector physiotherapists in the country. This database can assist researchers in physiotherapy research initiatives to improve the profession especially in the area of intensive care.

ii) The SASP CPRG also need to include a database of all physiotherapists who work specifically in ICUs in South African public and private sector hospitals. In this way new physiotherapists working in intensive care can be tracked and offered support and post-graduate training for this specialised area of physiotherapy. Like the training received by medical and nursing staff who work in ICU, physiotherapists already specialised in this area should provide similar training.

iii) It is recommended that health care organisations consider using a process-oriented programme management model, associated with lower costs, higher clinical productivity and improved integration of staff roles. This model provides opportunities to expand leadership roles and promote communication among healthcare professionals (Fisher et al., 2012). Thus, physiotherapists would become part of the multidisciplinary team in the areas in which they provide services for example the intensive care multidisciplinary team (Fisher et al., 2012). This will allow for allocation of 'dedicated' ICU physiotherapists, proven to improve patient outcomes and reduce costs through the use of protocol care (Hanekom et al., 2012)

iv) It is recommended that the whole ICU team be involved in the implementation process in order to create awareness of the change process amongst the team who can provide the appropriate support and motivation for changing practices by physiotherapists in ICUs. Implementation researchers and healthcare professionals should include an analysis of the organisation in which they attempt to change practice and evaluate the readiness for change in the particular organisation or if change has already taken place to eliminate factors that will influence effectiveness of their implementation strategy or intervention. Using a local champion and leader and not an external change agent which can be perceived as having their own vested interest in the implementation process and influence "buy-in" of the healthcare professionals in the implementation process is also recommended.

v) Hospital Management need to look into improving record keeping and the storing of patient medical records by putting systems in place to prevent folders and notes on patient care from going missing. Missing patient records present a problem not only for researchers attempting

to provide evidence to improve practice but is a problem when documentation and proof of medical treatment and care for malpractice cases is required. It also presents a problem for patients who need to be reassessed each time previous documented information is missing and can affect patient treatment and outcome. Medical records for patients discharged within a period of less than 6months could not be located and therefore there were patients lost to follow-up in the CBA trial study. The HPCSA, (2008) in SA requires that all private and public health-care facilities should retain patient records for at least six years. Electronic database capturing systems are still required in some hospitals and need to be developed and existing ones improved. This may facilitate improved storage and availability and accessibility of medical records to patients, healthcare professionals, malpractice practitioners and researchers.

7.7.2 Recommendations for Future Studies

i) Research into staffing ratios for allied health professions, specifically physiotherapy internationally and in SA is scarce and lags behind the nursing and medical fields (Cartmill et al, 2012). This has implications for the physiotherapists in that they may not be able to render services at an optimum level and may not cover all patients every day (Fisher et al., 2012). The healthcare policymakers and researchers need to further evaluate the needs of public sector physiotherapists in SA and the physiotherapy to patient ratio to guide service planning and delivery especially in the ICU setting where the physiotherapy to ICU bed ratio in the public health care setting is not known.

ii) The ICU physiotherapy survey used in this study should be conducted with private sector physiotherapists who provide ICU care which will aid comparison of services and current practices between the two sectors that can be used to benchmark practice. Within the public sector there are still district and specialised hospital categories that provide emergency and intensive care services in the country and physiotherapy services to these hospital emergency or ICU facilities should also be investigated.

iii) An investigation as to the factors influencing the use of specific evidence based physical functioning and HRQoL outcomes is needed as the improved use of these outcomes can provide information as to the effectiveness and role of the physiotherapist in the ICU. The survey did not include use of more recent outcome measures such as the CPAx which can be included in future surveys.

iv) Mobilisation and rehabilitation activities which have been proven safe and effective in improving ICU patient outcomes need to be further explored with regards to the barriers and facilitators for these activities as perceived by ICU healthcare professionals including ICU physiotherapists.

v) A systematic review of the effectiveness of financial and regulatory implementation strategies for the uptake of CPGs and guidelines in the ICU as well as including studies evaluating structural indicators can contribute further insight into implementation in the ICU and is recommended.

vi) A systematic review of qualitative studies evaluating factors affecting the uptake and adherence to protocols therefore influencing the effectiveness of implementation processes/strategies in facilitating practice change in the ICU, should be conducted in the light of increasing primary qualitative studies in this area of implementation research.

vii) No "gold standard" for the tailoring of implementation strategies exists. We recommend a scoping or systematic review be conducted to determine current methods and their effectiveness in tailoring implementation strategies for the intensive care setting.

viii) Future studies using the NGT to tailor implementation strategies should use consensus in the decision-making process, and not majority vote, in order to obtain "buy-in" to the implementation process from all involved implementation. Researchers using this technique should conduct the round robin step as described in the literature in order to generate more ideas and allow more time in the session for clarification and in-depth discussion. We recommend that more time be given to unpack the ideas around barriers and facilitators for the strategies before final voting.

ix) Implementation of evidence-based CPGs and protocols for changing ICU physiotherapy practice should be conducted using robust randomised controlled trials especially in developing countries where evidence is limited. Evaluation of the effect of structural indicators on implementation processes and adherence to CPGs and protocols is also recommended for future implementation effectiveness studies. The use of the CFIR in ICU implementation initiatives is supported. It is recommended that the CFIR not only be used to identified the factors

influencing the various domains of implementation planning and implementing but that the spiralling nature of the framework be utilised to provide feedback, adapt or make changes by addressing barriers before moving forward and repeating this process at each level of the implementation process. Therefore, we recommend that the spiralling nature of the framework be used to provide and make changes at each level of the process of implementation.

x) Exploring the factors affecting the sustainability of practice change initiatives following successful implementation and practice change and investigating methods for sustaining practice change are recommended.

7.8 Summary of Main Findings

The key findings of this dissertation are:

i) All central, regional and tertiary public sector hospitals with ICU facilities have existing and functioning physiotherapy departments that provide physiotherapy services and that are organised and structured on a departmental model of service delivery;

ii) The physiotherapists working in the public sector hospitals are South African trained, young and in the early phase of their careers. They have minimum basic qualifications and are employed mainly in permanent production level grade I (“junior” level) positions and have a physiotherapy to hospital bed ratio of 1:69 which can affect effective service delivery, quality of patient care and outcomes;

iii) The ICU physiotherapists who work exclusively (no ward duties) in the public sector ICUs are early-career physiotherapists with minimal basic qualifications and years of experience, are mainly employed in permanent production level grade I (“junior” level) positions and have minimal to no post-graduate ICU qualifications and ICU related continuous professional development and training, which have implications for ICU patient care and outcomes.

iv) The current services provided by ICU physiotherapists are variable between ICUs in the country. The majority work on a rotation basis rotating every three months through the ICU, work on a referral basis from mainly the doctor, with no weekend ICU physiotherapy services reported by 81% (n= 42/52) of the ICU physiotherapists. While the minority rotate every 6

months or yearly, see all ICU patients daily and provide weekend physiotherapy in the ICUs. Referral patterns differ between units with varying number of patients referred in the week and weekend between ICUs. While some physiotherapists are exclusively allocated to the ICUs others have additional ward duties and in some units a variety of physiotherapists work in the unit in the week and on weekends contributing to the variability current practice.

v) The current practices of the ICU physiotherapists in the management of patients are also variable. While some ICU physiotherapists provide one treatment per ICU patient in the week, there are some who provide two treatments per patient. The use of evidence-based physical functioning and health related quality of life outcomes by ICU physiotherapists are lacking with a small minority using the 6-minute walk test, NYHA Functional Classification and ICF outcomes. While the majority of physiotherapists used evidence-based mobilisation and rehabilitation CPGs and protocols other ICU physiotherapists did not. The majority of ICU physiotherapists spent >50% of the time on chest physiotherapy in the ICU than a minority (one third) who spent >50% of the time on mobilisation and rehabilitation activities respectively that may imply that mobilisation and rehabilitation CPGs and protocols are not effectively applied in the ICU.

vi) Multidisciplinary clinical team and plan and communication and case discussion including telemedicine implementation strategies were strategies unique to the ICU.

vii) Multifaceted implementation strategies are significantly more effective [OR 4.07, 95% CI: 2.93-5.65; p<0.00001] in improving process of care measures/indicators than single implementation strategies facilitating CPGs and protocol uptake intensive care settings in developed countries.

vii) Personal learning styles (interactive and practical strategies), organisational (resources such as time, space, patient availability for teaching), and characteristics of the strategy (resource intensive in terms of time, allowing interaction, clarification and practical input) were described as barriers to and facilitators for the best-practice educational implementation strategies and influenced the physiotherapists decisions on the best-practice educational strategies tailored for implementation in their specific unit.

viii) A tailored best-practice multifaceted educational implementation strategy combined with reminders achieved high levels of implementation fidelity with 80% attending the workshops and 76% attending the grand rounds/bedside teaching sessions.

ix) The tailored best-practice multifaceted educational implementation strategy combined with reminders (intervention) had no effect on the economic TISS-28unit outcome, process of care indicators and clinical outcomes when compared between the units within phases and within the units between phases while adjusting for confounders.

CHAPTER 8
Project Conclusion

In the currently transforming health care system in SA where the NHI is in the process of being implemented and intends to use CPGs and protocols to guide the provision of health care for South Africans, this study is significant. This first "real world" ICU Physiotherapy implementation trial study contributes evidence of an implementation process guided by the CFIR for the implementation of an ICU physiotherapy protocol for the management of surgical ICU patients and the contextual factors affecting the implementation process within the current transforming, resource limited health care system in SA.

The tailored best-practice multifaceted implementation strategy alone was not effective in improving the uptake/adoption of and adherence to evidence-based practices for the ICU physiotherapists. ICU physiotherapy protocol implementation is complex due to the dynamic nature of the ICU and limited public ICU physiotherapy resources. Contextual factors such as organisation and structure (structural indicators) of ICU physiotherapy services including referral policy and systems, staffing levels, workload allocations, "buy-in" to the implementation process, need for practice change, perception of the CPGs and protocols, resistance to change, self-efficacy, local champions and change agents, ICU team support and communication, patient perception of ICU care and stage of change (already high adoption rates) should be considered by healthcare professionals, organisations and implementation researchers when implementing practice change initiatives in the ICU.

Public sector physiotherapists can use the study findings to highlight the impact of the current physiotherapy resource limitations on service delivery, adherence to best-practices, quality care, patient outcome and cost of care to healthcare managers, policymakers and funders. The survey findings can be used to assess the current service delivery model and facilitate the reorganisation of physiotherapy services for health conditions such as intensive or critical care conditions that have shown to benefit positively from physiotherapy intervention thereby effectively managing limited physiotherapy resources. A "dedicated" ICU physiotherapist has been reported in other studies to assist the implementation of evidence-based practices and outcomes, improve quality of care, optimize ICU patient outcomes and reduce ICU and hospital costs. Public sector ICU physiotherapists should therefore strongly advocate for "dedicated" ICU physiotherapists. Furthermore, support from healthcare management and academics for

ICU related CPD, post-graduate training and ICU leadership opportunities for young early-career physiotherapists entering the public ICU healthcare workforce are needed and should be provided to improve knowledge, skills and standards of care to improve patient outcomes and may boost work morale, job satisfaction and productivity in the ICU.

The review provided a synthesis of the effectiveness of implementation strategies to facilitate uptake of CPGs and protocols into ICU practice. The meta-analysis identified multifaceted implementation strategies as more likely to improve process of care in the ICU than single implementation strategies. However, which combination of implementation strategies are most effective are still unknown. Implementation fidelity to assess exposure to implementation strategies and the CPGs and protocols for successful implementation was also identified. ICU healthcare professionals and implementation researchers can use these findings for CPG and protocol implementation. Evidence for the Nominal Group Technique (NGT) as a viable, time and cost effective and efficient method to identify barriers to and facilitators for implementation strategies and facilitate selection and tailoring of implementation strategies to targeted healthcare professionals and organisations is provided for future implementation initiatives. The NGT process can affect healthcare professional "buy-in'' to implementation both positively if consensus is reached or negatively if shared ideas do not reach a level of consensus. The NGT is especially useful in resource constrained health care environments in which immediate implementation is required and time is limited. Evidence for its use by implementation researchers to tailor implementation strategies is now available.

The use of the CFIR to plan and guide implementation in the ICU setting is supported. The formative (subjective) evaluation of the implementation process through the qualitative exploration of the ICU physiotherapists perceptions (characteristics of the individual domain) of the implementation process, identified contextual factors influencing implementation, valuable in explaining and supporting the objective findings of the implementation trial. This ICU physiotherapy trial contributes new evidence to the CFIR database of implementation research for use by other ICU healthcare professionals and implementation researchers. Once an effective ICU implementation process is achieved, we recommend that methods for sustaining ICU practice change be explored to maintain quality care, improved patient outcomes, and reduced healthcare costs.

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Addendum 1: Ethics Approval Letter

UNIVERSITEIT•STELLENBOSCH•UNIVERSITY

Approval Notice
New Application

22-May-2014
Karachi, Farhana

Ethics Reference #: S13/09/170

Title: **The implementation and evaluation of a validated evidence-based physiotherapy protocol in a surgical ICU: A controlled before and after Experimental Trial.**

Dear Ms Farhana Karachi,

The **New Application** received on , was reviewed by members of **Health Research Ethics Committee 2** via Expedited review procedures on **23-Sep-2013** and was approved.
Please note the following information about your approved research protocol:

Protocol Approval Period: **25-Sep-2013 -25-Sep-2014**

Please remember to use your **protocol number (S13/09/170)** on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.
Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No 61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389207.

Included Documents:
addendum 1 5
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protocol
addendum 1
addendum2.4
addendum1 8
cv nk
applic form
addendum1 4
checklist
addendum3 1
addendum1 7
addendum 2 2
dec letters
addendum2 1
synopsis
addendum 1 3
cv farhana
addendum1 9
cov letter
addendum3 2

Sincerely,

Mertrude Davids
HREC Coordinator
Health Research Ethics Committee 2

Addendum 2A: Poster and Oral Presentations of Survey Results

Scientific Poster Presentation Critical Care Congress, 2014

A Profile of current Physiotherapy Practices in Intensive Care in South Africa

PRELIMINARY RESULTS

Karachi F, Hanekom S, Gosselink R

Stellenbosch University, University of the Western Cape & Katholieke Universiteit, Leuven

CRITICAL CARE CONGRESS 2014

INTRODUCTION

Physiotherapists are part of the health care team and have an integral role to play in managing critically ill patients in intensive care units (1-4). However, the role and practices of intensive care physiotherapists is variable (1, 5-8). While numerous surveys have been published describing physiotherapy practice internationally (1, 7), in South Africa only one study has described the physiotherapy practice of therapists working in intensive care but was limited to a specific ICU setting (8). International guidelines have been developed to define physiotherapists input in ICU. The purpose of these guidelines is to optimize benefit to patients and other healthcare team members. It is unclear whether therapists are able to adhere to these guidelines within the South African health care environment. **SIGNIFICANCE:** This study will provide much needed information regarding current practices of intensive care physiotherapists and use of protocols in South African ICU's. In addition, the information will assist in international benchmarking of current South African physiotherapy practice.

AIM: To describe the current physiotherapy practice in public sector intensive care units (level I – IV) in South Africa.

OBJECTIVES: To describe general data of the physiotherapy departments rendering ICU services, qualifications, training and work experience, referral system, workload, patient care or management, utilization of protocols and outcome measures, discharge procedure and follow-up related to the ICU physiotherapists.

METHOD

A descriptive , cross-sectional study design using a self-developed two part electronic survey (questions on general data, qualifications, training and work experience, referral system, workload, patient care or management, utilization of protocols, discharge procedure and follow-up) study has been conducted. The Population included all Physiotherapy Departments in Tertiary, Central and Regional Public Sector Hospitals in SA rendering ICU services. Part I of the survey was mailed to all Physiotherapy Heads of Departments included in the study. Part II was mailed to the physiotherapists working in the specific ICUs per department. Survey data was automatically submitted and stored in the survey database for analysis. Only descriptive data is presented here and analysed as frequencies, means and SD or percentages . Inferential analysis will be completed once all data has been collected. Approval for the study was obtained from Stellenbosch University Human Research Ethics Committee (S13/09/170) and each DOH from each province in SA. Permission was obtained from the hospitals and physiotherapy departments included in the study. All aspects pertaining to ethical conduct during the study was adhered to.

RESULTS

Preliminary results are presented here as final data is still being collected and submitted. Mainly descriptive data is presented.

A total of 68 public sector physiotherapy departments rendering ICU services were included in the study. **PART I:** 38/68 (55.9%) surveys have been completed to date. From these 38 surveys it has been indicated that physiotherapy services are being rendered to 112 different ICU settings. Only 35/112 (31.3%) **PART II** surveys have been submitted to date.

GENERAL DATA: 331 Physiotherapists are reported to be employed covering an average of 7-8 ICU beds. The majority of the physiotherapists were between 22-30 years of age followed by the 31-40 year , then the 41-65 year age category. 26 (86.7%) of physiotherapy departments reported that staff rotated through the ICUs with 60% rotating staff quarterly.

QUALIFICATIONS: 238(71.9%) have BSc degrees and 10 (3.02%) have MSc degrees with only 1(0.1%) specifically in ICU.

TRAINING: 73.7% reported that physiotherapists trained only in SA and 26.3% reported internationally trained physiotherapists which were 14 in total. Only 3 (1.08%) departments reported that they had physiotherapists who did not have an ICU clinical block as a student. 50% (18) of the departments did and did not train and/or supervise students in ICU respectively. 17 Departments reported that the main post-graduate ICU training their staff had was ICU/Cardiopulmonary Seminars/ Workshops/CPD activities followed by 14 reporting attending the Adult and Paediatric ICU Refresher Courses. The majority (82.4%) were interested in a specialised post-graduate ICU training programme for ICU Physiotherapy specialisation in ICU.

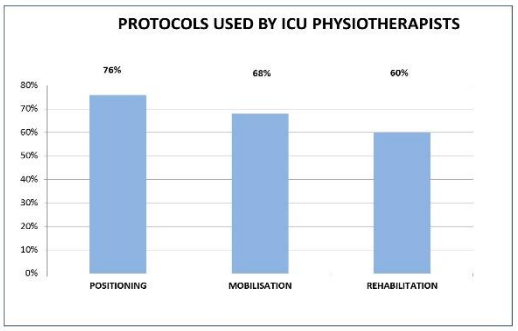
WORK EPXPERIENCE: Only 27/331 (8.2%) had international ICU working experience. The majority of physiotherapists exclusively allocated to work in the ICU had 5-10 (33.3%) and more than 10 (27.8%) years of ICU work experience.

REFERRAL SYSTEM: In most units (75%) patients were referred for physiotherapy. Referral was reported to be mainly via the medical doctor/intensivist and secondly via routine physiotherapy assessment. 63.6% of departments did not have their own physiotherapy referral guidelines.

WORKLOAD: Only 16.7% are exclusively allocated to the ICU and 50% work in both ICU and wards. 58.8% spend only 0-25% of their time in the ICU on a daily basis in the week. The majority (> 50%) treat patients only once a day. 63.3% reported to have an on call roster and treat ICU patients on weekends and after hours in the week, also only reporting treating once per day.

PATIENT CARE: Chest Physiotherapy techniques were reported to be more frequently used than mobilisation and then rehabilitation activities in this order when treating the ICU patients.

PROTOCOL USE: In terms of physiotherapy protocols 76%, 68% and 60% used positioning, mobilisation and rehabilitation protocols respectively.



USE OF OUTCOME MEASURES: Lung auscultation followed by evaluation of Saturation O_2 were reported to be the physiological outcome measures most frequently used, 95% did not use any of the physical function and/or HRQoL outcome measures.

DISCHARGE PLANNING: 85.2% are involved with patient goal setting, and 41.7% reported that they are involved in this with the team and 33.3% with the team and patient. 59.3% are not involved in discharging a patient to the ward/home.

FOLLOW-UP: 100% agree that follow-up is needed in the ward, 72.4% in an out-patient facility and 57.7% in the community (home visit). 68%are aware of follow-up facilities in the community and report that the ICU physiotherapist mainly refers ICU patients for follow-up rehabilitation. Only 50% provided follow-up physiotherapy rehabilitation to ICU patients in their hospital.

DISCUSSION AND CONCLUSION

It can be seen from the preliminary data that the current practice of ICU Physiotherapists in SA seem to be similar in terms of qualifications, training, workload, time spent in ICU, frequency of treatments use of protocols and outcome measures, referral, follow-up and discharge planning. However our current ICU physiotherapy practice varies somewhat from practices reported internationally. There therefore seems to be the need for standardisation of our practices for benchmarking and comparisons between local and international ICU Physiotherapy practices.

STUDY LIMITATIONS: Time delay with DOH approval, physiotherapists response time and rate, data is still being submitted to date that could still possibly influence some results.

REFERENCES

1. Norrenberg M, Vincent JL. A profile of European intensive care unit physiotherapists. European Society of Intensive Care Medicine. Intensive Care Med. 2000 Jul; 26(7):988-994.
2. Jones AY. Intensive care physiotherapy – medical staff perceptions. Hong Kong Physiotherapy Journal 2000; 19:9-16.
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4. Reeve JC. A survey of physiotherapy on-call and emergency duty services in New Zealand. New Zealand Journal of Physiotherapy 2003; 31(2):75-83.
5. Van Aswegan H, Potterton J. Pilot Survey of the Current Scope of Practice of South AfricanPhysiotherapists in Intensive Care Units. South African Journal of Physiotherapy 2005; 61(1):17-22
6. Clini E, Ambrosino N. Early physiotherapy in the respiratory intensive care unit. Respiratory Medicine 2005; 99(9):1096-1104.
7. Hodgin KE, Nordon-Craft A, McFann KK, Mealer ML, Moss M.Physical therapy utilization in intensive care units: Results from anational survey.Critical Care Medicine 2009; 37(2) 561-568
8. Wiles L, Stiller K. Passive limb movements for patients in an intensive care unit: A survey of physiotherapy practice in Australia. Journal of Critical Care 2000; in press.

ACKNOWLEDGEMENTS

Thank you to the NRF, MRC and Harry Crossley for the funding, my Supervisors and to the Research Assistants who have been assisting in data collection and follow-up of participants, as well as the participants in the project. You have contributed only positively to the success of this project.

Published Abstract Critical Care Congress, 2014

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A profile of current physiotherapy practices in intensive care in South Africa

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Background. Neither internationally nor locally has the profile, role and practices of intensive care physiotherapists been defined, but some evidence exists for the effectiveness of intensive care physiotherapy. No study has attempted to evaluate the profile, role and current practices of public sector intensive care unit (ICU) physiotherapists in South Africa (SA) particularly.

Objective. To conduct a survey of the current profile, role and practices of physiotherapists in public sector ICUs in SA.

Methods. An electronic survey on general data, qualifications, training, work experience, workload, patient load, referral system, patient management, utilisation of protocols, discharge procedure and follow-up was used to collect data. All physiotherapy heads and respective physiotherapists offering services to public sector ICUs in SA were included. Descriptive data are currently being analysed.

Results. Preliminary results show that the majority of physiotherapists working in intensive care have BSc degrees, minimal postgraduate ICU training, increased workload, are not exclusively allocated to a unit, use very few protocols, if any, and do not have a standardised referral, discharge and follow-up service.

Conclusion. Preliminary results concur with international findings that there is variation in practice of intensive care physiotherapists in SA. This may have an effect on patient outcome in intensive care. Final conclusions will be drawn once all data have been collected and analysed.

Scientific Poster Presentation WFSICCM Congress, 2015

A Profile of current Physiotherapy Practices in Intensive Care in South Africa

Karachi F, Hanekom S, Gosselink R

University of the Western Cape, Stellenbosch University & Katholieke Universiteit, Leuven

INTRODUCTION

- Physiotherapists are part of the health care team and have an integral role to play in managing critically ill patients in intensive care units (1-4).
- However, the role and practices of intensive care physiotherapists is variable (1, 5-8).
- While numerous surveys have been published describing physiotherapy practice internationally (1, 7), in South Africa only one study has described the physiotherapy practice of therapists working in intensive care but was limited to a specific ICU setting (8).
- International guidelines have been developed to define physiotherapists input in ICU.
- The purpose of these guidelines is to optimize benefit to patients and other healthcare team members.
- It is unclear whether therapists are able to adhere to these guidelines within the South African health care environment.

SIGNIFICANCE

- This study provided much needed information regarding current practices of intensive care physiotherapists and use of protocols in South African ICU's. In addition, the information will assist in international benchmarking of current South African physiotherapy practice.

AIM

- To describe the current physiotherapy practice in public sector intensive care units (level I – IV) in South Africa.

OBJECTIVES

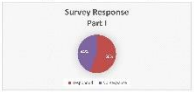
- To describe general data of the physiotherapy departments rendering ICU services, qualifications, training and work experience, referral system, workload, patient care or management, utilization of protocols and outcome measures, discharge procedure and follow-up related to the ICU physiotherapists.

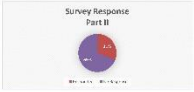
METHOD

- A **descriptive , cross-sectional** study design
- The **Population** included all Physiotherapy Departments in Tertiary, Central and Regional Public Sector Hospitals in SA rendering ICU services.
- A **self-developed two part electronic survey** was used.
  - Part **I** of the survey was mailed to all Physiotherapy Heads of Departments included in the study.
  - Part **II** was mailed to the physiotherapists working in the specific ICUs per department.
- **Descriptive data** is presented as frequencies, means and SD/ percentages.
- **Approval** for the study was obtained from Stellenbosch University Human Research Ethics Committee (S13/09/170) and each DOH from each province in SA. Permission was obtained from the hospitals and physiotherapy departments included in the study. All aspects pertaining to ethical conduct during the study was adhered to.

RESULTS

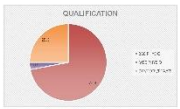
- **68 Total Hospitals and Physiotherapy Departments respectively in the 9 provinces.**





PART I RESULTS

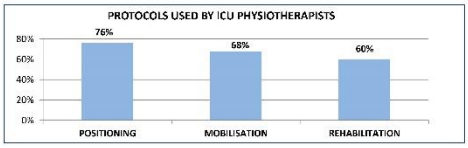
- 331 Physiotherapists are employed covering an average of 7-8 ICU beds.
- The majority of the physiotherapists were between 22-30 years of age followed by the 31-40 year ,then the 41-65 year age category.
- 86.7% of physiotherapy departments reported that staff rotated through the ICUs with 60% rotating staff quarterly.



- **TRAINING:** 3 (1.08%) departments reported physiotherapists who did not have an ICU clinical block as a student. 50% (18) of the departments did and 50% did not train and/or supervise students in ICU respectively.
- 45% (17) attended ICU/Cardiopulmonary Seminars/ Workshops/CPD activities followed by 14 (37%) reporting attending the Adult and Paediatric ICU Refresher Courses.
- The majority (82.4%) were interested in a specialised post-graduate ICU training programme for ICU Physiotherapy specialisation in ICU. **In PART II however:** 85% working in the unit had no ICU PG training but >70 % interested
- **WORK EXPERIENCE:** The majority of physiotherapists exclusively allocated to work in the ICU had 5-10 (33.3%) and more than 10 (27.8%) years of ICU work experience.

PART I RESULTS

- **REFERRAL SYSTEM:** 75% of units referred patients for physiotherapy, mainly via the medical doctor/intensivist and secondly via routine physiotherapy assessment.
- 63.6% of departments did not have their own physiotherapy referral guidelines.
- **WORKLOAD:** Only 17% are exclusively allocated to the ICU and of this:
- 50% work in both ICU and wards
- 59% spend only 0-25% of their time in the ICU on a daily basis in the week and on weekends
- > 50% treat patients only once a day
- 63% reported to have an on call roster and treat ICU patients on weekends and after hours in the week, also only reporting treating once per day.
- **PATIENT CARE:** Chest Physiotherapy techniques (manual techniques and secretion clearance techniques) were reported to be more frequently used than mobilisation (PM, AE then mob from the bed) and than rehabilitation activities (active ex in chair, on spot mob, mob without vent) in this order when treating the ICU patients.
- **PROTOCOL USE:** In terms of physiotherapy protocols 76%, 68% and 60% used positioning, mobilisation and rehabilitation protocols respectively.



- **USE OF OUTCOME MEASURES:** Lung auscultation followed by evaluation of Saturation O_2 were reported to be the physiological outcome measures most frequently used, 95% did not use any of the physical function and/or HRQoL outcome measures.
- **DISCHARGE PLANNING:** 85.2% are involved with patient goal setting, and 41.7% reported that they are involved in this with the team and 33.3% with the team and patient. 59.3% are not involved in discharging a patient to the ward/home.
- **FOLLOW-UP:** 100% agree that follow-up is needed in the ward, 72.4% in an out-patient facility and 57.7% in the community (home visit). 68%are aware of follow-up facilities in the community and report that the ICU physiotherapist mainly refers ICU patients for follow-up rehabilitation. Only 50% provided follow-up physiotherapy rehabilitation to ICU patients in their hospital.

DISCUSSION AND CONCLUSION

- The response rate in this study is also low especially for part II. Electronic vs Postal Survey.
- Current practice of ICU Physiotherapists in SA seem to be variable as well in terms of qualifications, training, workload, time spent in ICU, frequency of treatments use of protocols and outcome measures, referral, follow-up and discharge planning.
- Our current ICU physiotherapy practice also varies from practices reported internationally. Physiotherapists in SA are not actively involved in adjustment of mechanical ventilation, weaning from mechanical ventilation, in extubation and in the implementation of non-invasive mechanical ventilation as in a European study by Norrenberg & Vincent 2000. In SA there are very few units that reported having a physiotherapist in the unit at night like Germany and Sweden whereas in UK 80% report availability of physiotherapists at night.
- There therefore seems to be the need for standardisation of our practices for benchmarking and comparisons between local and international ICU Physiotherapy practices and patient outcomes.

STUDY LIMITATIONS

- Time delay with DOH approval & Time to get permission from the Hospital CEO
- Detailed database for public sector physiotherapists (although available from the SASP was also a procedure and ultimately we found our own way)
- Internet access to access surveys (did not do postal as this proved to also limit responses
- Physiotherapists response time and rate

THE WAY FORWARD

- Survey of private sector ICU physiotherapists current practices in SA
- In depth study with regards to protocols and outcomes measures used/not used – barriers and facilitators
- Involvement in weaning patients, discharge planning and referral.
- What do the other ICU professionals perceive our role to be in the ICU?
- Looking at ways to assist benchmarking our practice and including evidence in practice in intensive

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1. Norrenberg M, Vincent JL. A profile of European intensive care unit physiotherapists. European Society of Intensive Care Medicine. Intensive Care Med. 2000 Jul; 26(7):988-994.
2. Jones AY. Intensive care physiotherapy – medical staff perceptions. Hong Kong Physiotherapy Journal 2000; 19:9-16.
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ACKNOWLEDGEMENTS

Thank you to the NRF, MRC and Harry Crossley for the funding, my Supervisors and to the Research Assistants who have been assisting in data collection and follow-up of participants, as well as the participants in the project. You have contributed only positively to the success of this project.

WFSICCM 2015 Congress Poster Programme

Byungchul YU, Jungnam LEE, Giljae LEE, Mina LEE, Jaejung PAK, Min CHUNG (Republic of Korea)

WFSICCM_TP_244

EARLY PREDICTION OF MASSIVE TRANSFUSION IN SEVERE TRAUMA PATIENTS WITH INITIAL HYPOTENSION
Yun Su MUN, Oh Sang KWON, Seung Je GO, Toung Hoon SUL, Jin Bong YE, Joong Suck KIM, Yeong Cheol KIM (Republic of Korea)

WFSICCM_TP_245

EFFECTS OF ACID-BASE BALANCE OF SEVERE TRAUMA PATIENT ON OXYGEN DELIVERY TO TISSUES
Byungho CHOI, Eunseog HONG, Kyu-Hyouck KYOUNG (Republic of Korea)

WFSICCM_TP_246

CHANGE OF QUANTITATIVE D-DIMER VALUE AFTER TRAUMA MAY BE PREDICTIVE OF VENOUS THROMBOEMBOLISM IN CRITICAL CARE CENTER
Osamu SHIGEMITSU, Shinsuke WADA, Ryuichi TAKENAKA (Japan)

WFSICCM_TP_248

ENDOVASCULAR REPAIR FOR TRAUMATIC THORACIC AORTIC INJURY: MID & LONG-TERM RESULTS IN A SINGLE CENTER
Jeong Won KIM, Yunseok KIM, Yong Jik LEE, Chang-Ryul PARK, Seong Hoon CHOI, Soon Eun PARK, Eun Seog HONG, Jong-Pil JUNG (Republic of Korea)

WFSICCM_TP_250

PROGNOSTIC FACTORS INFLUENCING OUTCOME OF PATIENTS WITH NON-RESECTABLE LUNG CANCER ADMITTED TO THE INTENSIVE CARE UNIT
Jessica L. QUAH, Yi H. TAN (Singapore)

WFSICCM_TP_251

SLEEP IN MECHANICALLY VENTILATED PATIENTS IN THE INTENSIVE CARE UNIT
Ebru Ortac ERSOY, Atila KARA, Serpil OCAL, Arzu TOPELI (Turkey)

WFSICCM_TP_252

PHASE ANGLE IN BIOIMPEDANCE ANALYSIS AND FLUID STATUS IN CRITICALLY ILL PATIENTS
Osamu TAKASU, Keita TASHIRO, Shuhei NIIYAMA, Takatoshi KAMBE, Mikinori KANNAE, Mariko MOROKI, Toshio MORITA, Masakazu NABETA, Atsuo NAKAMURA, Yoshihide SHIMOJO, Shinjiro MORI, Teruo SAKAMOTO (Japan)

WFSICCM_TP_253

THE FEASIBILITY OF ALLEN COGNITIVE LEVEL ASSESSMENT ON PATIENTS WITH ACUTE RESPIRATORY FAILURE
Jae Young MOON, Sungju JEE, Cuk Seong KIM, Kwang-Sun SUH, Ji Eun PARK, Gu-Hyun AN, Min-Jeong KWON, Eungyoung KANG (Republic of Korea)

WFSICCM_TP_254

RED CELL DISTRIBUTION WIDTH AS A PREDICTOR FOR MORTALITY IN ICU PATIENTS.
Shinya IWASE, Masataka NAKAMURA, Tadanaga SIMADA, Daiki SAITO, Shigeto ODA, Hiroyuki HIRASAWA (Japan)

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EARLY REALITY-ORIENTING ASSURING AND SLEEP ASSURANCE FOR DELIRIUM IN INTENSIVE CARE UNIT(ICU): A QUALITY IMPROVEMENT(QI) PROJECT; PRELIMINARY DATA
Seungyong PARK, Hyunsun KIM, Yeonghun CHOE, Sori KIM, Seoungju PARK, Yongchul LEE, Dongchan KIM, Heungbum LEE (Republic of Korea)

WFSICCM_TP_256

UTILIZATION OF A STANDARDIZED TRACHEOSTOMY CAPPING AND DECANNULATION PROTOCOL TO IMPROVE PATIENT SAFETY
Jimyoung NAM, Jinhee JUNG, Heeog LEE, Sunyoung WON (Republic of Korea)

WFSICCM_TP_257

EXPERIENCE OF USING PASSY-MUIR VALVE IN ICU PATIENTS
Heeog LEE, Jinhee JUNG, Jimyoung NAM, Sunyoung WON (Republic of Korea)

WFSICCM_TP_259

THE FEASIBILITY OF LIBERAL SAFETY SCREENING IMPLEMENTATION FOR EARLY MOBILIZATION IN MEDICAL INTENSIVE CARE UNIT
Jin Hee JUNG, Soo Hyun CHO, Sun Young WON, Hee Og LEE, Seon Mi KIM, Yoon Mi LEE, Youngjun KO, Jin Yeong KO, Gee Young SUH, Chi Ryang CHUNG (Republic of Korea)

WFSICCM_TP_260

THE EFFECTIVE WORKING SCHEDULE OF A PHYSICAL THERAPIST TO FACILITATE EARLY MOBILITY IN AN ENVIRONMENT OF LIMITED MANPOWER
Youngjun KO, Seon Mi KIM, Jin Hee JUNG, Soo Hyun CHO, Sun Young WON, Yoon Mi LEE, Jin Yeong KO, Hee Og LEE, Gee Young SUH, Chi Ryang CHUNG (Republic of Korea)

WFSICCM_TP_261

FOUR-YEAR EXPERIENCE OF EXTRACORPOREAL MEMBRANE OXYGENATION FOR KIDNEY TRANSPLANTATION PATIENTS WITH SEVERE REFRACTORY CARDIOPULMONARY INSUFFICIENCY
Jongkwan BAEK, Sukkyung HONG (Republic of Korea)

WFSICCM_TP_262

APACHE II SCORE AND LACTATE LEVEL AS AN EARLY PROGNOSTIC MARKER OF MORTALITY IN CRITICALLY ILL PATIENTS
Primartanto WIBOWO, Hori HARYANTO, Oloan E. TAMPUBOLON (Indonesia)

WFSICCM_TP_263

A PROFILE OF CURRENT PHYSIOTHERAPY PRACTICES IN INTENSIVE CARE IN SOUTH AFRICA
Farhana KARACHI (South Africa), Susan HANEKOM (South Africa), Rik GOSSELINK (Belgium)

WFSICCM_TP_264

ANALYSIS OF CHANGES IN MEDICAL CONSULTATIONS AT INTENSIVE CARE UNITS
Mi Kyoung HONG, Joohyun PARK, Jeong Won HEO, Eunmi GIL, Tae Sun HA, Dae-Sang LEE, Jeong-Am RYU, Chiryang CHUNG, Jeong Hoon YANG, Jinkyeong PARK, Joongbum CHO, Geeyoung SUH, Chi-Min PARK (Republic of Korea)

WFSICCM_TP_265

BEST-PRACTICE PROCESS OF IMPLEMENTATION STRATEGIES IN INTENSIVE CARE: A SYSTEMATIC REVIEW
Farhana KARACHI (South Africa), Susan HANEKOM (South Africa), Rik GOSSELINK (Belgium)

WFSICCM_TP_266

INFECTIOUS COMPLICATIONS RELATED TO EXTRACORPOREAL MEMBRANE OXYGENATION IN ADULT PATIENTS
Yun Seong KIM, Woo Hyun CHO, Doo Soo JEON, Seong Hoon YOON, Hye Ju YEO, Bong Soo SON, Do Hyung KIM (Republic of Korea)

WFSICCM_TP_267

APPLICATION OF EJECTION-TYPE INTRAOSSEOUS INFUSION DEVICE IN CRITICALLY ILL PATIENTS IN THE PLATINUM 10 MINUTES
Zhongjie HE, Zhiyoung SHENG, Fuli WANG, Yonggong WANG, Shangqin LIU, Jiayi ZHENG, Hongyuan LIN (China)

WFSICCM_TP_269

PRELIMINARY STUDY ON THE RESPONSE TYPE OF RAPID RESPONSE SYSTEMS: RECOMMENDATION VS ACTIVATION
Jae Hee CHUNG, Seok-Chan KIM, Hwa-Young LEE, Sei-Won KIM, Ji-Hyun KIM, Keum-Sook JEUN, Mi-Ra HAN, En-Hyoung KANG, Yong-Suk LEE (Republic of Korea)

WFSICCM_TP_270

BODY MASS INDEX AS A PREDICTOR OF ACUTE KIDNEY INJURY IN CRITICALLY ILL PATIENTS
Ho Cheol KIM, Tae Won LEE, Sunmi JU, Seung Hun LEE, Jung-Wan YOO, Yu Ji CHO, Yi Yeong JEONG, Jong Deog LEE (Republic of Korea)

WFSICCM_TP_271

PREDICTING ICU INTERVENTIONS IN INTENTIONAL DRUG OVERDOSE
Huub VAN DEN OEVER, Mirja VAN DAM, Esther VAN 'T RIET (Netherlands)

WFSICCM_TP_272

THE RELATIONSHIP BETWEEN ANXIETY AND SLEEP DISTURBANCES IN RELATIVES OF PATIENTS WITH ACUTE PHYSIOLOGICAL STATUS CHANGES IN INTENSIVE CARE UNIT
Bekir OPUS, Funda GOK, Alper KILICASLAN, Alper YOSUNKAYA (Turkey)

WFSICCM_TP_273

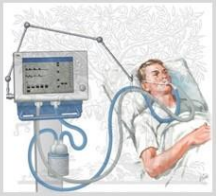
CLINICAL EFFECTIVENESS OF THE UTILIZATION OF

Scientific Oral Presentation UWC CHS Faculty Symposium, October 2015

A Profile of current Physiotherapy Practices in Intensive Care in South Africa

Phase One of the Project Entitled
The implementation and evaluation of a validated evidence-based physiotherapy protocol in a surgical ICU
A Controlled Before and After Experimental Trial

Supervised By
Prof SD Hanekom (*Stellenbosch University*) & Prof R Gosselink (*Katholieke Universiteit, Leuven*)



FARHANA KARACHI
PHD PHYSIOTHERAPY
CHS FACULTY RESEARCH SYMPOSIUM
1 OCTOBER 2015

Addendum 2B: Poster and Oral Presentations of Review Results

Scientific Poster Presentation WFISCCM Congress, 2015

Best Practice Process of Implementation Strategies for effective change in ICU Practice: A Systematic Review

Karachi F[1], Hanekom SD[2], Gosselink R[3]

[1]University of the Western Cape, Cape Town, [2]Stellenbosch University, Cape Town [3]Katholieke Universiteit, Leuven

BACKGROUND

A major challenge faced by intensive care physiotherapists, and other multidisciplinary intensive care team members is implementing evidence into practice (1) and this may be due to uncertainty regarding effective implementation strategies (2). Implementation strategies that work in other clinical settings may not necessarily work in a complex and dynamic setting such as intensive care (3). While various implementation strategies have been investigated in ICU, this data has not been synthesized. Thus the optimal best practice implementation strategies in ICU remain unknown (3). The aim of this review was to systematically identify rigorous evaluations and determine effectiveness of implementation strategies to facilitate protocol implementation in ICU. The specific review objectives were to describe: i) the various implementation strategies used, ii) the outcomes measured following implementation, iii) the factors associated with successful practice change implementation and iv) estimate the effectiveness of implementation strategies in changing intensive care practice.

METHOD

Seven electronic databases (Figure 1) were searched (date of inception to 31.03.2014) using a predetermined search strategy by the reviewer. Two reviewers independently screened articles at title, abstract and full text level for selection and inclusion (Table 1). No further titles were identified through pearling. A Third Reviewer was consulted as an independent consensus reviewer during disagreement between the two reviewers at any of the aforementioned levels of selection.

Figure 1. Electronic Databases Searched

Table 1. Selection Criteria	
Participants	Multidisciplinary ICU HCP
Interventions	Implementation Strategies to Implement Clinical Guidelines/ Evidence Based Protocols
Comparisons	Comparing two single, two multi-faceted and/or a single to a multi-faceted or more than two types of implementation strategies
Outcomes	Objective measures of health care provider behaviour, knowledge, attitude and self-efficacy and/or patient outcome and/or process indicators

The Cochrane Effective Practice and Organization of Care Review Group (EPOC) Data Abstraction Form and Data Collection Checklist was used to extract data. The EPOC methodological quality criteria was used to critically appraise the included studies. Due to heterogeneity a meta-analysis was not possible and results were presented in narrative format.

RESULTS AND CONCLUSION

A total of nine studies were included in the review (Figure 2).

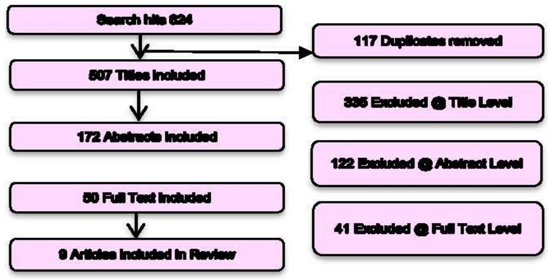


Figure 2. Study Selection Process

Characteristics of the 9 Included Studies (4-12):

- Seven CRCT and 2 ITS studies published between 2004 and 2013, conducted in Canada, North America, US, UK, Australia, New Zealand and Netherlands
- Multidisciplinary ICU HCP (medical doctors, intensivists, physicians, nurses, dieticians or entire team) conducted these studies,
- clinical guidelines/protocols implemented varied (eg. Implementation of feeding, VAP, DVT prevention, end of life care),
- process of care measures or indicators and/or primary outcomes evaluated varied between studies, quantitative, qualitative or both outcomes evaluated,
- different implementation strategies evaluated (1 compared active to passive dissemination[8], 8 used multifaceted strategies[4-7, 9-12].

Implementation Strategies in ICU: Multifaceted and active implementation strategies were reported more effective than single and passive strategies. Five main implementation strategies were identified namely educational outreach, audit and feedback, reminders, support and a quality improvement plan and/or team. All studies used educational outreach strategies. Educational outreach consisted of strategies like educational material, workshop/workshop series, academic detailing, grand/ward rounds, didactic lectures and video/web based education. Seven studies used audit and feedback strategies[4-7, 9-11] and five quality improvement plan/teams[6,8,9,10,12].

Conclusion: Heterogeneity between studies was high as a variety of clinical guidelines/protocols were implemented, primary outcomes measured differed and reporting on compliance differed. It is strongly recommended that studies implementing clinical guidelines/protocols should be reported in a standard or formalised way in order to be able to compare research findings. Besides identifying the most effective strategy, future research should also be conducted to understand why, how and when the specific strategy/ies works best in an ICU setting.

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I would like to ***acknowledge*** *the* ***NRF, MRC*** *and* ***Harry Crossley*** *for their* ***Funding Support*** *for this Review.*

Scientific Oral Presentation UWC CHS Faculty Symposium, October 2015

Best Practice Process of Implementation Strategies for effective change in ICU Practice: A Systematic Review

Phase Two of the Project Entitled:

The implementation and evaluation of a validated evidence-based physiotherapy protocol in a surgical ICU: *A Controlled Before and After Experimental Trial*

Karachi F[1], Hanekom SD[2], Gosselink R[3]

[1]University of the Western Cape, Cape Town, [2]Stellenbosch University, Cape Town [3]Katholieke Universiteit, Leuven, Belgium

CHS FACULTY RESEARCH SYMPOSIUM 2015

Addendum 3A: Poster Presentation: Patient Perception of Physiotherapy in the ICU

MSc Project 1, 2015

Published Abstract Critical Care Congress Abstract, 2015

Patient perceptions of ICU care: A scoping review

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Background. Physiotherapy practice in intensive care unit (ICU)s is changing. Early mobilisation programmes are included and prioritised. Methods and measures to assess physiotherapy effectiveness in the ICU have often been geared to physiological data. It is unclear whether patients' perspective and satisfaction with care in ICU have been investigated.
Method. A scoping review was undertaken with the aim of determining how patient perception and satisfaction with critical care is measured. Seven databases were searched using the following keywords in various combinations: physiotherapy or physical therapy, patient satisfaction, perception or patient perception, patient experience, intensive care unit or ICU, critical care, hospitalised adult population, hospital, measurements, measuring and outcome measure.
Results. 1 626 articles were independently screened by two reviewers at title, abstract and full text level respectively. The final review included 26 articles. Only two of the studies were conducted in Africa, compared with ten in Europe and six in Northern America, respectively. Nine of the included articles investigated a particular service such as nursing care, emergency care and physiotherapy with regards to patient perception and satisfaction. Only one article, published in 2008, investigated patient perception and satisfaction in physiotherapy. Various outcome measures were identified in this review that measure perception and/or satisfaction. However, there is currently no validated and reliable instrument to assess patient satisfaction with care in the ICU.
Conclusion. A gap in the literature was identified for patient perceptions regarding physiotherapy care in the ICU. The results will be used to inform the planning of a primary qualitative study. Knowing and understanding the patients' perception and satisfaction with care, ensures the professional development in the critical care field, and improving the quality of care.

Scientific Poster Presentation Critical Care Congress, 2015

Patient perceptions of ICU care: A Scoping review

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INTRODUCTION: Patient satisfaction is fast becoming an essential concept for improving quality of care (1,2). Documenting what elements are important to a patient when evaluating their health care is vital in assessing and improving quality of care (3). A patient's satisfaction and positive experience with health services has been related to increased compliance with treatment plans, better patient's safety and improved clinical results (4,5). The World Health Organisation (WHO) has recognised the importance of patient opinion, perception and satisfaction level, in order to meet all the patients' necessary needs.

A scoping review was undertaken with the aim of determining patient's perception and satisfaction with critical care. The objectives of the scoping review were to describe the components of care, services and the geographical distribution of the literature, for patient perception and/or satisfaction with critical care.

METHODS: A total of seven databases were electronically searched between 06/02/2015 - 20/02/2015 namely: MEDLINE, CINAHL, Science Direct, Pubmed, Web of Science, Scopus, Google Scholar. No time period limitations were set for the databases during the searches. Search terms included: *Physiotherapy or Physical therapy, Patient satisfaction, Perception or patient perception, patient experience, Intensive care unit or ICU, Critical care, hospitalised adult population, hospital, measurements, Measuring, Outcome measure.*

At the end of the search period, two reviewers independently reviewed papers at title, abstract, full-text levels (Refer to *Figure 3-1 Selection process flow diagram* and *Table 2-1 for the study inclusion and exclusion criteria*).

Table 2-1 Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
• Only adult populations (>18years of age) • Only English/Spanish articles • Only Human Articles • Hospitalised environments • ICU/ Critical care • Articles only not reviews • Patient perception or satisfaction of care • Measurements of perception or satisfaction with care	• Palliative care / Cancer & End of life care • Perceptions of others, rather than the patients (Family/nurse/ Physician) • Outpatients & Chronic conditions • Primary health care • Neonates/children populations • Only QOL investigations • Pregnancy/delivery • Behavioral changes • Imaging • Theoretical/conceptual studies

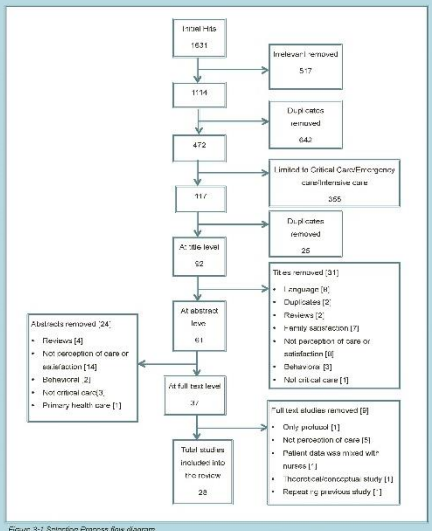

Figure 3-1 Selection Process flow diagram

RESULTS: 28 of the papers were included.

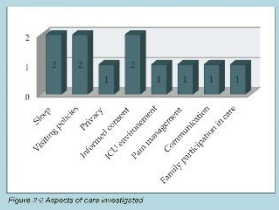

Figure 3-2 Aspects of care investigated

Table 3-1 Study characteristics

Study characteristics	Number [#]
Investigation Categories	
Investigated services (5,6,8,9,11,13-16)	10[35,7]
Investigated care component (10-24,27-30,35)	11[39,3]
Investigated ICU experience (26,31-33)	4[14,3]
Investigated ICU care quality/satisfaction (7,25,34)	3[10,7]
Countries of Publication	
Europe (n=16)	
France (26)	1[3,6]
The Netherlands (29)	1[3,6]
Switzerland (28)	1[3,6]
Norway (18)	1[3,6]
Iceland (19, 29)	2[7,1]
Spain (8, 34, 35)	3[10,7]
England (20)	1[3,6]
Northern America (n=7)	
Canada (21)	1[3,6]
USA (6,7,13,21,23,31)	6[21,4]
South America (n=1)	
Brazil (33)*	1[3,6]
Africa (n=2)	
Nigeria (11,14)*	2[7,1]
Australia (n=4)	
Australia (15,17,24,32)	4[14,3]
Asia (n=4)	
Turkey (19,33)*	2[7,1]
Israel (9)	1[3,6]
China (26)	1[3,6]

Table 3-2 Studies investigating a component of care

Care Component	Studies	Positive Issues	Negative Issues
Privacy	Cerda et al (35)	• Professional empathy • Nursing professionalism • Closing curtains = individual space	• Feelings of vulnerability, shame, nakedness • Distance of family • Disruption of family roles • Loss of independence • Lack of physical individual space • Shared space
Informed consent	Clark(23)	• Effective informed consent was of high value to patients. • Positive info-med consent process were more likely to have a higher health status after discharge. • Male>female	• ↑ICU stay • Patients dying for heart issue • ↑Age
	Modris et al(24)	• Patients prefer receiving information verbally (81%) • Patients prefer giving consent verbally (50%) • 30% patients expect to give procedural consent to all procedures • 80% report sufficient procedural information • 50% report easy to understand information.	
Family participation in ICU care	Gerrousle-Digsas et al (30)	• 77.2% favorable to family participation • Previous ICU stay • Middle aged • ↑Age • Care from spouse vs grown children	• Image preservation • Embarrassment • Nurses are better skilled • Safety concerns • Unwilling to assist • Physical shyness
Visiting policies	Gonzalez et al (21).	• Flexible hours • 1/3 prefer unlimited visiting time and 1/3 prefer visiting times once a day only	• When patient unwell • When visitor dynamics not ideal • Timing: early morning/ late evenings
	Novaes et al (22)	• ↑Visiting time • Detailed informed consent	
Communication during respirator treatment	Hafsteindottir (29)	• Explanations prior to treatments • Suggested observation of patient need for suctioning • Suggested use of an alternative methods of communication	• Fear and anxiety • Wanting to give up • Feelings of suffocation, confusion, nightmares and impaired memories
Sleep	Jones et al (20)		• Discomfort • Pain • Anxiety • Noise • Wearing a mask • Environmental tube presence • Lighting
	Dgray & Ozkelkr (19)		• Immobilisation • Anxiety • Pain • Discomfort • Short visiting times • Noisy environment • Nursing interventions
ICU environment	Jongerden et al (28)	• Single room ICU • Adapted colouring • Reduced noise • Better form of facilities • Daylight exposed rooms	
Pain Management	Tapolovec Vranic et al (27)	• Assessor pain scores for the worst pain epic • Communication of pain treatment significance • Nurse and physician responses to pain management	

Table 3-3 Studies investigating patient perception and/or satisfaction with a service

Services	Studies	Level of satisfaction	Positive Issues	Negative Issues	Recommendations
Emergency care	Arika et al (14)	51,2% rated the care either good or excellent	• Adequate equipment	• ↑Waiting time • ↓Facility size • Unfriendly health workers	• Improved interactions with health care workers
	Goldwag et al(9)	↑High satisfaction (89% satisfied)		• ↑Waiting time • Elementary schooling • Arabic/Russian speaking • Ethnicity • Self-rated health status • Knowledge of medical issue • Dr attitude	• Improved communication with patient
	Oluwayemi et al (11)	↑High satisfaction		• ↓Privacy • ↓Poor interactions with health care workers • ↑Time to surgery	• Improved interactions with health care workers • ↑time to access surgery
	Sun et al(5)	Large proportions of patients were satisfied with overall care.	• ↑ Treatment sessions • ↑ Age	• Ethnicity • ↓Triage status • ↓Communication with patients • Hand lacerations > Abdominal pain	• Manage the perceptions of waiting time • Improve communication with patients • Manage patient expectations.
Nursing care	Doey (13)	↑High satisfaction	• ↑Friendliness of staff • ↑Pain management	• Preparation for transfer	• Continue positive interactions with health care workers
	Hunt (17)			• Noisy setting • Delay or planned procedures	• Patient education • Noise reduction • Acknowledge non-verbal communication from patients • Plan nursing care to allow for sleep
	Jonsdottir & Baldursoorir (16)		• ↑ Age • Gender (Female > Male) • Lower education		• A moment of care requires nurses to be conscious of fulfilling the patients needs
	Johannessen et al (18)	↑Extremely high satisfaction		• ↓Nurse competence levels • ↓ information for patient • Hygiene	
	Ramem-Garcia et al (8)	Satisfied with nurses when care is holistic	• Holistic care • Verbal and non-verbal communication • Professionalism and clinical competence • Continuous care • Mobilization • Hygiene & comfort • Pain control • Keeping safe and the treatments.		• Holistic approach and treatment with combination of care • Effective communication and professionalism
Physiotherapy	Stiller & Wiles (15)	↑High satisfaction	• ↑Privacy • ↑Dignity • ↑Sufficient explanations • ↑Empathy & care		

DISCUSSION & CONCLUSION: The scoping review was able to identify a gap in the available literature for the areas regarding physiotherapy perceptions and satisfactions within the ICU, as well as the geographical distribution of published literature in the field. Only one article, namely; Stiller and Wiles (15) investigated patient satisfaction with regards to physiotherapy care in the ICU setting. Stiller and Wiles (15) were unable to identify any research focused in assessing patient satisfaction with physiotherapy within an ICU context (15) and this scoping review further confirms their findings.

According to the World Bank Group (37), 82,1% of the 28 studies included in the review, were from developed countries, while 17,9% were completed in developing countries. As documented by several of the studies, the patient's perception and/or satisfaction with the care was influenced by gender, age, culture and language. This could lead one to assume that patients perception and satisfaction with care would differ greatly depending on the country and population of patients.

Patients were previously not thought to be appropriately prepared, to judge the components of care and the quality thereof. However they are now more readily seen as crucial informants regarding quality aspects with care (7). This review noted the need for further research into patient perception and satisfaction with physiotherapy in the ICU, and more research in developing countries.

Addendum 3B: Abstract accepted for Presentation at WCIM 2018

MSc Project 2, 2017

From: "WCIM 2018- The 34th World Congress of Internal Medicine, Ca..." <Registration@Wcim2018.com>
Date: 01 August 2018 at 14:01:11 SAST
To: Jacquesphysio@gmail.com
Subject: WCIM 2018 - Abstract Accepted - Registration deadline extended to 10 August 2018

Dear Jacques Maritz,

Thank you for submitting your abstract to **The 34th World Congress of Internal Medicine**, Cape Town, South Africa, 18-21 October, 2018 (WCIM)

We are pleased to inform you that your abstract entitled "

Physiotherapists' Perception of a Best Practice Implementation Process in a Surgical ICU: A Qualitative Study

" has been accepted as part of the Scientific Programme.

Due to the high number of abstracts received, the scientific committee is currently still reviewing and we will advise shortly if you will be an Oral or Poster presenter. We hope to advise you by next week.

The committee has advised that should your abstract not be accepted for oral presentation, it will be accepted for Poster presentation, so you can go ahead and complete your registration.

Please note: All presenters are required to register for the Congress. All abstract presenters will be able to register at the Early Bird Registration price.

We kindle request you proceed to complete your registration using one of the following links:

Registrations from outside South Africa **Register Here**

Registrations from South African Delegates only **Register Here**

We look forward to welcoming you to South Africa!

WCIM 2018 Secretariat
Email: secretariat@wcim2018.com

Addendum 4: Patient Perception of Physiotherapy in the ICU

MSc Project 1, 2015

CHAPTER 3: RESEARCH MANUSCRIPT

"THEY PLAY A BIG ROLE …" PATIENT PERCEPTIONS OF PHYSIOTHERAPY IN THE ICU: A QUALITATIVE STUDY

3.1 INTRODUCTION

The intensive care unit (ICU) environment has been described as a stressful and overwhelming setting for the patients (10) and their families. According to Cutler, (57) a critical illness and consequent admission into an ICU is a substantial event in a patient's life. Patients admitted into an ICU usually require extensive monitoring and continuous management. (48)

Physiotherapists form part of the multidisciplinary team that is involved in the management of ICU patients. (58) Physiotherapy in the ICU includes management of airway secretions, mobilisation and muscle training, which aims to reduce ventilator dependency and weaning difficulties, as well as mobilisation impairment and limitations among others. (59) Physical and respiratory recovery, prevention of the side-effects associated with prolonged bed rest, reduction and termination of mechanical ventilation along with increased health state, are clinical results associated with physiotherapy in the surgical and medical sectors. (59)

Hanekom, Louw and Coetzee (34) reported that it is the obligation of the physiotherapy profession not only to find methods to measure the value of the physiotherapy service in the ICU environment but also to describe the quality of this service. (34) While multiple measures exist to measure patient perception or satisfaction in the critical care setting, there is no consensus on the gold standard of measurement.

The outcome measures available for assessing physiotherapy effectiveness within the ICU specifically, have often been geared to physiological data and have not taken the patient's perspective into account. (27) The lack of patient perspective may be due to ICU patients routinely receiving heavy sedation, and this is thought to reduce patient recall regarding their ICU experience. (39) However, as ICU practices change, including daily sedative interruption (31,60,61) and the prioritisation of rehabilitation in the ICU, (30,61) particularly with physiotherapy

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early mobilisation, (29) this may no longer be true.

The changes in both physiotherapy and ICU practices can improve patient functions, decrease delirium duration, decrease ventilator time, shorten ICU length of stay (31) and could facilitate the opportunity to access the patients' perceptions of the ICU experience and the services involved. As documented by Stiller and Wiles, (27) "subjective outcomes" such as patient satisfaction and perception are as important to critically ill patients as the physiological outcomes. Understanding and investigating patient perception and satisfaction with regard to healthcare is vital in both the assessment and improvement of quality of care. (18) Thus, a primary qualitative study was conducted to describe patient perceptions and satisfaction regarding the physiotherapy care received during their surgical ICU stay.

3.2 MATERIALS AND METHODS

3.2.1 Study design

An interpretive and descriptive qualitative design was used. The aims of interpretive research are to create meaning through explanation, description and exploration. (44)

3.2.2 Research setting and context

The research was conducted in a level 1, (62) 14-bed surgical ICU at a tertiary institution in the Western Cape. In this unit, the physiotherapy responsibility is rotated every three months, and one physiotherapist is responsible at a time. This physiotherapist is not exclusively allocated because they also cover ward duties. As per the weekend policy, weekend physiotherapy is provided to four patients selected by the doctor on call. In addition, two Western Cape universities currently make use of this unit as an academic platform for clinical rotations of final-year physiotherapy students. (36, Bester A, Daries H 2015, personal communication, October 21)

This primary study addressed one objective of a larger umbrella project namely: The implementation and evaluation of a validated, evidence-based, physiotherapy protocol in a surgical ICU: A controlled before and after experimental trial (Ethics Approval Number: S13/09/170). This umbrella project consisted of three phases. The final phase (Phase 3) involved the implementation

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of an evidence-based and validated physiotherapy protocol within a surgical ICU as well as an evaluation of the protocol implementation. The physiotherapy protocol consists of five algorithms. (33,34) These were developed to aid physiotherapists in making "evidence-based clinical decisions" (35) involving both rehabilitation strategies (including early physiotherapy mobilisation) and respiratory management when treating ICU patients. (35,36) The use of evidence-based treatments and protocols may contribute to improving ICU care quality. (34)

Due to the implementation of the evidence-based and validated physiotherapy protocol, the ICU research unit was considered to be in transition. Patients included in the primary study were also involved in the umbrella study and, therefore, they received a combination of usual hospital physiotherapy care as well as the protocol care.

3.2.3 Population

All adult patients discharged from the surgical ICU of the institution during the data collection time period (6 August 2015 to 4 September 2015) were eligible for inclusion in the study.

3.2.4 Sampling methods

A purposive sampling method was used for this study. Patients were excluded from the study if they were 1) under the age of 18 years old; 2) unable to communicate in English, Xhosa or Afrikaans; 3) un-cooperative; 4) had no memory of the ICU or physiotherapy; or 5) presented with cognitive impairments. Co-operation and consciousness (58) were determined and aided by the use of the Glasgow Coma Scale (GCS) and Adequacy score (SQ5). (30,58,63) Patients scoring below the maximum total for each score were excluded from the study.

3.2.5 Ethical considerations

Ethics approval was obtained from the Human Research and Ethical Committee (HREC) (S15/04/094) (Appendix B). Institutional approval to conduct the research was also provided (Appendix C). All patients provided their written consent, and patients were informed and assured that their involvement would be anonymous. All patient interviews and patient-related data were coded alphabetically to ensure confidentiality and privacy. Collected data was stored on a password-protected computer to ensure the investigator had exclusive access.

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3.2.6 Recruitment method

The primary investigator (PI) visited the ICU daily to compile lists of patients discharged from the unit. The patients were followed up in the wards and assessed for inclusion into the study. Patients available for inclusion were purposefully selected for the study according to predetermined characteristics. The predetermined characteristics included patient demographics (age, gender), pre-admission status (education, employment), admission status (Apache Score II (severity of illness) and diagnosis) and ICU management (mechanical ventilation and ICU length of stay (LOS)).

Patients who passed the GCS and SQ5 criteria were informed of the study objectives, aims and methodological aspects by the PI. On receipt of their written consent, an interview date and time was arranged with the patient. Patients were individually interviewed by the PI within 3 to 5 days of being discharged from the ICU, while still in a general ward or in a High Care Unit of the tertiary institution.

3.2.7 Data collection and management

The PI conducted 18 individual, semi-structured interviews of varying length (25−60 minutes) using a discussion schedule (Appendix E). Interview length depended largely on the quality of the interview and the patient's ability to participate. All interviews were audiotaped, which allowed for the data to be transcribed and used for analysis.

A Xhosa translator was present for four of the interviews and when possible, an observer was present to document observations during the interviews. Throughout the data collection process, the PI confirmed and summarised the data obtained during the interviews to verify the PI's understanding. The PI also kept a field journal during the data collection process for reflection, documentation of research decisions and bias identification. Both the Adequacy score (Appendix F) and the discussion schedule (Appendix E) were piloted prior to use to ensure saliency (Appendix G).

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3.2.8 Data analysis

All audiotapes were transcribed verbatim. The PI cleared and checked the transcription against the audiotapes for accuracy. Thereafter, the data was analysed inductively according to interpretive content analysis principles. Content analysis involves using a systematic process to summarise and categorise the communicated message. (64) This requires considering data from various angles and identifying important aspects in the text to assist in the understanding and interpretation of the raw data. (64) During data analysis, the data was coded and categorised into groups until themes were drawn (Appendix J).

3.2.9 Quality criteria

The PI established credibility and truth-value through checking the audiotaped data with that of the originally transcribed interviews. After the data collection and analysis phases, all the patients were contacted telephonically and invited to participate in the member-checking contact session to ensure credibility and trustworthiness of the data collected. Fourteen patients (78%) were willing to participate in the member checking, of which six were completed telephonically. Truth-value was ensured because the PI immersed herself completely in the data during the collection and analysis phases.

Dependability and credibility were further safeguarded through triangulation of the collected data, namely, the audiotaped interviews, the transcriptions and available observer notes as well as the PI's field journal. Furthermore, the transcriptions and analysis of the interviews were peer reviewed by a third party. In order to ensure confirmability, the transcriptions and analysis were available for audit, and the field journal as well as reflection of the study process facilitated the recognition of bias.

3.3 RESULTS AND DISCUSSION

Eighteen patients were included in the study (Figure 3.1), of which ten were male. During the initial sampling process, an additional male patient was recruited because he met the criteria for the SQ5 and GCS scores. However, during the interview, his testimony became unreliable and inconsistent and as a result, this patient's testimony was excluded.

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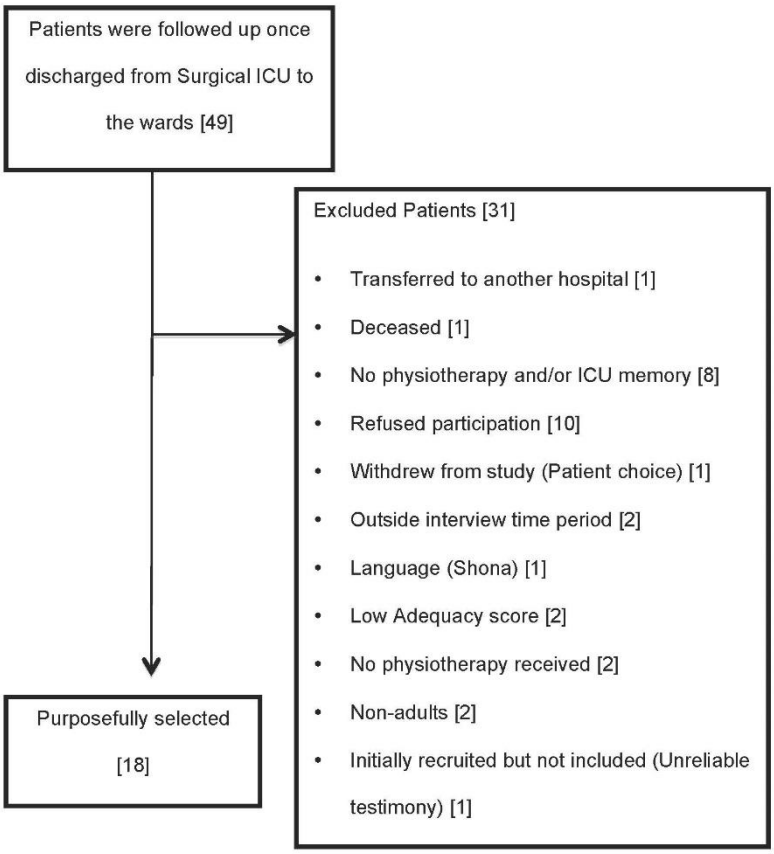

Figure 3.1: Flow diagram depicting patient selection

The overall median age of the patients was 44 years and the median LOS was 6 days. Table 3.1 demonstrates the diversity among the patients for each selected characteristic.

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Table 3.1: Patient characteristics

Characteristic	n
Age (years)	
18–30	2
30–45	7
45–60	6
60–70	2
>70	1
Home language	
English	5
Afrikaans	7
Xhosa	6
Education level	
Tertiary education	5
Secondary education	11
Primary education	2
Employment status	
Employed	8
Unemployed	7
Pensioner	2
Disability grant	1
Severity of Illness (APACHE score)	
≤5	5
6–10	4
11–15	3
16–20	3
>20	-
Not Provided	3
Diagnosis	
Elective	5
Emergency	9
Trauma	4
ICU LOS (Days)	
≤5	8
6–10	7
11–15	-
16–20	1
>20	2
MV	
Y	14
N	4

Yes (Y); no (N); length of stay (LOS); mechanical ventilation (MV); none (-)

3.3.1 Themes

A total of 12 themes emerged. These included: 1) patient expectations and understanding; 2) physiotherapy activities and the implication of mobilisation; 2) physiotherapy benefits and

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progression; 4) physiotherapy value; 5) interdisciplinary team; 6) the physiotherapist; 7) safety; 8) tangebilities; 9) continuity of care; 10) satisfaction; 11) communication; and 12) patient perception and experience. Verbatim quotes have been used to support the study findings. All non-English quotes have been translated into English. The PI also made enquiries regarding barriers, facilitators and challenges to the physiotherapy care received. These are discussed under the relevant themes.

3.3.1.1 *Expectations and understanding*: "*I have a better understanding…"*

There was wide-spread diversity in the patients' expectations and understanding of physiotherapy in the ICU. Many patients understood physiotherapy to be predominantly outpatient based and not usually practised within a hospital, even less so in the ICU. Physiotherapy was also reportedly understood to be more for musculoskeletal injuries, gait re-education, returning to previous functional level and not necessarily for treatment of the lungs.

> MM5 (p. 14): *The purpose of all of this [physiotherapy] is to get me out and back on my feet … so that I can be the same person that I was.*
>
> VNA11 (p. 9): *I thought they were just exercising your limbs.* [Laughs] *Now I understand it's not just your limbs. It's everything. Ja.*
>
> KC18 (p. 8): *And then I actually, uh, understood, uh, understood what it actually was. It is actually about my lungs that were perhaps weakened, or something of that nature, because it needs to be strengthened.*
>
> SF3 (p. 15): *And of course, once the op is finished … You need physiotherapy to be able to get the muscles going again … You see? It's got to be going. Otherwise … It's like a-a, a battery. Car battery. If it's flat or if it's down … You can't use it. You have to send it somewhere to be recharged. Am I right ?… You can compare that with physiotherapy … Your body needs to go somewhere to be recharged.*

Patients who had previous physiotherapy experiences had a better understanding of what physiotherapy entailed, and their expectations were more in line with the care they received. Thus,

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having had a previous physiotherapy experience was a facilitator in the understanding of the physiotherapy care received. In contrast, most patients who had never experienced physiotherapy prior to their ICU admission did not know what to expect in the session. For some of these patients, the first experience of physiotherapy was described as strange and even shocking. Expectations of physiotherapy treatment was also influenced by the patient's condition and expectations of the ICU environment.

> BA1 (p. 6): *Noo. In ICU I was expecting to sle-, lie on the bed, totally. So I can wakeup when I go. Not to … step out and sit on the chair. It was like, I was expecting to sleep … the whole day … So … I thought I would lie, all the day. So, when they, put me in the chair I thought that they were not doing their job because I feel sick. But they took me in the chair. How can a sick person can be able to sit? It was like that.*

> VWJ2 (p. 3): *It was pretty alright because I have done a lot of [physiotherapy] previously… Its not like it was a strange feeling like the first time … the first time of physio, that was bad for me. It was … with the very first operation, seven years ago. I hadn't an idea of physio or what would happen. It was quite bad for me.*

Patient expectations were further influenced by the patient's understanding and communication. Both communication and understanding acted as bridging factors to link the patient's expectations and the comprehension of physiotherapy.

> KT16 (p. 12): *...once I understood what the physio is gonna do for me … it was just positive from there.*

> KC18 (p. 22): *…I would say again, yes. Because like she, like she explained to me, what the next step was … Then I just thought to myself this is now, it's about this now, yes. Understand? … So I understood it more, like how she explained each step for step to me.*

Through the ICU experience of physiotherapy and being placed in the patient role, some patients' understanding of physiotherapy changed. One patient, a healthcare worker, reported:

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KT16 (p. 4): *I have a better understanding [of physiotherapy] because, okay, once they, uh, gave me physio, I noticed everybody else got-gets physio too.*

KT16 (p. 21): *Number one, physio is for everybody. Every sick person. Especially like I said, I saw in ICU, we all had different injuries and they were catering to every person's need … From-from being sick and laying in the bed. I know what it is now … When I treat somebody this time round, I think it-it will definitely impact on my work that I do.*

3.3.1.2 ***Physiotherapy activities and implications of mobilisation***: "*The goal is to get to the chair.*"

Patients described multiple activities completed during physiotherapy in the ICU. Activities included chest physiotherapy, breathing exercises, limb movement and activity as well as mobilisation. Most patients also described using a 'PEEP bottle' and breathing exercises that some felt assisted their breathing and rib pain.

DS23 (p. 2): *They make me blow that bottle so they say I must blow that bottle so … Ever since now they learn me how to blow that bottle now. I s-, there's no pain anymore in my ribs.*

GS7 (p. 12): *They also taught me how to cough … to cough as well. Yes … How to cough that all the phlegm can always … -the phlegm. Can come out.*

MM5 (p. 5): *A water-bottle pipe. The uh … physio lady came on the following day. With the bottle. Then we done some few exercise, whereby I was sitting in the chair again … She will say to me I must breathe in … And then I must breathe … ah … uh … out. And then I must do one, three times. Then after that we will take the bottle, with the pipe, and then I must breathe in deep. And then after that, when I'm blow … when I'm breathing out, I must breathe on that bottle.*

MJS20 (p. 8): *Ja ... Normally because my, my problem is about breathing. It's about breaths. And it's about standing. Because I injured my, my spinal cord. I injured my ribs … So … It feel the people tried to put my ribs back. By giving me the blowing, you know, one of these* [indicates] *… Ja, the PEEP bottle.*

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JR24 (p. 1-2): *Uh. They helped me out of the bed … And let me sit upright. Cushion behind my back, like … a stiff cushion … Lifted arms. Deep breathing … Moving legs … Feet … That's that.*

Those patients who mobilised did so in bed, relocated to the chair or progressed into standing or walking in the ICU, largely with the assistance of the physiotherapists. Some patients described mobilisation as a difficult component of the care, mainly due to pain, tiredness and dizziness.

PB6 (p. 3): *They made in sit on chair for four bloody hours … I, I dunno. I … can know that you allowed to sit in pain, 'cause I was in pain.*

BA1 (p. 18): *I hate to sit in the chair … Because I was very tired and everything.*

BA1 (p. 13): *Sometimes I would refuse. They say why? I'm tired, I can't sit. Sometimes say I'm dizzy. I can't sit on the chair. They would say okay. It's fine. We'll put you two hours. And then we'll come back and then we'll put you back. And then I said thank you. Yes, they do understand. Saying, okay. Maybe, in the morning we will put you two or one hour. Then we'll come later…*

Yet most patients found mobilisation to be a positive experience and the beginning of their recovery. The majority of patients described the experience of mobilisation positively as follows:

WM14 (p. 6): *It was an experience, you know? … Because you're still weak from the, uh, the things of yours. They sit you in a chair … and you sit there now. And your still in a condition that you do not care to read magazines or to look, you know? … Or to listen. So you sit and die.*

WM14 (p. 7): *It was also nice … Because, it was when I felt here it begins. The recovery … Yes, it made me feel, you know, I begin.*

KC18 (p. 9): *It was almost to say a big joy. It's almost like a relief … compared to lying in the bed. It's that moment that I came into the chair, that I felt I was almost like a person that now*

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> *… could move … because I sat upright. Do you understand? It is a, it was more of a relief, than just lying in the bed.*

> KT16 (p. 3): *[Sitting in the chair] you felt like you could see what they were talking about, you could finally do what they said you could do.*

> VNA11 (p. 17): *Ja. I was just glad to get out.* [Laughs] *Ja. I wanted to get away from all the tubes and* [laughs] *get up and go.*

Barriers to mobilisation and activities of physiotherapy received were dizziness, pain, tiredness and weakness during mobilisation. These barriers arose largely due to medications and prolonged lying in bed, resulting in patients being tired and experiencing a general lack of energy for specific tasks. The effects of the medication also affected some of the patients' memories and their post-operative state of mind and thus, their co-operation with physiotherapy as well.

> SF3 (p. 10): *Little bit wobbly, yes … Head spinning … Uhm … I sta- still have … drugs in me that needs to come out. You understand?*

> SF3 (p. 6): *…they give you some kind of … uh … painkillers, morphine and all that stuff. Right? Now, this stuff, plays havoc with your mind.*

One patient mentioned rules specific to the ICU that did not allow for mobilisation outside the unit. A general barrier was the multitude of external lines and drains, which also limited the patients' abilities to mobilise. Specifically during mobilisation, the preparation of the area and the physiotherapists carrying the lines and drips were facilitators of physiotherapy.

One patient commented:

> PB6 (p. 21): *No I was on quite a lot [of lines] … So couldn't actually move around really.*

While another patient stated:

> VNA11 (p. 3): *As soon as the tubes were off I was up.*

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Physiotherapy practice in the ICU is changing. (29) Early progressive mobilisation has been included and has demonstrated shorter ICU stay and improvement in functional mobility among other benefits. It has been shown to be safe and realistic, (29,32) and it is evident from the primary study results that the majority of patients responded favourably to early mobilisation even though barriers were identified. Patients were able to identify the barriers and the impact they have. In addition, they were able to realise that mobilisation was effective in the improvement of their condition. Furthermore, the mobilisation barriers identified in the study, including pain, tiredness, dizziness, external lines and drains, also correspond with the patient-related mobilisation barriers discussed in Dafoe et al. (32)

Although not all the patients included in the study participated in mobilisation out of the bed, those who did reported predominantly positive experiences. Mobilisation resulted in empowering and encouraging independence, thus better equipping patients for when they moved into the wards where they were required to do more independently. This is consistent with the findings of Stiller (29) who reported that early mobilisation positively influences the patient's "functional ability", mobility and independence. Thus, both current literature as well as patient feedback supports the inclusion of mobilisation in addition to other physiotherapy activities during physiotherapy ICU treatment. This further solidifies the inclusion of early mobilisation in ICU physiotherapy practice as evidence-based practice. Furthermore, with the development of physiotherapy evidence-based ICU protocols, specialised and non-specialised physiotherapists alike will be aided in their clinical decision-making, increasing the possibility that rehabilitation and early mobilisation be incorporated into treatment when appropriate. (35,36)

3.3.1.3 ***Benefits and progression***: "*…so I feel I am a bit more ahead …*"

Almost all the patients commented on the benefits of participation in physiotherapy, which was verified by physical improvements and progression in their abilities. Among the improvements were 'feeling stronger and better', particularly regarding mobilisation, and returning to 'normal', as well as improved coughing ability and decreased pain. Although most improvements discussed were physical, two patients also described the psychological benefits that occurred in the sessions. They reported that the physiotherapists 'built them up' and encouraged them. One patient described a

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mind shift that occurred once she had mobilised out of the bed. She described it as being able to see what she was capable of and what the physiotherapist had been explaining to her.

> KT16 (p. 3): *…when [I] was physically upright, sitting in the chair for the first time. That made a huge difference. [It] takes you from the bed, everything you've learned mentally, and bring it now into the chair … [It's a] different mindset. [It's] a different scenario in terms of how you have pictured it. Because, you can actually do the things now, and you understand more, as to what they were talking about. Once you sitting in there and you can physically do the things that you can do.*

In addition to both the psychological and physical improvements, patients also described being taught exercises and receiving information regarding those exercises. This encouraged patient empowerment and independence because some patients continued with these exercises independently. Three patients stated:

> KT16 (p. 18): *There's nothing that I can say that I've learned that, that is useless. Right now I'm still doing this stuff that she told me to do in the, in the ICU, I still get to do it in the bed. And so I feel I am a bit more ahead than the rest of the people because they lay everyday - I don't lay in the bed anymore, I sit up. I do my own thing.*

> VNA11 (p. 16): *… she's doing something to help me, you know? She's … gonna help me, help myself, you know? And so. [She] showed me how to do things a diff-, a little bit different, make it a bit easier.*

> MM5 (p. 16): *So it helped me a lot as a person as well, not just to rely on the physio. To try do the exercises on my own…*

3.3.1.4 *Physiotherapy value:* "*They play a big role …*"

In light of the benefits and improvements felt by the majority of the patients that promoted independence, many of them described the value and importance of physiotherapy. Physiotherapists were additional support to them while in the ICU, bearing the same goal of returning them home.

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KT16 (p. 16): *…it's always good to know, there-there's other people besides the doctors and the nurses that are caring for you. It's really good to know, okay, physio is here, 'cause the physio is here to see that you get home. Physio is here to see that you also get home. Just, just not the doctors, just not the nurses. There's somebody else that's actually also here, that's here to see you get home.*

Furthermore, physiotherapy was illustrated as a contributing factor for the patient's survival and recovery in the ICU. It was described as a precious and much-needed service, without which some patients felt they may not have survived or recovered as quickly.

MM5 (p. 9): *If it wasn't for them … maybe I couldn't make it…*

DS23 (p. 7): *I feel very good, because while they were, uh, helping me, they did, I-I did know how to walk now I can at least get out of bed do something's I didn't know. Because if they didn't help me, they didn't do nothing in physio, I wouldn't even be here, maybe walk.*

MSJ20 (p. 14*): So … I really need them. Through every day, it was a dream for me to see them.*

Patients perceived physiotherapy in the ICU as both worthwhile, making them 'feel better and stronger'. It is a service that patients felt should 'never' be removed from the hospital since physiotherapists have a role to play in helping others.

MM5 (p. 24): *They play a big role to each and everyone of those patients here.*

WM14 (p. 23): *You know, I'll tell you one thing, but its something they should never ever take away … from the ICU … Because those people's work is precious … because that's how I felt. I am through it.*

3.3.1.5 *Interdisciplinary team*: " *… they were working together*"

Although not a dominant theme by comparison, the patients did discuss the presence of the interdisciplinary team. It was reported that the nurses and doctors helped the patients to mobilise if the physiotherapist needed assistance. This assistance, together with a referral from the doctor,

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influenced the patients' co-operation with treatment in physiotherapy. The presence of teamwork between the disciplines and among the physiotherapists themselves helped to confirm the presence of knowledge and communication.

> PB6 (p. 21): *… they were very helpful for the sisters of … for the ... uh ... application if they needed a pipe, or this or that … But the doctors did assist them … They knew this is an important thing that the physio's are doing, so … [g]ive them a hand where it's needed … They did help her as well, to take me out of my bed and into the chair also.*

> DS23(p. 16): *It was because they were working together. Because there were two or three, they were working as a team, so one will say do this, and then other one will agree. And then they will help each other with, uh, lifting [me] and then exercise with [me]. So. That's why [I] said they do have the knowledge of what they were doing.*

3.3.1.6 *The physiotherapist*: "*They know what they doing"*

This theme was centred on the physiotherapist. It comprises subcategories of behaviour exhibited by the physiotherapists, patient-reported characteristics and physiotherapy competence. Patients felt the physiotherapists were knowledgeable and competent in their abilities, knowing that they had studied to become a physiotherapist and had drawn knowledge from their work and work experience. They reported that the physiotherapists were prepared, worked well and skillfully and in a sufficient and quick manner. Although multiple patients commented that their physiotherapists were students, most of them stated:

> MM5 (p. 14): *They know what they doing.*

Two patients were surprised by the physiotherapists' ability to read the monitors and surprised that they worked closely with the "more technical side of the nursing side". (DS13: p. 20-21)

> KT16 (p. 14): *The knowledge was-was was quite good. 'Cause I-I was surprised to see that she could read my monitor … Ja. Because I'm in the medical field, so I could read the monitor, I could read the monitor. I knew exactly what it said. I just didn't tell her that I can read the monitor.*

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However, the physiotherapists' interaction and communication with the patients, as well as their interaction as observed by others, was most commonly reported to have given the impression of the physiotherapists being knowledgeable and competent. The explanations and relative communication that was associated with the activities during the sessions also displayed knowledge.

> ES8 (p. 6): *They are very well trained … because the manner how they speak to you and how they say the things that you must do it. Not too fast. Just on my own pace.*

> JL12 (p. 10): *I felt that they had knowledge with their work … It's the way, it's the way, they work with you.*

The physiotherapists were described as friendly, well-mannered professionals who exhibited traits of patience, kindness, helpfulness and the ability to work well with others in a pleasant but firm manner. They were also reportedly understanding and sympathetic to patients' current abilities in the ICU setting. As was commonly reported, acting professionally allowed patients to trust the physiotherapists. The physiotherapist's behaviour, attitude and manner in which physiotherapy care was completed in the treatment sessions influenced the patient's perception of the care in general. One patient reported:

> VWJ2 (p. 8): *No because, with the first time she helped me to pull up the bed upright, so, you felt like ... um ... she did not go and pull up the bed or whatever … She did it with feeling. So … You realise quickly when, when someone, I almost said, wishes to hurt you …*

Another patient reported:

> PA4 (p. 23): *And you can see one her face she gets upset … The way she talks … Her voice kind of like going a bit up. She's raising her voice … And stuff like that. Complaining to the doctor. And the doctor would come and like forcing as well.*

These results are consistent with the findings of Stiller and Wiles. (27). Stiller and Wiles, (27) an Australian quality assurance study conducted in 2008, investigated physiotherapy satisfaction in the ICU. They reported on the patient "likes" of physiotherapy, including the physiotherapists'

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professionalism, friendliness, helpfulness and caring attitude. (27) While the results of this South African study corroborate the findings of Stiller and Wiles, (27) it reports on additional aspects and characteristics regarding the physiotherapist in the ICU as described by the patients, thus contributing to the limited body of literature available for physiotherapy within the ICU.

These results also indicate that while there may be variations in physiotherapy practice across countries and ICU settings, (35,36) patients still report on characteristics and behaviours of the physiotherapist as part of their care. Thus, emphasing that physiotherapy is and will continue to be an interactive and people-based service.

3.3.1.7 *Safety*: *"…don't worry it's gonna be fine, we here to help you…"*

Patients felt safe during the physiotherapy sessions. This was primarily due to the physiotherapists' professionalism, reassurance and communication. Communication reassured the patients and aided them in knowing what to expect during physiotherapy activities and sessions. This reassurance and communication also assisted in making the patients feel comfortable, thus building a trustworthy relationship with the physiotherapists. The presence of the physiotherapists, the physical assistance of more than one physiotherapist, standing close to the patients and mobilising together reassured them that they were safe and would not fall. Falling was a repeated concern for some patients, and many patients specifically reported not falling due to assistance and support. Providing a calm and comfortable situation is essential to make patients feel safe during physiotherapy. Three patients reported:

> KT16 (p. 16): *Just by the exercise and by speaking to me every day. Ya-you know, it's just that that reassurance, don't worry it's gonna be fine, we here to help you, we're here to ensure your safety, we're here to-, we not gonna do anything to harm you or anything like that, you know?*
>
> ES8 (p. 12): *Because … they held you … and didn't let you fall … I can say, I didn't have any fears … was very good … very safe. Very.*
>
> WM14 (p. 20-21): *Because I had trust in them … It let me feel, you know, that I would get over the bridge, it was then like that … Look your relationship with them … Because I felt my relationship with them is, is good.*

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Although general consensus was reached regarding the feeling of safety during physiotherapy, one patient clearly described the importance of ensuring the feeling of safety, explaining that fear and pain were directly linked. He continued to say that pain would be less exaggerated or reduced to a certain extent if fear were managed.

> SF3 (p. 13): *Now did you know, that, uh … if you look at … fear and pain. Fear one side, pain the other side … If you … have fear in your heart. It makes the pain worse. Am I right?*

According to the above quote, fear and the anxiety of pain can negatively influence a patient's experience of physical pain. As previously discussed, one of the barriers to physiotherapy is pain. Therefore, it could be conceived that by ensuring that patients feel safe during physiotherapy while in the ICU, one could control pain to some degree and thus limit its impact as a barrier to physiotherapy activities and mobilisation. Consequently, through reassurances, clear communication and physical support, patient co-operation with physiotherapy treatments could be encouraged.

3.3.1.8 *Tangebilities*: "*… they looked like professionals.*"

Tangibilities refers to the physical aspects included in physiotherapy care. They relate to the environment, equipment, appearance of the physiotherapists and the timing of the therapy. The ICU environment was described as a busy environment by many patients, but there were mixed reports regarding the space being too small and whether it was sufficient or not. It was, however, explained that the physiotherapists adapted the working environment depending on the task at hand, thus accommodating the patient in most instances. At times, due to the busy environment, physiotherapy sessions were shifted around other ICU pertinent care, which presented as a barrier to physiotherapy care in the ICU. This was confirmed in the following statement:

> DS13 (p. 38)*: I think they are not given enough time to do their side of the job … They got a sort of, they've got a sort of fit in … Like I was supposed to go on for a, go on Friday for a … a CT scan today … Been laying here at the hospital for two and a half days waiting for the CT scan. And it never happened. And, uhm, so the physios, if, if they had to come fetch me for example, just assuming that when I come here at eight-ten o'clock or ten thirty in the morning*

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> *… And suddenly there's the CT scan department decided they got a booking from me, that would have been, that's, that would have been the end of that session … That's up to me, that's a slight problem…*

In general, the physiotherapists in the ICU reportedly used minimal equipment: the chairs, water bottles, breathing machines and the physiotherapists' hands. Another barrier, which was identified by only one patient, was the limited availability of chairs in the ICU.

> KT16 (p. 7): *They set it up in the, in the area, in the environment that I was in, that suited me best, that was comfortable for me. Even though it was the bed, it was the most comfortable.*

> GS7 (p. 18): *The ICU was too busy.*

> DS13 (p. 11): *And then I sat on the bed for a while. 'Cause there was only one chair in the ward and [it] was being used by someone else.*

In the busy environment, the physiotherapy sessions predominantly occurred in the mornings. If the patients were unable to participate at this time, the physiotherapists would return in the afternoon. For most patients, there was no preference for the timing of the therapy, stating that:

> GS7 (p. 14*): I waited for them anytime … I didn't worry.*

A few of the patients, however, reported that morning physiotherapy was better for them. This was because in the mornings, the patients were awake, washed and fed by the time the physiotherapists arrived whereas in the afternoons, they were often tired. This is demonstrated in the following quote:

> JL12 (p. 2-3): *They came every morning … In the mornings it was better … because I was already washed and … in the afternoon, I was a bit drowsy.*

The patients recognised the physiotherapists largely due to their uniform and the use of nametags, as well as introductions. The use of uniforms allowed patients to make the distinction between physiotherapists, student physiotherapists and personnel of other disciplines. Physiotherapists

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were neatly and appropriately dressed for their occupation. Their appearance was important for first impressions and the expectations of the patients.

> MS21 (p. 15): *You can point them even, when there are lots of people from them, because they neat and then you can see … the way they were dressing they are, they were professionals.*

> KC18 (p. 13*): Like I'll say, the physio was, was dressed properly. Like-like a person that works at a hospital or clinic.*

> JR24 (p. 11): *Looked neat, yes … That is important for me … You must look neat. You can't go untidy to someone … I mean take myself, I can't go to some one if I, look untidy. How will it the first, uhm … First impression? First impressions.*

3.3.1.9 *Continuity of care*: "*…I just hope that I stay continue with the girl…* "

Continuity of care through the use of the same physiotherapist further enabled patients to identify the physiotherapists. In addition, it empowered and fostered continued use of the exercises once transferred out of the ICU. It appears that through continuity of care, a relationship and a manner of communication is developed between physiotherapist and patient, which is best emphasised in this quote:

> MSJ 20 (p. 3): *And I just hope that I stay continue with the girl … [with] their group.*

One patient specifically reported the change in physiotherapist to be upsetting, and it made him uncomfortable. He stated:

> PA4 (p. 5): *They change now, then they change after that, they cha-, they do some-, they did something that [I] was not, like, comfortable to do, like to sit on the bed.*

> PA4 (p. 19): *I think that second one, [I] wa-is, it was the one that [we] were not communicating well.*

Furthermore, most patients were seen daily and for some, physiotherapy continued after their discharge from the ICU into the ward. This additionally emphasises continuity of care and is

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consistent with the findings of Stiller and Wiles. (27) Continuity of care and session constancy were also positive factors documented by the patients in the study of Stiller and Wiles, (27). Therefore, demonstrating that patients recognise and are favourable towards physiotherapy continuity of care both within the ICU setting and following ICU discharge.

3.3.1.10 *Satisfaction*: "*Attitude determines your altitude…*"

While all patients had different definitions for satisfaction, most equated it to completed and well-handled work, physiotherapy without pain and a goal-orientated service.

> KT16 (p. 18): *…somebody provides a service to you, are you generally happy with the service that you were given [?] So you either satisfied or you're unsatisfied. One of the two. Can't be in-between really. So. If you asking me, was the service satisf[actory], I would say it was more than satisfactory…*

> KC18 (p. 28): *I was very satisfied with their co-operation, and what they, what they actually did. Uh. Because I think there is a reason for everything … There is work for everything. And what they did, I feel one hundred percent satisfied with everything they did for me.*

> KT16 (p. 19): *Because I learned a lot and-and-and and the bottom-line is, the goal was reached, the service that I got was excellent. But more-most importantly the goal was reached. The goal was for me to get, was to be mobilised from that bed to the chair.*

Patients also commented that satisfaction is influenced by the manner in which they were treated and their happiness with the treatment outcomes. The majority of the patients were satisfied with the physiotherapy care they received while in the ICU. Patients stated that their reasons for being satisfied were largely due to the communication and interaction with the physiotherapists. They reported that the understanding and listening skills of the physiotherapists, as well as their professionalism and attitude towards both the patients and their work, were reasons for satisfaction.

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VNA11 (p. 22*): Just her attitude, you know? Ja, her attitude towards me, to-towards the patients. The way she handled … me. You know? … Physically. Uhm. Talking to me, all of that.*

VNA11 (p. 23): *Attitude determines your altitude … How far, how you get things done … Depends on yourself.*

DS23 (p. 18): *The way they were holding [me], communicate with [me], make [me] do exercise. That's why [I've said I am] satisfied with them.*

MS21 (p. 22): *They were working like everyone else. Like, uh, the understanding, the communication the handling of, uh, physio, like exercise. [I] will say that [I] was satisfied, yes, with them.*

The patients commented on characteristics the physiotherapists displayed that were additional reasons for satisfaction, namely: the preparation for the session; the setting and reaching of goals; patience and time spent with patients; and the demonstration of competence and attitude in connection with their approach to the patients. Patients described trust, reassurance, physical assistance and support during sessions, as well as the building of relationships as assisting in their satisfaction level. These reasons affected their willingness to participate in the therapy sessions. One patient who was dissatisfied with his physiotherapy care reportedly refused all therapy treatment after an incident of poor communication and trust. He was left sitting over the edge of his bed for an extended period of time without explanation or a way to return to his bed. This incident resulted in dissatisfaction with the service and his overall experience, illustrating that when patients feel dissatisfied with the care they receive, it can and will negatively influence their compliance with treatment plans. The same concept but on the opposite spectrum was reported by Prakash (16) and Price (17) who stated that patient satisfaction and positive experiences are related to increased compliance. Ultimately, overall satisfaction and perception regarding a service or care can be influenced negatively or positively by only one incident.

Factors that would have decreased satisfaction with the physiotherapy care received were predominantly linked to pain and ultimately poor communication. Authorative or poor attitude, poor

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presentation and untidiness, the possibility of falling during mobilisation, no assistance and no support during activities and failure to meet established goals were all aspects described by patients as factors that could have decreased satisfaction.

> KT16 (p. 20): *So if you look untidy and you don't look the part or your hair's untidy, or you swearing what, it's not gonna work by me. You work, you-you working in a hospital environment, the sisters are neatly dressed, the doctors are neatly dressed, I expect the same from the physio.*

> VNA11 (p. 23): *I think if, if, uh, if her attitude was, uh, not so … you know, cheerful or, uhm, nice … If she was a bit, maybe had a bad day or something then that wouldn't have made it so great.*

The study findings relating to decreased satisfaction are consistent with the negative issues highlighted by other studies in the critical care setting, namely, unfriendly staff, (21) fear, (46) pain (48,55) and poor communication. (13) These studies, however, investigated patient perceptions of critical care components such as sleep (48) and communication, (46) patient perceptions of emergency care (21) and patient satisfaction with emergency care (13) as opposed to investigating aspects specific to physiotherapy in a critical care setting.

Alternatively, patients reported factors that would have increased satisfaction. These included the adaption of exercises to the bed and increased variation in exercises given. The previously mentioned patient, who was not satisfied with the physiotherapy care he received, reported that good communication would have improved his experience and his satisfaction. One patient found that her time in the ICU was too short and that an increased ICU time would have been better because she felt that she was improving in the ICU. The patient suggesting an increased ICU LOS for increasing satisfaction was unexpected since patients are usually eager to move out of the ICU as soon as possible. In addition, this is contrary to management in the ICU where intensive care staff aim for early discharge and reduced LOS. (31) However, at the time of the interview, this patient had not received physiotherapy since her ICU discharge to the ward. Thus, her perception

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and suggested ICU LOS increase may have differed if she had continued with physiotherapy while in the ward.

All patients were asked to suggest changes or improvements to physiotherapy care in the ICU. Some were reluctant to comment on aspects requiring change because they felt underqualified to give such suggestions. Others commented that no improvements were needed. Two patients reported that physiotherapy should occur once the patients are at their 'full senses' due to the effects of the medication and/or the busyness of the environment.

> SF3 (p. 6): ...*that is also something that I would suggest, you know? Give the patient time to come by their fullest, full senses. It's not use giving them physiotherapy and the poor guy is zonked out [on] pain and tablets, he doesn't even know what's going on around him.*

One patient suggested a physiotherapy-specific room for all patients, not only those in the ICU. Another patient reported that setting time periods for physiotherapy would reduce the time wasted due to colliding care from multiple disciplines. This is depicted in the following quote:

> KC18 (p. 18): *To just put a time period and to say we are there at that time.*

The current research findings also align with the results of two other studies (8,39) that investigated the nursing care service in the critical care setting. They reported that staff friendliness, (39) professionalism, communication and continuity of care (8) were associated with improved satisfaction.

With regard to physiotherapy care in the ICU, this study demonstrated that multiple aspects of the physiotherapy experience ultimately culminated in the patient's satisfaction level. Thus, patient satisfaction is multifactorial and encompasses the patient's perception of the entire experience. Overall, most of the patients were satisfied with the physiotherapy care they received, and this is consistent with the high satisfaction levels reported by Stiller and Wiles. (27)

3.3.1.11 *Communication:* "*…we communicate like friends…*"

This theme comprised multiple categories and codes including interactions, explanations and miscommunications. Communication was the most common theme in all of the interviews. It was

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noted to be central to the way in which patients understood and interpreted the experience and ultimately, it influenced their satisfaction with the service (Figure 3.2). Effective communication encouraged patient understanding, assisted in reducing fear and prompted co-operation. Generally, patients felt the communication to be good, commenting that the interactions between patient and physiotherapist were encouraging and motivational.

> KT16 (p. 2): *…then they send somebody over and then she spoke to me, and she introduced herself. She said to me the importance of physio and I said, okay, no, Okay I will give it a try.*

> MSJ20 (p. 11): *In a way you're not sure of yourself … In a way you think that you won't make it … You know. They always try to put words on you. But you will lift your spirit up.*

> MSJ20 (p. 27): *So it was so painful … And I wanted to give up … I wanted to tell the doctor; No. If you cannot put me asleep and do me this, I won't do this anymore … But she keep on correcting me … Telling me that others have gone through this.*

Communication was generally friendly and filled with jokes and laughing, enabling the development of a relationship, a friendship, and thus influencing how the patients felt in the sessions.

> DS13 (p. 28): *Excellent. Nothing, no, no, uhm, no lack of communication or problem … No lack of communication or poor communication between the physios and myself … Or the other lady opposite … The other patient.*

> MSJ20 (p. 28): *…We speak like friends … we communicate like friends … we take each other like friends. We take each other that, we can handle each other about this.*

But communication was not always easy. One patient in particular experienced difficulties due to being intubated and ventilated. Another had difficulties with breathing and was thus distracted, which led to a lack of understanding when the physiotherapist spoke to her.

> KT16 (p. 11): *Oh, it was difficult… and then after a while the pipes came out. And I could … speak to her, one on one … Look, there was no other way for me to communicate with her. And she knew that, therefore she knew, she brought the book and pen everyday so that I could in case, like, before we started she'd ask me if I would like to ask a couple of questions*

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> *or if I wanna write something down, is there something that I wanna know about yesterday? So she would give me that opportunity … So before we started, for me to do it … Well, that was terrible. Communication for me was … I hated it. But at that point it was the best way of communication. But the thing is the message got across, the point got across, and I could understand whatever …*

> WM14 (p. 18): *Many times I did not understand properly, because then, you know if your short of breath and you … can't get a good breath in, then it was as if I misunderstood her … And then she would say Aunty, come lets start from the beginning again.*

Explanations and repeated instructions helped patients to understand what was expected of them. Instructions and communication delivered in a language and tone the patients could understand further facilitated co-operation.

> KT16 (p. 14): '*Cause, you know, she didn't force me to do anything. She came down to my level, and she spoke to me in the tone that I could understand.*

> KC18 (p. 6): *… I was not really prepared for it, but as the physio explained to me, what is, what the reasons are and why she does it. And then I gave my body to work with, uh, to go with the physio.*

> KC18 (p. 24): *Because she spoke in my, in my mother tongue, I understood very, very well.*

In contrast, when communication was not clear, it resulted in a miscommunication that caused a loss of trust and a refusal of further treatment, as described by a patient in the statement below:

> PA4 (p. 7): *Then … she came back, like the next day … wanted to do physio again. And I refuse. And the others coming, try. I refuse … I was so sick and tired.*

> PA4 (p. 8-9): *The thing was the because she left [me] unattended. This is the only thing. Not … because [I] standing because [I] was trying to stand but she left [me] … and [I] couldn't climb back in the bed … She did explain what she's gonna do. But she didn't ex… she didn't tell [me] that she's gonna leave. This is the only thing.*

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As illustrated in Figure 3.2, communication integrates and influences multiple aspects of physiotherapy care. Communication affected how the patients understood the care they received and how they felt during mobilisation. Among other aspects, communication also empowered patients through education and shared knowledge, and influenced satisfaction. The PI found this discovery to be enlightening. Communication is a component of care that can easily be overlooked and/or rushed in a busy environment such as the ICU and where most patients have previously been sedated. As is evident in this study, communication has a substantial impact on the patient's perception and ultimately, their satisfaction. Ashworth (11) reported that communication and information are vital for human beings to feel comfortable, especially for people in a strange environment. Effective communication in the ICU, an arguably strange environment, will comfort patients and influence their overall perception of care.

Several studies conducted in the critical care setting have reported positively on communication as a component of care with regard to informed consent, (43,45,56) verbal information, (56) explanations prior to treatment and the use of alternative methods of communication. (46) Physiotherapists should be mindful of the impact that communication can have on the physiotherapy management of ICU patients and the patients' co-operation with treatments. Continuing to communicate with patients effectively may aid in ensuring understanding and potentially reduce episodes of miscommunication. It will also assist in the physiotherapist-patient relationship, patient education and treatment co-operation, thus increasing trust and patient satisfaction with care.

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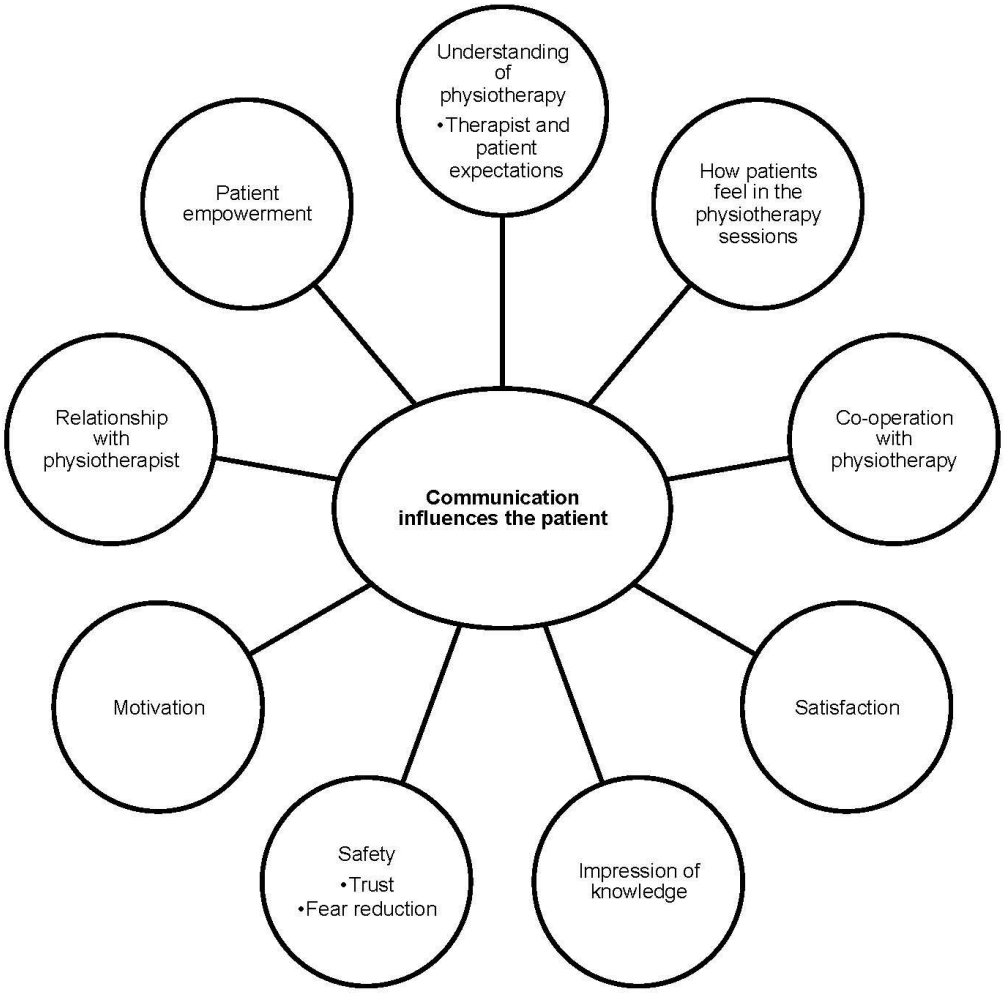

Figure 3.2: Diagram depicting communication-influenced aspects

3.3.1.12 ***Patient perception and experience of physiotherapy***: "*…I had a wonderful experience.*" As demonstrated in the above-mentioned themes, patients' perception and experience of physiotherapy in the ICU were the result of multiple aspects. Overall, the majority of patients perceived physiotherapy in the ICU favourably. They used words such as 'good', 'wonderful', 'excellent' and 'happy' when describing their experience and perception of physiotherapy in the ICU. However, some patients found the experience difficult. Patients' perceptions of physiotherapy

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were chiefly influenced by their understanding, their expectations and their previous experiences thereof.

KT16 (p. 22): *Just that I had a wonderful experience.*

BA1 (p. 5): *Like [I] had to sit on the chair. [I] felt like, they don't care about [me]. They were like, uhm, it takes long even they put [me] on the chair. It's like they put [me] too long. But at the end it did help [me]. [I] didn't understand that. But at the end it did … [I] was little bit irritated about that. 'Cause of the pains.*

ES8 (p. 19): *It's a … good experience, hey … I can't complain. I [had] very good care …*

VWJ2 (p. 2): *This time it was difficult. It wasn't too much … Uhm. It was enough physiotherapy …*

This study aimed to identify and describe patients' perceptions and satisfaction as well as barriers and facilitators of physiotherapy in the ICU. Multiple facilitators and barriers were identified and discussed with regard to physiotherapy in the ICU. Some barriers could be construed as aspects for improvement, for example, the presence of pain, which limits ability and co-operation in mobilisation. However, it must be made clear that not all barriers can be altered, for example, the busyness of the environment. Therefore, some barriers must merely be noted and circumvented to try and limit the effect they have on the service of ICU physiotherapy. By comparison, the facilitators were diverse and patient specific. The presence of the physiotherapist and independent mental preparation of the patient also facilitated physiotherapy in the critical care setting.

The variety of the patients purposefully selected enabled a large pooling of differing perceptions and opinions regarding physiotherapy in the ICU. The data collected in this study allows healthcare practitioners the opportunity to understand and interpret patients' first-hand experiences of ICU physiotherapy. This is a unique opportunity that is not often available in the ICU setting due to previous sedation practice in the ICU.

With the change in ICU practices, including daily sedative interruption and early mobilisation requiring active patient participation, this opportunity may become more readily available. (31)

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Concurring with the literature review by Stein-Parbury, (41) the results of this study confirm that patients are able to recall the ICU setting to some extent. This study further demonstrated that some patients were able to recall specific aspects of care (e.g. physiotherapy).

The potential increase in availability of patient perceptions regarding care in the ICU could assist in evaluating and ensuring ICU care quality. Healthcare practitioners could use patient satisfaction and perceptions not only to understand the patient's ICU experience but also to identify potential areas for improvement. As reported by Ariba et al., (21) patients are the consumers of care, and their opinions regarding it should be of concern to healthcare providers. (21) Furthermore, patients are the primary elements in the assessment of service quality. The patient's resultant satisfaction level regarding the service received can be used as an indicator of care quality. (8,22)

3.4 LIMITATIONS

Although the results of this study cannot be generalised and applied to all ICU settings, the diversity in the patients selected for the study as well as the study methods continuing until data saturation demonstrate the credibility of the results. The study findings also provide a good base for future studies in that the study is the first of its nature in South Africa.

A minority of the participants did not partake in the member checking (22%). This is seen as a minor limitation as it is unlikely to have significantly influenced the study results. Another minor limitation could have been the use of an interpreter. This could have resulted in deviations in either the interpretations or explanations of some of the data collected. Every effort was made to reduce this potential effect by using the same interpreter and ensuring the study aims and objectives were understood completely prior to the interview commencement.

3.5 CONCLUSIONS

Physiotherapy in the ICU is a valuable experience predominantly perceived positively and satisfactorily by patients. It is clear that communication is a key component that has an influence on the patient's perception and satisfaction of physiotherapy in the ICU. While there are multiple barriers and challenges encountered in the ICU setting, this does not detract from the value of the physiotherapy service itself. Through the understanding of the patients' perceptions and

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experiences regarding physiotherapy in this environment, potential areas for improvement may be uncovered in order to ensure quality of care. As the physiotherapy practices in the ICU change, so should the interaction and communication with ICU patients.

3.6 KEY MESSAGES

- Clear communication between the physiotherapist and the patient is essential to ensure both parties understand what is expected from each other and to manage patient expectations.
- Physiotherapists should be aware that maintaining communication and a professional demeanour assists in preserving the trust in the patient-physiotherapist relationship.
- Patients confirm the value of ICU physiotherapy and the benefits of early mobilisation in the ICU.
- Satisfaction with physiotherapy in the ICU is multifactorial.
- Patient perception of care in the ICU can be investigated.

Addendum 5: Physiotherapists Perception of an Implementation Process

MSc Project 1 – 2017

CHAPTER 3: PRIMARY STUDY

PHYSIOTHERAPISTS' PERCEPTION OF A BEST PRACTICE IMPLEMENTATION PROCESS IN A SURGICAL ICU: A QUALITATIVE STUDY

3.1 BACKGROUND

The synthesis and implementation of research evidence through clinical practice guidelines and protocols are considered to reduce practice variation and bridge the gap between best available evidence and clinical practice. (55,89) Multiple frameworks have been developed to guide the implementation processes of these interventions. (24) However, in reality over two-thirds of all projects implementing change are deemed to fail (90) and non-adherence to interventions is common. (20) This poor success rate may suggest a possible absence of valid frameworks for implementing and managing the conversion of current practices to evidence-based practices. (91) To our knowledge, no framework currently exists that has been developed specifically for the implementation of guidelines and protocols in the intensive care unit (ICU), despite the reported special features of ICUs, which pose unique barriers to intervention implementation and adherence. (35)

Both the American College of Critical Care Medicine and the European Society of Intensive Care Medicine regard physiotherapy as a basic requirement for patient management in intensive care. (92,93) While physiotherapy interventions applied in the ICU have sufficient evidence, (94,95) the variety of physiotherapy practices observed between countries, regions and individual units, is a concern. (87,96) Practice variation in other ICU disciplines is concurrent with sub-optimal patient outcomes and increased cost. (97) The development and implementation of best available evidence-based protocols are encouraged to address this variation. (98)

The main factors affecting physicians' adherence to interventions are knowledge, attitudes and behaviours. (81) Similar findings were recognised in the ICU environment for other health disciplines. (28,29,68) Even though knowledge and appropriate attitudes are necessary, they alone are insufficient for adherence to interventions. Favourable behaviour may still be required due to barriers presented

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by the patient, intervention, implementation, or organisational factors. (29,36,37) A pragmatic meta-theoretical framework for the formative evaluation of implementation, the Consolidated Framework for Implementation Research (CFIR), supports these findings. (3) Relevant aspects of the framework as well as knowledge, attitude and behaviour must therefore be addressed when reflecting on the implementation process of an intervention.

To ensure that the implementation of interventions is effective and sustainable, adherence is imperative. A recent paper (99) highlighted that further information regarding the factors that influence the adherence of the target audience to interventions is required. The understanding of the perceptions that clinical users have towards the implementation process of the intervention can be valuable to identify factors influencing adherence to interventions. (19) This can be done through the assessment of barriers and formative (subjective) evaluation of the implementation process. Multiple studies have investigated the perceptions of ICU health personnel after the implementation of interventions. (64-72) However, to our knowledge, none have investigated the perceptions of physiotherapists after the implementation of a new ICU physiotherapy protocol especially in a resource-constrained environment.

The aim of this study is to describe the perception of physiotherapists regarding the implementation process guided by a pragmatic meta-theoretical framework (3) of a protocol which is deemed safe, viable and based on current evidence for physiotherapy in surgical ICUs. (49-51,96) The study had four objectives. The objectives were to explore and describe the perception of the physiotherapists regarding 1) the nominal group technique that was used to tailor the implementation strategies; 2) the implementation strategies used in the implementation process; 3) how the physiotherapists perceived the real-world implementation of the protocol; and 4) what the factors were affecting their protocol adherence. This information could add to the understanding of how to reduce practice variation and bridge the gap between best available evidence and clinical practice.

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3.2 MATERIALS AND METHODS

3.2.1 Study design

A descriptive and interpretive qualitative design using semi-structured interviews was chosen to gain in-depth insights about the physiotherapists' perceptions and experiences of the implementation process. (100)

3.2.2 Research context and setting

This study forms part of a larger project, namely: "The implementation and evaluation of a validated evidence-based physiotherapy protocol in a surgical ICU: A controlled before and after experimental trial" (Ethics Approval Number: S13/09/170). The larger project consists of three phases. Phase 3 aims to evaluate the implementation process of a validated, evidence-based physiotherapy protocol for the management of surgical ICU patients. (52,101)

A validated evidence-based physiotherapy protocol for the management of surgical ICU patients (49,52,96,101) was implemented in a level one, 14-bed surgical ICU at a tertiary training institution in the Western Cape. (102) It is the responsibility of one physiotherapist to ensure that the unit is provided with physiotherapy service during the week from 7:30 am to 4 pm. There are different physiotherapists on call every evening that may attend to patients in the surgical ICU. The weekend policy stipulates that weekend physiotherapy will be provided to four patients who are referred by the doctor on call. Final year physiotherapy students from two Western Cape universities also make use of the unit for clinical rotations. (102)

Through a nominal group technique, the physiotherapists involved in the implementation process, tailored the best practice educational implementation strategies to best fit their needs and organisational structure. The tailored educational implementation strategies included a paper and electronic educational handbook (protocol and relevant published evidence), workshop series (interactive sessions on the algorithms and their application using patient scenarios of patients that had been admitted to the surgical ICU during the study period), and grand rounds (bedside discussions regarding application of the algorithms to selected patients in the ICU). Reminders, which included pocket cards of the algorithms for

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each physiotherapist and posters of the algorithms that was put up in the ICU and physiotherapy department, were also used in the implementation process.

Best practice, within the implementation science, dictates the development of a tailor-made implementation programme, (86) to ensure that there is adherence. The controlled before and after experimental trial evaluates objectively whether the implementation process that the physiotherapists agreed to, resulted in effective practice change. This study describes the perception of physiotherapists regarding the implementation process of the protocol and presents a formative (subjective) evaluation of the process.

3.2.3 Population

All physiotherapists employed at the time of data collection (August to September 2016) at the tertiary institution, who were involved in the implementation process of the validated evidence-based physiotherapy protocol for the management of surgical ICU patients, were eligible for the study. The educational implementation strategies were completed on 11 February 2016, which allowed time for the physiotherapists to reflect on the process and implement the protocol as required.

3.2.4 Sampling methods

Participants were recruited using a complete target population sampling method. The target population consisted out of 17 potential participants. Marshall et al. (103) suggests a sample size of fifteen to thirty participants for single case studies. Due to the small size of the study population, attempts were made to recruit all members from the population. (104) However, data saturation will ultimately determine the final sample size required. (103)

3.2.5 Ethical considerations

Ethics approval was obtained from the Health Research and Ethical Committee at the Health Sciences Faculty of Stellenbosch University (S16/05/091) (Addendum C). The institution granted approval and provided a venue where the research was conducted (Addendum D).

Participation was completely voluntary, and all participants provided written consent prior to data collection. The targeted physiotherapists were informed and assured

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that their involvement and contribution would be kept anonymous. The primary investigator (PI) was neither involved in the protocol design nor implementation process.

3.2.6 Recruitment method

Multiple meetings were scheduled with the physiotherapy department at the institution to give all potential participants opportunity to attend an introductory meeting. The physiotherapists were informed that they were only eligible to participate in the study if they were involved in the implementation process of the validated evidence-based physiotherapy protocol for the management of surgical ICU patients.

During the meetings the study was explained, and each attendee received a copy of the participant information leaflet and consent form (Addendum E) and attendees were requested to complete an attendance register (Addendum F) at each meeting. Attendees received a participation acceptance sheet (Addendum G) to indicate whether they would like to participate in the study or not. Attendees who indicated their willingness to participate were contacted telephonically, from information provided in the participation acceptance sheets, to arrange an appointment for an interview. Furthermore, notices (Addendum H) with copies of the participant information leaflet and consent form were placed on the noticeboards in the physiotherapy department inviting any further potential participants to the study. All documents were made available in Afrikaans and English.

3.2.7 Data collection and management

The PI conducted 12, individual, semi-structured interviews with a mean length of 40 minutes using a discussion schedule (Addendum I). The discussion schedule was guided by the findings of a scoping review (Chapter 2). The PI conducted 12 follow up, individual, semi-structured interviews with a mean length of 48 minutes to ensure clarity on statements made in the previous interviews. All the interviews were audio-recorded, which allowed for the data to be transcribed and analysed.

The discussion schedule was piloted prior to data collection to ensure relevancy. Pilot testing consisted of conducting individual interviews with two physiotherapists who participated in the implementation process, but were not any longer enrolled at

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the institution. The interview responses from the pilot participants were not included in the study sample, but provided the PI with an opportunity to review and revise the discussion schedule.

3.2.8 Data analysis

The data was analysed using deductive-inductive content analysis. The data was themed according to the objectives of the study. The data related to each objective of the study were thereafter analysed using inductive interpretive content analysis for emerging codes, categories and sub-themes. (104,105) The datasets generated and analysed during the current study are not publicly available due to participant privacy that could be compromised, but are available from the corresponding author on reasonable request.

3.2.9 Quality criteria

All audio recordings of the interviews were transcribed verbatim. The PI ensured credibility and truth-value of the data by using summarising and clarification techniques as validity checks throughout the interviews and comparing the transcriptions with the interview recordings. Follow-up interviews were conducted to ensure that the PI made limited assumptions during data analysis. The PI immersed himself completely in the data analysis, to understand the information in its entirety. Following the data collection and analysis process, all study participants were invited telephonically to participate in member checking. Member checking entitled the participants to review the analysed data to safeguard its credibility and trustworthiness. Incentives for member checking were provided and five participants (42%) participated.

Providing detailed descriptions of the study context and methodology ensured transferability and dependability of the results. Peer review of the study process, the transcripts and analysis of the interviews by a third party established credibility, dependability, auditability and confirmability. The PI kept a field diary during the data collection process. The diary was used to reflect on the study process, document research decisions and bias identification. Research bias was recognised and declared. An additional function of the field diary was to document any attentive impressions of the interviewees and summarisation of the main points of each interview. Dependability and credibility were further safeguarded through

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triangulation of the collected data, namely, the recorded interviews, the transcriptions and the PI's field journal.

3.3 RESULTS

Thirteen (76%) of the target population physiotherapists attended the introductory meetings. Twelve physiotherapists indicated their willingness to participate and were included in the study.

The median age of the participants was 34 years and the median general experience of the participants was nine years. The diversity among participants regarding each selected characteristic is demonstrated in Table 3.1.

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Table 3.1: Participant characteristics

Characteristics	n
Age (years)	
24-30	3
31-35	5
36-40	3
>40	1
Qualification	
BSc Physiotherapy	11
MSc Physiotherapy	1
Year BSc Physiotherapy qualification obtained	
Before 2000	1
2000-2005	4
2006- 2010	5
After 2010	2
General clinical experience (years)	
2-5	3
6-10	4
>10	5
Public practice clinical experience (years)	
2-5	3
6-10	4
>10	5
ICU clinical experience (years)	
2-5	5
6-10	3
>10	4
Specific interest in ICU clinical practice	
Y	9
N	3

n = Number of participants; Y = Yes; N = No

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3.3.1 Themes and sub-themes

Ten sub-themes emerged from the data. Verbatim quotes have been used to support the results. The sub-themes are discussed under their respective themes. All non-English quotes used in the results have been translated into English (Addendum J).

3.3.1.1 The nominal group technique

Three sub-themes emerged from the data, which reflected the perception of the physiotherapists regarding the tailoring of the implementation strategies. These included 1) understanding of the nominal group technique, 2) experience of the nominal group technique and 3) behaviour of participants.

3.3.1.1.1 Understanding of the nominal group technique: *"… if we just understood better…"*

Not all participants understood the purpose of the nominal group technique and perceived that the change agent should have made the purpose of the activity clearer to them. During the nominal group technique, some participants were unaware that the activity would determine the implementation strategies used in the implementation process of the protocol in their setting. Not all participants took their needs and organisational structure into consideration when they voted what strategies should be implemented.

> PT7 (p.29): *… we did not know we really had to go do it… I think if we just understood better and understood that we should choose something that fits our current schedule, then, maybe then it would have been a little bit better.*

There was not complete agreement from all the participants regarding the implementation strategies used in the implementation process of the protocol.

> PT9 (p.11): *… the three that were chosen were not the three for which I actually voted… I was forced to use it to work for me.*

3.3.1.1.2 Experience of the nominal group technique: *"… it also makes us feel more appreciated, more part of it…"*

Various perceptions regarding the nominal group technique were reported. The activity was either experienced as enjoyable or tedious. Furthermore, some participants felt appreciated and empowered by the activity, because their input was

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valued. Participants were satisfied that the voting during the activity was anonymous to avoid external influences.

> PT3 (p.24): *Yes, and it also makes us feel more appreciated, more part of it, that we are not just there to implement your research.*
>
> PT4 (p.4): *I feel there was a lot of repetition. Then things took a little longer. And if you still have work then it always feels a bit [giggles] longer if you're pushed for time.*

3.3.1.1.3 Behaviour of participants: *"[The change agent] got the buy-in from us by giving us the responsibility…"*

The nominal group technique affected participants' buy-in towards the implementation process. Participants were more likely to buy-in when they felt empowered and in agreement with the results of the activity. It must also be noted that some participants that agreed initially with the implementation strategies were no longer in agreement at the point when the strategies were implemented.

> PT3 (p.24): *[The change agent] got the buy-in from us by giving us the responsibility to choosing what way we wanted this to be done.*
>
> PT11 (p.61): *… when it came to that point of having to have it delivered they just decided well they didn't want to do it like this anymore.*

3.3.1.2 The implementation strategies

Attendance of and participation in implementation strategies and application of strategies are the two sub-themes that emerged.

3.3.1.2.1 Attendance of and participation in implementation strategies: *"… if I know that something is going to benefit me… I want to participate…"*

The personal context of participants, aspects of the implementation strategies, the change agent and the organisational structure and culture affected the attendance and participation of participants to the implementation strategies.

Personal context included the buy-in of participants to the implementation process, the degree of overlap between participants' practice and the protocol, areas of interest in physiotherapy and the participants' perceived benefits of the protocol, the

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implementation process and the research project. Participants perceived that participation in the implementation strategies could have been better if they were more aware of the benefits prior to the application of the strategies.

> PT7 (p.62): *… before we could continue to understand the algorithm… [The change agent] must have 100% buy-in.*

> PT6 (p.39): *You always think that they are going to teach you something new in the workshop but um, it was nothing new… I just got verification that I am still up to date… with the treatment happening in ICU…*

> PT11 (p.53): *… if [the change agent] out right said in the beginning, these are going to be the benefits you are going to be getting from this implementation of the study… if I know that something is going to benefit me… I want to participate…*

The implementation strategies consisted of several educational sessions. The aspects of the implementation strategies that affected the participation of participants included the number of sessions, duration of sessions, date and time of sessions, timing between sessions, number of participants allowed per session and degree of interaction or group work.

> PT13 (p.8): *It should have been closer together, because I feel if workshops are grouped closer together you still can remember what was discussed in the last workshop…*

Punctuality and time management of the change agent during the educational sessions affected the attendance and participation of participants. Changing of educational sessions without consultation with the staff, negatively affected participants' willingness to attend and their perception regarding the aim of the educational sessions. The change agent's motivation and encouragement during the implementation strategies affected participation.

> PT6 (p.38): *It gives you a negative feeling towards the research, because then it is not really aimed at informing us, because if [the change agent] change a date and… don't take care to find out from people is this still going to be a suitable time [the change agent] may end up coming here and many people can't attend…*

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PT11 (p.62): *… I think if [the change agent] had to really just encourage us and really be there to motivate then I think maybe attitudes would have been a bit different… I think then we would've been a lot more participative and encouraging…*

The organisational structure that affected the attendance and participation of participants included their area of work and workload. A non-participative culture to research studies exists in the physiotherapy department mainly due to two reasons. Firstly, research studies are perceived by the staff as additional workload and secondly participants feel unappreciated by the university, which is where they perceive the research study originated from.

PT6 (p.41): *… it really wasn't of that much importance to them to be attending and to receive this information as they wouldn't spend a lot of time implementing it or hardly get a chance to implement it in the ICU.*

PT13 (p.9): *… not everyone could attend, cause of the workload we have.*

PT11 (p.56): *… there's not very much of a participative culture when it comes to research and study and doing these things and assisting people outside of your own area… because they just don't want to do, give anything extra of themselves, they feel they are doing enough…*

PT7 (p.23): *… we have absolutely no relationship with the university staff… Some of them don't even know your name [laughs]… And now the university comes, and they put another extra task on you.*

3.3.1.2.2 Application of strategies: *"I really enjoyed having that combination…"*

The implementation of multiple strategies, rather than a single strategy was well received. The layout of the posters and reminders, the presentation of the workshops and the environment where the implementation strategies were executed, all affected the learning abilities of the participants.

PT14 (p.4): *I really enjoyed having that combination of the information sessions and the paper patient and then the application at the bedside on that day in that environment…*

PT8 (p.8): *… with the cards? I just get confused with them [laughs]… Arrows going there… So, I never really take any cards with.*

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PT7 (p.31): *… it is an intensive care, so the atmosphere is a bit different. So, it's not an ideal learning atmosphere.*

The grand round, the practical bedside teaching of the protocol was mostly perceived as having limited benefit. Participants expected the grand rounds to be more practical in nature and include real life demonstrations. There was a need to observe what to do when faced with practical challenges that prevented adherence to the protocol.

PT12 (p.35): *… it also solidified the new theory that we had been taught so it's, in my mind it is no use teaching you something and then don't apply it later on and [the change agent] by doing the grand round showed us that it doesn't only work within paper patients, but actually in real life situation it does affect the patient.*

PT3 (p.44): *I would have liked [the change agent] to go through, because I think that in the complicated patients where… the techniques or what the algorithm says you should be doing is contraindicated or the patients are not stable enough for them, then what do we offer those patients?*

Additional strategies that participants perceived should have been implemented, included one-on-one sessions with the change agent and the identification of opinion leaders and champions. The inclusion of other surgical intensive care unit (SICU) staff to improve multidisciplinary engagement when implementing the protocol was recommended by participants.

PT7 (p.7): *… if [the change agent] is gone, then there was not someone else there who half motivated and kept that optimism and excitement there… there were no key role players.*

PT4 (p.21): *But I think it would also be good if one could get the whole team into it, because we often have trouble with the nurses that they do not want to mobilise… mobilisation is not necessary-, necessarily a physiotherapy thing. Anyone can do it… But that everyone has half fully bought into the idea…*

3.3.1.3 The real-world implementation of the protocol

The real-world effect following the implementation of the protocol is discussed under two sub-themes namely, the effect on the physiotherapists and the effect on the organisation.

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3.3.1.3.1 The effect on the physiotherapists: *"… my thinking has changed."*

The implementation process of the protocol has had an impact on the participants' decision-making and practice of physiotherapy. Following the implementation process, mobilisation as a treatment technique was perceived as more valuable. Participants are mobilising patients earlier and are using less, but higher, functional and more patient-specific treatment techniques compared to before the implementation process.

> PT3 (p.40): *Um, well I will push more to mobilise patients on day one… Because it enhances their recovery.*
>
> PT12 (p.49): *I do specific techniques instead of all techniques as what we were taught previously per se…*
>
> PT13 (p.32): *… this protocol actually did me a favour, because I did a lot less, you know of like the manual techniques and all of that, I rather mobilise, and my patients got better quicker, so I mean my thinking has changed.*

By attending and participating in the implementation process and adhering to an evidence-based protocol, participants gained more confidence and independence in their ICU treatment decisions. The protocol brought about a level of independency in the practice of participants by evaluating what is the best possible treatments for patients instead of mindlessly following the instructions of doctors. However, some participants were not regularly in the SICU environment and reportedly experienced no personal change.

> PT7 (p.71): *… just knowing that you have that evidence base algorithm, it gives you the confidence that if someone is going to ask me now but why, you can tell that one that it has been proven, it's evidence proven. So, I'm not just working with experience, I'm not just working with opinion.*
>
> PT3 (p.25): *I didn't really work much in the surgical ICU. So, it didn't really affect my implementation that much.*

3.3.1.3.2 The effect on the organisation: *"… from my point of view, everything is the same…"*

The perceptions regarding the effect of the implementation of the protocol varied between participants. Some participants were unsure, others perceived no change

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and some perceived changes. Reported changes included, SICU staff being more aware of the protocol and that there is an improved multidisciplinary approach in the SICU.

PT9 (p.24): *For me, what I can see from my point of view, everything is the same…*

PT12 (p.23): *I am aware of the fact that people are a lot more aware of the fact that there is a protocol that does exist in the surgical ICU…*

PT7 (p.72): *Yes definitely. I feel it is more a multidisciplinary approach.*

3.3.1.4 The factors affecting protocol adherence

Three sub-themes emerged from the data regarding the perceived factors affecting the adherence of the physiotherapists to the protocol. The sub-themes included: 1) perceptions of the protocol, 2) resistance to change, and 3) the organisation.

3.3.1.4.1 Perception of the protocol: *"I take it as a guide…"*

Participants' perceptions of the protocol, whether it was perceived as a guide, recipe or tick list affected their anticipated and experienced benefits and drawbacks of the protocol. The perceived benefits and drawbacks of the protocol affected participants' attitude and adherence towards the protocol.

PT12 (p.13): *I take it as a guide… because I understand that this is ideal patients in an ideal world with ideal circumstances but unfortunately we don't have that ideals here…*

PT8 (p.5): *… it's sort of like the tick list …I cannot always say that I am following the protocol, I haven't tick everything on the list yet…*

PT10 (p.10): *… some of the older, more experienced [physiotherapists] are not, (pause) they feel that maybe they are, are given a recipe and, and, and the algorithm is preventing them from being somebody independent and free to do whatever they need to do…*

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3.3.1.4.2 Resistance to change: *"People don't like change especially here…"*

Resistance to change practices affected adherence to the protocol. This resistance was due to their perceived mistrust in the clinical benefits of the protocol and their perception of the change agent.

Participants' perception of the quality of the evidence of the protocol, their inability to observe the clinical benefits of the protocol and their years of clinical experience resulted in the perceived mistrust in the clinical benefits of the protocol.

> PT12 (p.40): *Um, I think it's just how we were taught and…I mean I've been a [physiotherapist] for a long time now and we were always taught you know be effective and doing a bit of introspection for me repositioning of a patient is not effective enough…*
>
> PT11 (p.58): *People don't like change especially here… You know most people have been working for quite a long time and they feel… it is their right to do certain things the way they want to do it…*
>
> PT6 (p.19): *I do not have a lot of patients where I could implement and see the effects of it and then evaluate for myself if it is worthwhile doing it that way rather than the other way.*

The perceived degree of communication between the change agent and participants, whether the change agent is enrolled at the institution or not and the perceived motives of the change agent affected participants' perception of the change agent.

> PT5 (p.33): *… if I already have an attitude towards [the change agent] then I'm going to say to myself I'm not going to apply it, why must I…*
>
> PT7 (p.39): *I want to change and [the change agent] have to show me what the benefit will be for me, in my career, and in my personal and social life, if I am going to change.*
>
> PT5 (p.32): *It feels like someone comes from outside in our daily work… and comes saying, here is my, my thesis… I want to implement it, do it… So, a bit forced, just do it…*

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3.3.1.4.3 The organisation: *"… is a case of wrong time, wrong place…"*

The participants perceived that both the organisation of the physiotherapy department and the SICU affected their adherence to the protocol. Factors related to the physiotherapy department that affected protocol adherence included, the weekend policy, shortage of physiotherapists, workload of participants, lack of support from the management, limited treatment time and participants being allocated to a particular area.

> PT12 (p.23): *We are short staffed… So, it's more difficult to apply the research protocol… because we have limited resources.*
>
> PT9 (p.19): *… is a case of wrong time, wrong place. Truly, in the ideal world with the ideal ICU and the ideal team, it will work perfectly.*
>
> PT7 (p.49): *So, at the end of the day, is it probably important that the manage-, management is on board… I did not get the impression that there was any level of enforcement from, from, from management to follow the protocol…*

In the SICU it was perceived that limited resources, regular turnover of all health disciplines, unavailability of nursing staff to assist with mobilisation, a lack of team approach and the communication between SICU team members affected protocol adherence.

> PT9 (p.53): *… extension lines maybe or more IVACs or drip stands that can move together with you. The drip stands of us are stuck in the bed, so it cannot get loose. Um, maybe like a rollator… There's nothing like that…*
>
> PT3 (p.47): *Well, I don't know how well the rotating doctors were made aware of the protocol… we check with the doctors if they agree with your treatment plan… if the doctor had merely understood the algorithm better or understood the benefit of it then you might have, wouldn't have that discrepancy…*
>
> PT10 (p.48): *… a lot of the things in the ICU, we can't always do alone. You sometimes need somebody's assistance um, and I kind of got the idea that nursing said: well, this is a [physiotherapy] thing, there you go, do it on your own…*

Participants perceived that a team approach was necessary for the protocol to be sustainable in the SICU. All health disciplines involved in the SICU should manage

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and adhere to the protocol. This would encourage a culture of adherence to the protocol, because staff would be in agreement with treatments, have shared responsibilities and mutual goals.

> PT13 (p.17): *I feel that… a lot of people still need to um, like doctors, nurses all the other parts of health needs to be included on this for it to be sustainable and like to be effective and efficient in the ICU itself…*

3.4 DISCUSSION

Participants expressed a range of perceptions regarding the implementation process and factors affecting their adherence to the protocol. All perceptions were influenced by one of four subjects, namely: 1) the individual; 2) the organisation; 3) the protocol, and 4) the implementation process. The four subjects confirm the CFIR framework (3). Our findings are supported by multiple reviews, including reviews outside the scope of health care. (22,26,61,62) Similar to Damschroder et al. (3) and Durlak and DuPre, (26) we found that the factors related to the four subjects interact with one another to affect the perception of the participants; however, this interaction was not measured. The inclusion of quantitative methodology and a tool to measure this interaction is recommended. No additional or different subjects were identified in this study compared to similar studies conducted in ICUs in developed countries or with different health disciplines. (64-72)

The nominal group technique is a consensus method for problem solving, idea-generation, or determining priorities. (106) Consensus is defined as a process where final decisions are made by agreement. (107) This means all involved parties agree with the final decision and are willing to carry out the decision. (107) From the data it is clear that there was not complete agreement from all participants regarding the implementation strategies used in the implementation process of the protocol. Our results suggest if the target audience reach consensus regarding the educational strategies used in the implementation process their buy-in towards the process might improve.

Resistance to change was evident and has been described in other health care studies. (108,109) A possible reason for the resistance against new practice is due to habits. Habits are automatic responses to contextual factors, acquired through repeating a similar action in the presence of these factors. (109) It has been

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suggested that clinical practice is to an extent habitual in nature and to effectively change practice not only does the target audience have to learn new practices, but also unlearn relevant habits. (109,110)

The change agent plays a significant role in affecting the perceptions of the participants regarding the implementation processes and the factors affecting their adherence towards interventions. The CFIR supports this finding. (3) A recent study reported on the importance of effective communication between change agents and teachers regarding the implementation process in school-based interventions. (111) Our findings indicate that the choice of change agent and effective communication between the change agent and target audience may be vital for the effectiveness of the implementation process in health care interventions. Evidence indicates that when the targeted professionals are directly and actively participating in the development phase of an intervention the likelihood of successful implementation is increased. (36,85) The results of this study suggest the involvement of the target audience in the development of the implementation process may also be beneficial.

Little literature has reported on the factors affecting the attendance and participation of the target audience to implementation strategies. However, a study exploring the factors influencing attendance in a structured physical activity programme, (112) found similar results to us. The study also reported the benefits of the programme, the participants' other obligations, the atmosphere of classes and logistics such as inconvenient venue or class times affected attendance. (112) The factors affecting the attendance and participation of the target audience to implementation strategies might be a field for further investigation.

It is suggested that implementation processes of physiotherapy interventions in multidisciplinary environments should include staff from other disciplines if their assistance or their agreement with the interventions is required. This finding is supported by two other studies that found similar results in the ICU for other health disciplines interventions. (84,113)

This study highlights the value of subjectively evaluating implementation processes by using target audiences' reflections of implementation processes and the factors affecting their adherence to interventions. Despite using a pragmatic meta-theoretical framework (3) to guide the implementation of the protocol and tailoring

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the training strategies, multiple barriers hampering adherence to the protocol were still reported by the target audience during the subjective evaluation of the implementation process. Current research suggests that the success of any implementation depends on the consideration of the barriers facing practice change and the use of tailored strategies to overcome these barriers. (20) The method to perform barrier assessments has, however, not been well described in the literature. Further research is necessary to find the gold standard approach in performing barrier assessments. Our findings suggest the perceived barriers affecting adherence will be related to the four subjects discussed above, which can be used to guide barrier assessments.

3.5 LIMITATIONS

The study findings cannot be generalised to all ICU settings due to the qualitative methodology of the study, however multiple studies confirmed the results of the study.

The PI was known to the target population, which may have affected the data collected from the participants; to what extent is however unknown.

> PT11 (p.17): *So knowing [the change agent] makes a difference like knowing you, makes a difference as well.*

Some participants were aware of the intervention. The intervention was previously implemented and evaluated in the research setting and could have affected the perceptions of the participants. (52,96,101)

> PT14 (p.2): *I obviously have been aware of the algorithms… The research have been available for a long time.*

All participants were invited to participate in a member checking session and 42% participated. It is unknown to what extent the additional participants (58%) would have affected the study results.

3.6 CONCLUSION

This is the first study to describe the perception of physiotherapists regarding the implementation of an ICU intervention in a developing country. No new factors that

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affect the perceptions of staff regarding implementation processes of ICU interventions were reported in this study compared to studies conducted in developed countries. The individual, organisation, intervention and implementation processes need to be considered when following a process of implementation of evidence into practice. The change agent plays a significant role in the implementation process as they affect participant perceptions of the process. Implementation processes of physiotherapy interventions in multidisciplinary environments should include staff from other disciplines if their assistance or agreement with the interventions is warranted.

Subjective evaluation of implementation processes is important. Despite using a framework to guide the implementation of a physiotherapy protocol and tailoring the educational implementation strategies, multiple barriers hampering adherence to the protocol were still reported by the target audience. Implementation science should aim to develop a gold standard approach in performing barrier assessments to grant change agents with the best possible opportunity to identify the barriers prior the implementation of interventions.

Addendum 6: List and Categories of Public Hospitals in SA

STAATSKOERANT, 12 AUGUSTUS 2011 No. 34521 3

GOVERNMENT NOTICE

DEPARTMENT OF HEALTH

No. R. 655 **12 August 2011**

NATIONAL HEALTH ACT, 2003

REGULATIONS RELATING TO CATEGORIES OF HOSPITALS

The Minister of Health intends, in terms of section 35 read together with section 90 of National Health Act, 2003, (Act No. 61 of 2003), after consultation with the National Health Council, to make the regulations in the Schedule.

Interested persons are invited to submit any substantiated comments or representations on the proposed regulations to the Director-General: Health, Private Bag X828, Pretoria, 0001, within a period of two months from the date of publication of this notice.

SCHEDULE

Definitions

1. In these regulations any word or expression to which a meaning has been assigned in the National Health Act, 2003, shall have such meaning and unless the context otherwise indicates:-

"**post levels and salary scales**" mean post levels and salary scales as determined from time to time by the Minister for Public Service and Administration in terms of the Public Service Act, 1994 (Proclamation No. 103 of 1994) as amended.

Categories of public hospitals

2. The following are categories of public hospitals:

(a) district hospital;
(b) regional hospital;
(c) tertiary hospital;

(d) central hospital; and

(e) specialized hospital.

District hospitals

3. (1) District hospitals are categorized into small, medium and large district hospitals with the following number of beds:

(a) small district hospitals with no less than 50 beds and no more than 150 beds;

(b) medium size district hospitals with more than 150 beds and no more than 300 beds; and

(c) large district hospitals with no less than 300 beds and no more than 600 beds.

(2) A district hospital must –

(a) serve a defined population within a health district and supports primary health care;

(b) provide a district hospital package of care on a 24 hour basis;

(c) have general practitioners and clinical nurse practitioners providing health services;

(d) provide services that include in-patient and ambulatory health services as well as emergency health services.

(3) A district hospital receives outreach and support from general specialists based at regional hospitals.

(4) A district hospital may only provide the following specialist services-

(a) paediatric health services,

(b) obstetrics and gynaecology,

(c) internal medicine; and

(d) general surgery.

Regional hospitals

4 (1) A regional hospital must, on a 24 hour basis, provide -

(a) health services in the fields of internal medicine, paediatrics, obstetrics and gynaecology, and general surgery and;

(b) health services in at least one of the following specialties–

(i) orthopaedic surgery;

(ii) psychiatry;

(iii) anaesthetics;

(iv) diagnostic radiology;

(c) trauma and emergency services;

(d) short term ventilation in a critical care unit; and

(e) services to a defined, regional drainage population, limited to provincial boundaries and receives referrals from several district hospitals.

(2) A regional hospital receives outreach and support from tertiary hospitals.

(3) A regional hospital has between 400 and 800 beds.

Tertiary hospitals

5. A tertiary hospital-

(a) provides specialist level services provided by regional hospitals;

(b) provides subspecialties of specialties referred to in paragraph (a);

(c) provides intensive care services under the supervision of a specialist or specialist intensivist; and

(d) receives referrals from regional hospitals not limited to provincial boundaries; and

(e) has between 400 and 800 beds.

Central Hospitals

6. (1) A central hospital -

(a) must provide tertiary hospital services and central referral services and may provide national referral services;

(b) must provide training of health care providers;

(c) must conduct research;

(d) receives patients referred to it from more than one province;

(e) must be attached to a medical school as the main teaching platform; and

(f) must have a maximum of 1200 beds.

(2) Central referral services are provided in highly specialised units, require unique, highly skilled and scarce personnel and at a small number of sites nationwide.

(3) National referral services-

(a) refer to super-specialised national referral units; and

(b) represents extremely specialised and expensive services (e.g. heart and lung transplant, bone marrow transplant, liver transplant, cochlear implants).

Specialized hospitals

7. A specialized hospital-

(a) provides specialized health services like psychiatric services, tuberculosis services, treatment of infectious diseases and rehabilitation services; and

(b) has a maximum of 600 beds.

List of public hospitals

8. The list of public hospitals is attached hereto as an *Annexure* to these regulations.

Categories of private hospitals

9. Private hospitals are categorized into-

(a) for profit private hospitals; and

(b) not for profit private hospitals.

Management of public hospitals

10. (1) Public hospitals must be managed in accordance with national policy as determined from time to time by the Minister in terms of sections 3(1)(c) and 23(1) of the National Health Act, 2003.

(2) The policy referred to in subregulation (1) shall include:

(a) management structures, post levels and salary scales;

(b) delegations of functions;

(c) list of health establishments; and

(d) hospital boards.

11. The Minister shall publish in the *Gazette* the policy referred to in regulation 10.

Transitional measures

12. (1) Public hospitals that exist at the time of commencement of these regulations and that require time to effect changes to their structures, number of beds, services or any other matter in order to comply with these regulations shall effect such changes within such period, after the commencement of these regulations, as requested by the relevant Member of the Executive Council and approved by the Minister.

DR A MOTSOALEDI, MP
MINISTER OF HEALTH

ANNEXURE

List of Designated Public Hospitals

CENTRAL HOSPITALS

PROVINCE	DISTRICT	Facility type	Facility	No of beds	Population (DHIS) District
GAUTENG	Johannesburg F SD	Central Hospital	gp Charlotte Maxeke JHB Hospital	1018	6,567,130
	Johannesburg D SD	Central Hospital	Chris Hani Baragwanath Hospital	2888	
GAUTENG	Tshwane Central Health District	Central Hospital	gp Steve Biko Hospital	832	3,394,015
	Tshwane Odi Health District	Central Hospital	gp George Mukhari Hospital	1652	
EASTERN CAPE	OR Tambo DM	Central Hospital	ec Nelson Mandela Academic Hospital	507	5,078,975
FREE STATE	Motheo DM	Central Hospital	fs Universitas Hospital	636	2,775,331
KWA-ZULU NATAL	Ethekwini MM	Central Hospital	kzn Inkosi Albert Luthuli Hospital	846	3,403,197
	Ethekwini MM	Central Hospital	kz King Edward VIII Hospital	922	4,624,618
WESTERN CAPE	Cape Town MM	Central Hospital	wc Tygerberg Hospital	1310	3,507,640
	Cape Town MM	Central Hospital	wc Groote Schuur Hospital	945	
CENTRAL total			**10**	**July 2010**	49,991,300

List of Designated Public Hospitals
Eastern Cape Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
A Nzo DM	Maluti SD	District Hospital	ec Madzikane kaZulu Memorial Hospital	267	406,723	194,599
	Umzimvubu SD	District Hospital	ec Mount Ayliff Hospital	167		212,124
Amathole DM	Amahlathi SD	Specialised TB Hospital	ec Khotsong TB Hospital	198	1,803,186	150,022
		District Hospital	ec SS Gida Hospital	122		
	Buffalo City SD	District Hospital	ec Bhisho Hospital	265		909,739
		District Hospital	ec Grey Hospital	85		
		District Hospital	ec Nompumelelo (Peddie) Hospital	180		
		Regional Hospital	ec Cecilia Makiwane Hospital	1000		
		Provincial Tertiary Hospital	ec Frere Hospital	850		
		Specialised TB Hospital	ec Fort Grey TB Hospital	239		
	Mbhashe SD	District Hospital	ec Madwaleni Hospital	220		269,665
	Mnquma SD	District Hospital	ec Butterworth Hospital	350		306,815
		District Hospital	ec Tafalofefe Hospital	284		
		District Hospital	ec Fort Beaufort Hospital	70		
		District Hospital	ec Victoria Hospital	110		
		Specialised	ec Tower Hospital	600		

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
		Psychiatric Hospital				
		Specialised TB Hospital	ec Winterberg TB Hospital	106		
Chris Hani	Emalahleni SD	District Hospital	ec Glen Grey Hospital	208	780,975	119,245
	Intsika Yethu SD	District Hospital	ec Cofimvaba Hospital	140		165,992
	Inxuba Yethemba SD	District Hospital	ec Cradock Hospital	72		92,100
		District Hospital	ec Wilhelm Stahl (Middelburg) Hospital	83		
		District Hospital	ec Frontier Hospital	450		
		Specialised Psychiatric Hospital	ec Komani Hospital	440		
	Ngcobo SD	District Hospital	ec All Saints Hospital	310		140,779
		District Hospital	ec Mjanyana Hospital	100		
	Sakhisizwe SD	District Hospital	ec Cala Hospital	92		61,075
		District Hospital	ec Elliot Hospital	52		
Cacadu DM	Camdeboo SD	District Hospital	ec Andries Vosloo Hospital	76	438,025	123,448
		District Hospital	ec Midland Hospital	70		
		Specialised TB Hospital	ec Margery Parkes TB Hospital	80		
	Kouga SD	District Hospital	ec Humansdorp Hospital	85		168,250
		Specialised TB Hospital	ec PZ Meyer Hospital	57		
	Makana SD	District Hospital	ec Port Alfred Hospital	60		146,327
		District Hospital	ec Settlers Hospital	219		
		Specialised Psychiatric	ec Fort England Hospital	313		

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
		Hospital				
		Specialised TB Hospital	ec Marjorie Parrish TB Hospital	180		
		Specialised TB Hospital	ec Temba TB Hospital	60		
N Mandela MM	N Mandela A SD	District Hospital	ec Dora Nginza Hospital	570	1,139,032	539,642
	N Mandela B SD	District Hospital	ec Uitenhage Hospital	223		260,607
		Specialised TB Hospital	ec Jose Pearson TB Hospital	350		
		Specialised TB Hospital	ec Orsmond TB Hospital	201		
	N Mandela C SD	Provincial Tertiary Hospital	ec Livingstone Hospital	496		338,783
		Provincial Tertiary Hospital	ec Port Elizabeth Provincial Hospital	450		
		Specialised Psychiatric Hospital	ec Elizabeth Donkin Hospital	163		
		Specialised TB Hospital	ec Empilweni TB Hospital	333		
O Tambo DM	King Dalindyebo SD	District Hospital	ec Zitulele Hospital	146	1,748,624	440,890
		Provincial Tertiary Hospital	ec Mthatha General Hospital	973		
		Central Hospital	ec Nelson Mandela Academic Hospital	507		
		Specialised Hospital	ec Bedford Orthopaedic Hospital (Mthatha)	180		
		District Hospital	ec Nessie Knight Hospital	177		
		District Hospital	ec Dr Malizo Mpehle	135		
		Specialised Hospital	ec St Lucy's Hospital	110		
	Nyandeni SD	District Hospital	ec Bambisana Hospital	134		436,811
		District Hospital	ec Canzibe Hospital	140		
		District	ec Isilimela Hospital	110		

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
		Hospital				
		District Hospital	ec St Barnabas Hospital	340		
	Qaukeni SD	District Hospital	ec Greenville Hospital	100		659,431
		District Hospital	ec Holy Cross Hospital	242		
		District Hospital	ec Sipetu Hospital	120		
		District Hospital	ec St Patrick's Hospital	280		
		District Hospital	ec St Elizabeth's Hospital	425		
		District Hospital	ec Taylor Bequest Hospital (Elundini)	200		
Ukahlamba DM	Senqu SD	District Hospital	ec Empilisweni Hospital	93	339,467	134,975
		District Hospital	ec Umlamli Hospital	73		
Total			**64**			

List of Designated Public Hospitals
Free State Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
Fezile Dabi DM	Metsimaholo LM	District Hospital	fs Metsimaholo Hospital (Sasolburg)	133	499,875	125,679
	Moqhaka LM	Regional Hospital	fs Boitumelo Hospital	340		182,415
	Ngwathe LM	District Hospital	fs Parys Hospital	84		129,432
		District Hospital	fs Tokollo Hospital (Heilbron)	63		
Lejweleputswa DM	Masilonyana LM	District Hospital	fs Winburg Hospital	55	694,198	68,545
	Matjhabeng LM	District Hospital	fs Katleho Hospital (Virginia)	131		429,661
		District Hospital	fs Thusanong Hospital (Odendaalsrus)	126		
		Regional Hospital	fs Bongani Hospital (Goldfields)	450		
	Nala LM	District Hospital	Nala Hospital	58		104,522
	Tswelopele LM	District Hospital	Mohau Hospital	58		56,783
Motheo DM	Mangaung LM	District Hospital	fs Botshabelo Hospital	135	813,580	720,930
		District Hospital	fs Dr JS Moroka Hospital	240		
		District Hospital	fs National District Hospital	200		
		Regional Hospital	fs Pelonomi Hospital	758		
		Central Hospital	Universitas Hospital	636		
		Specialised Psychiatric Hospital	fs Free State Psychiatric Complex Hospital	877		
	Mantsopa LM	District Hospital	fs Mantsopa Hospital (Ladybrand)	57		61,911
T Mofutsanyane DM	Dihlabeng LM	District Hospital	fs Phekolong Hospital	100	767,678	137,599
		Regional Hospital	fs Dihlabeng Hospital (Bethlehem)	150		
	Maluti a Phofung LM	District Hospital	fs Elizabeth Ross Hospital	91		379,677
		District Hospital	fs Thebe Hospital (Harrismith)	100		
		Regional Hospital	fs Mofumahadi Manapo Mopeli Hospital	300		
	Nketoana LM	District Hospital	fs Nketoana Hospital (Reitz)	65		64,544
	Setsoto LM	District Hospital	fs Itemoheng Hospital (Senekal)	55		130,658
Total			**24**			

List of Designated Public Hospitals

Gauteng Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
Ekurhuleni MM	Ekurhuleni E1 SD	Regional Hospital	gp Pholosong Hospital	300	2,865,602	327,661
	Ekurhuleni E2 SD	Regional Hospital	gp Far East Rand Hospital	311		319,177
	Ekurhuleni N1 SD	Regional Hospital	gp Tembisa Hospital	840		367,132
	Ekurhuleni S1 SD	District Hospital	gp Germiston Hospital	300		269,663
		Regional Hospital	gp Tambo Memorial Hospital	642		
	Ekurhuleni S2 SD	Regional Hospital	gp Natalspruit Hospital	784		464,420
City of Johannesburg Metropolitan	Johannesburg B SD	Regional Hospital	gp Helen Joseph Hospital	485	3,701,528	268,650
		Regional Hospital	gp Raheema Moosa Hospital	338		
		Specialised Hospital	gp Tara H Moross Centre Hospital	141		
	Johannesburg D SD	Central Hospital	Chris Hani Hosp	2888		1,306,768
	Johannesburg E SD	Regional Hospital	gp Edenvale Hospital	230		463,022
		Specialised Hospital	gp Sizwe Tropical Diseases Hospital	286		
	Johannesburg F SD	District Hospital	gp South Rand Hospital	280		488,651
		Central Hospital	gp Charlotte Maxeke Hospital	1018		
Metsweding DM	Nokeng Tsa Taemane LM	Specialised Hospital	gp Cullinan Rehabilitation Hospital	298	214,355	69,600
Sedibeng DM	Emfuleni LM	District Hospital	gp Kopanong Hospital	248	867,623	717,690
		Regional Hospital	gp Sebokeng Hospital	800		
	Lesedi LM	District Hospital	gp Heidelberg Hospital	126		78,399
Tshwane MM	Tshwane Central Health District	District Hospital	gp Pretoria West Hospital	178	2,420,927	1,184,113
		District	gp Tshwane District	200		

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
		Hospital	Hospital			
		Regional Hospital	gp Kalafong Hospital	857		
		Specialised Hospital	gp Weskoppies Hospital	1067		
		District Hospital	gp Mamelodi Hospital	400		
		Central Hospital	gp Steve Biko Hospital	832		
		Specialized Hospital	gp Tshwane Rehab	79		
	Tshwane North SD	District Hospital	gp Jubilee Hospital	551		473,354
	Tshwane Odi Health SD	District Hospital	gp Odi Hospital	227		523,492
		Central Hospital	gp George Mukhari Hospital	1652		
West Rand DM	Merafong City LM	District Hospital	gp Carletonville hospital	180	658,733	132,314
	Mogale City LM	District Hospital	gp Dr Yusuf Dadoo Hospital	295		363,847
		Regional Hospital	gp Leratong Hospital	800		
		Specialised Hospital	gp Sterkfontein Hospital	820		
GP Total			**32**			

List of Designated Public Hospitals
KwaZulu Natal Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
Amajuba DM	Emadlangeni LM	District Hospital	kz Niemeyer Memorial Hospital	52	511,589	35,734
	Newcastle LM	Regional Hospital	kz Madadeni Hospital	1488		364,177
			kz Newcastle Hospital	340		
eThekwini MM	eThekwini MM Sub	District Hospital	kz Osindisweni Hospital	245	3,403,195	3,403,195
		District Hospital	kz St Mary's Hospital (Mariannhill)	200		
		District Hospital	kz Wentworth Hospital	300		
		Central Hospital	kz King Edward VIII Hospital	922		
		Regional Hospital	Dr Pixley ka Seme	450		
		Regional Hospital	kz Addington Hospital	571		
		Regional Hospital	kz Mahatma Gandhi Hospital	408		
		Regional Hospital	kz Prince Mshiyeni Memorial Hospital	1200		
		Regional Hospital	kz RK Khan Hospital	543		
		Regional Hospital	kz St Aidans Hospital	157		
		Specialised Chronic Hospital	kz Clairwood Hospital	426		
		Specialised Hospital	kz Hillcrest Hospital	212		
		Specialised Psychiatric Hospital	kz Ekuhlengeni Sanatorium Hospital	1200		
		Specialised TB Hospital	kz Charles James TB Hospital	220		
		Specialised TB Hospital	kz Don McKenzie TB Hospital	220		
		Specialised TB Hospital	kz FOSA TB Hospital	187		
		Regional Hospital	kz King George V Hospital	930		
		Central Hospital	Inkosi Albert Luthuli Hospital	846		

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
iLembe DM	KwaDukuza LM	Regional Hospital	kz Stanger Hospital	491	626,211	180,889
	Maphumulo LM	District Hospital	kz Umphumulo Hospital	146		131,835
		District Hospital	kz Untunjambili Hospital	130		
	Ndwedwe LM	District Hospital	kz Montebello Hospital	182		168,936
Sisonke DM	Gr Kokstad LM	District Hospital	kz East Griqualand and Usher Memorial Hospital	229	501,877	62,183
	Ingwe LM	District Hospital	kz St Apollinaris Hospital	155		113,463
	Ubuhlebezwe LM	District Hospital	kz Christ the King Hospital	238		108,090
	Umzimkhulu LM	District Hospital	kz Rietvlei Hospital	239		200,664
		Specialised Psychiatric Hospital	kz Umzimkhulu Hospital	440		
		Specialised TB Hospital	kz St Margaret's TB Hospital	80		
Ugu DM	Hibiscus Coast LM	District Hospital	kz Murchison Hospital	300	760,648	239,564
		Regional Hospital	kz Port Shepstone Hospital	366		
		Specialised TB Hospital	kz Dunstan Farrell TB Hospital	180		
	Umdoni LM	District Hospital	kz GJ Crooke's Hospital	300		69,158
	uMuziwabantu LM	District Hospital	kz St Andrew's Hospital	261		98,256
uMgungundlovu DM	Richmond LM	Specialised TB Hospital	kz Richmond Chest Hospital	364	1,058,086	71,726
	The Msunduzi LM	District Hospital	kz Northdale Hospital	385		632,658
		Provincial Tertiary Hospital	kz Grey's Hospital	530		
		Regional Hospital	kz Edendale Hospital	900		
		Specialised Psychiatric Hospital	kz Fort Napier Hospital	450		
		Specialised Psychiatric Hospital	kz Townhill Hospital	425		
		Specialised TB Hospital	kz Doris Goodwin TB Hospital	113		

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
uMgungundlovu DM	uMngeni LM	Specialised Psychiatric Hospital	kz Umgeni Waterfall Institute Hospital	624		84,942
	uMshwathi LM	District Hospital	kz Appelsbosch Hospital	138		122,165
Umkhanyakude DM	Hlabisa LM	District Hospital	kz Hlabisa Hospital	308	653,467	202,099
	Jozini LM	District Hospital	kz Bethesda Hospital	230		211,224
		District Hospital	kz Mosvold Hospital	213		
	Umhlabuyalingana LM	District Hospital	kz Manguzi Hospital	251		161,307
		District Hospital	kz Mseleni Hospital	184		
Umzinyathi DM	Endumeni LM	District Hospital	kz Dundee Hospital	288	512,742	60,382
	Msinga LM	District Hospital	kz Church of Scotland Hospital	347		184,505
	Nquthu LM	District Hospital	kz Charles Johnson Memorial Hospital	385		163,069
	Umvoti LM	District Hospital	kz Greytown Hospital	227		104,786
Sisonke DM	Gr Kokstad LM	District Hospital	kz East Griqualand and Usher Memorial Hospital	229	501,877	62,183
	Ingwe LM	District Hospital	kz St Apollinaris Hospital	155		113,463
	Ubuhlebezwe LM	District Hospital	kz Christ the King Hospital	238		108,090
	Umzimkhulu LM	District Hospital	kz Rietvlei Hospital	239		200,664
		Specialised Psychiatric Hospital	kz Umzimkhulu Hospital	440		
		Specialised TB Hospital	kz St Margaret's TB Hospital	80		
Ugu DM	Hibiscus Coast LM	District Hospital	kz Murchison Hospital	300	760,648	239,564
		Regional Hospital	kz Port Shepstone Hospital	366		
		Specialised TB Hospital	kz Dunstan Farrell TB Hospital	180		
	Umdoni LM	District Hospital	kz GJ Crooke's Hospital	300		69,158
	uMuziwabantu LM	District Hospital	kz St Andrew's Hospital	261		98,256

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
Uthukela DM	Emnambithi LM	Regional Hospital	kz Ladysmith Hospital	448	697,291	242,118
	Okhahlamba LM	District Hospital	kz Emmaus Hospital	156		145,847
	Umtshezi LM	District Hospital	kz Estcourt Hospital	311		64,530
Uthungulu DM	Mthonjaneni LM	District Hospital	kz KwaMagwaza Hospital	141	965,950	54,948
	Nkandla LM	District Hospital	kz Ekhombe Hospital	210		142,292
		District Hospital	kz Nkandla Hospital	266		
	uMhlathuze LM	Regional Hospital	kz Lower Umfolozi War Memorial Hospital	283		321,724
		Provincial Tertiary Hospital	kz Ngwelezana Hospital	859		
	uMlalazi LM	District Hospital	kz Catherine Booth Hospital	170		239,374
		District Hospital	kz Eshowe Hospital	460		
		District Hospital	kz Mbongolwane Hospital	196		
Zululand DM	Abaqulusi LM	District Hospital	kz Vryheid Hospital	338	849,634	205,325
	Nongoma LM	District Hospital	kz Benedictine Hospital	403		205,891
	Ulundi LM	District Hospital	kz Ceza Hospital	265		222,968
		District Hospital	kz Nkonjeni Hospital	360		
		Specialised Hospital	kz St Francis Hospital	105		
		Specialised TB Hospital	kz Thulasizwe Hospital	155		
	uPhongolo LM	District Hospital	kz Itshelejuba Hospital	150		128,125
Total			72			

List of Designated Public Hospitals
Limpopo Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
Capricorn DM	Aganang LM	District Hospital	Ip WF Knobel Hospital	243	1,205,294	152,332
	Blouberg LM	District Hospital	Ip Helene Franz Hospital	149		166,169
	Lepelle-Nkumpi LM	District Hospital	Ip Lebowakgomo Hospital	252		236,151
		District Hospital	Ip Zebediela Hospital	108		
		Specialised Psychiatric Hospital	Ip Thabamoopo Hospital	786		
	Molemole LM	District Hospital	Ip Botlokwa Hospital	56		114,110
	Polokwane LM	District Hospital	Ip Seshego Hospital	180		536,532
		Provincial Tertiary Hospital	Ip Mankweng Hospital	509		
		Provincial Tertiary Hospital	Ip Polokwane Hospital	701		
Gr Sekhukhune DM	E Motsoaledi LM	Regional Hospital	Ip Philadelphia Hospital	538	1,000,351	229,292
		Distric Hospital	Ip Groblersdal Hospital	52		
	Gr Marble Hall LM	District Hospital	Ip Matlala Hospital	120		127,023
	Gr Tubatse LM	District Hospital	Ip Dilokong Hospital	324		279,733
		District Hospital	Ip Mecklenburg Hospital	105		
	Makhudutamaga LM	District Hospital	Ip Jane Furse Hospital	252		269,562
		Regional Hospital	Ip St Rita's Hospital	400		
Mopani DM	Ba-Phalaborwa LM	District Hospital	Ip Maphutha L Malatjie Hospital	100	1,082,087	134,110
	Greater Giyani LM	District Hospital	Ip Nkhensani Hospital	360		235,881
		Specialised Psychiatric Hospital	Ip Evuxakeni Hospital	400		
	Greater Letaba LM	District Hospital	Ip Kgapane Hospital	262		219,129
	Greater Tzaneen LM	District Hospital	Ip Dr CN Phatudi Hospital	200		378,499
		District Hospital	Ip Van Velden Memorial (Tzaneen)	86		

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
			Hospital			
		Regional Hospital	lp Letaba Hospital	400		
	Maruleng LM	District Hospital	lp Sekororo Hospital	208		114,468
Vhembe DM	Makhado LM	District Hospital	lp Elim Hospital	550	1,293,788	534,982
		District Hospital	lp Louis Trichardt Hospital	52		
		District Hospital	lp Siloam Hospital	350		
	Musina LM	District Hospital	lp Messina Hospital	92		44,732
	Thulamela LM	District Hospital	lp Donald Fraser Hospital	349		625,136
		District Hospital	lp Malamulele Hospital	256		
		Regional Hospital	lp Tshilidzini Hospital	538		
		Specialised Psychiatric Hospital	lp Hayani Hospital	390		
Waterberg DM	Bela-Bela LM	District Hospital	lp Warmbaths Hospital	133	666,664	56,919
	Lephalale LM	District Hospital	lp Ellisras Hospital	130		104,548
		District Hospital	lp Witpoort Hospital	70		
	Modimolle LM	District Hospital	lp FH Odendaal (Nylstroom) Hospital	166		79,601
	Mogalakwena LM	District Hospital	lp George Masebe Hospital	260		321,908
		District Hospital	lp Voortrekker Memorial (Potgietersrus) Hospital	91		
		Regional Hospital	lp Mokopane Hospital	273		
	Thabazimbi LM	District Hospital	lp Thabazimbi Hospital	112		69,871
LP Total			**40**			

List of Designated Public Hospitals
Mpumalanga Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub – District
Ehlanzeni DM	Bushbuckridge LM	District Hospital	mp Matikwana Hospital	178	1,563,857	604,775
		District Hospital	mp Tintswalo Hospital	423		
		Regional Hospital	mp Mapulaneng Hospital	252		
	Mbombela LM	Provincial Tertiary Hospital	mp Rob Ferreira Hospital	301		483,613
		Regional Hospital	mp Themba Hospital	623		
		Specialised Hospital	mp Bongani Hospital	50		
	Nkomazi LM	District Hospital	mp Shongwe Hospital	350		335,633
		District Hospital	mp Tonga Hospital	250		
	Thaba Chweu LM	District Hospital	mp Lydenburg Hospital	100		84,269
		District Hospital	mp Matibidi Hospital	100		
		District Hospital	mp Sabie Hospital	99		
	Umjindi LM	District Hospital	mp Barberton Hospital	227		55,567
		Specialised TB Hospital	mp Barberton TB Hospital	150		
G Sibande DM	Albert Luthuli LM	District Hospital	mp Carolina Hospital	80	943,137	195,246
		District Hospital	mp Embhuleni Hospital	220		
	Govan Mbeki LM	District Hospital	mp Bethal Hospital	233		233,381
		District Hospital	mp Evander Hospital	76		
	Lekwa LM	District Hospital	mp Standerton Hospital	219		108,927
		Specialised TB Hospital	mp Standerton TB Hospital	150		
	Mkhondo LM	District Hospital	mp Piet Retief Hospital	227		149,057
	Msukaligwa LM	Regional Hospital	mp Ermelo Hospital	200		131,093
		Specialised TB Hospital	mp Sesifuba TB Hospital	56		
	Pixley Ka Seme LM	District Hospital	mp Amajuba Memorial Hospital	105		84,561

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub – District
Nkangala DM	Dr JS Moroka LM	District Hospital	mp Mmametlhake Hospital	55	1,128,194	268,409
	Emalahleni LM	Provincial Tertiary Hospital	mp Witbank Hospital	349		307,968
		Specialised TB Hospital	mp Witbank Specialised TB Hospital	226		
	Steve Tshwete LM	District Hospital	mp Middelburg Hospital	349		158,849
	Thembisile LM	District Hospital	mp KwaMhlanga Hospital	148		282,207
Total			28			

List of Designated Public Hospitals
Northern Cape Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
Frances Baard DM	Sol Plaatjie LM	Provincial Tertiary	nc Kimberley Hospital	604	375,167	237,460
		Specialised(TB & Mental Health)	nc West End Hospital	147		
		Specialised (Rehabilitation)	nc Kimberly Hospital Rehab Centre	90		
	Phokwane LM	District Hospital	nc Hartswater (Connie Vorster) Hospital	60		69,617
J T Gaetsewe DM	Ga-Segonyana LM	District Hospital	nc Kuruman Hospital	69	216,419	83,336
		District Hospital	nc Batlharos (Tshwaragano) Hospital	214		
Namakwa DM	Hantam LM	District Hospital	nc Calvinia (Abraham Esau) Hospital	51	125,035	23,177
	Nama Khoi LM	District Hospital	nc Springbok (Dr Van Niekerk) Hospital	77		52,042
Pixley ka Seme DM	Emthanjeni LM	District Hospital	nc De Aar (Central Karoo) Hospital	51	191,783	42,259
	Umsombovu LM	District Hospital	nc Colesberg (Manne Dipico) Hospital	45		28,006
Siyanda DM	!Khara Hais LM	Regional Hospital	nc Upington (Gordonia) Hospital	186	244,883	96,173
	Tsantsabane LM	District Hospital	nc Postmasburg Hospital	45		30,399
NC total			**12**			

List of Designated Public Hospitals
North West Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
Bojanala Platinum DM	Kgetleng Rivier LM	District Hospital	nw Koster Hospital	50	1,328,721	41,235
	Madibeng LM	District Hospital	nw Brits Hospital	215		388,884
	Moses Kotane LM	District Hospital	nw Moses Kotane Hospital	232		266,782
	Rustenburg LM	Provincial Tertiary Hospital	nw Job Shimankana Tabane Hospital	390		431,278
Dr K Kaunda DM	Maquassi Hills LM	District Hospital	nw Nic Bodenstein Hospital	100	893,818	92,643
	Matlosana LM	Provincial Tertiary Hospital	nw Klerksdorp/Tshepong Hospital	1015		479,242
	Tlokwe LM	Regional Hospital	nw Potchefstroom Hospital	335		171,860
		Specialised Psychiatric Hospital	nw Witrand Psychiatric Hospital	982		
Ngaka Modiri Molema DM	Ditsobotla LM	District Hospital	nw General de la Rey Hospital	61	797,108	154,857
		District Hospital	nw Thusong Hospital	300		
	Mafikeng LM	District Hospital	nw Gelukspan Hospital	350		270,905
		Regional Hospital	nw Mafikeng Provincial Hospital	492		
		Specialised Psychiatric Hospital	nw Bophelong Psychiatric Hospital	312		
	R Moiloa LM	District Hospital	nw Lehurutshe Hospital	105		143,553
		District Hospital	nw Zeerust Hospital	84		
Ruth Segomotsi Mompati DM	Greater Taung LM	District Hospital	nw Taung Hospital	468	456,347	191,642
	Kagisano LM	District Hospital	nw Ganyesa Hospital	60		93,976
	Mamusa LM	District Hospital	nw Schweizer-Reneke Hospital	67		51,089
	Naledi LM (nw)	Regional Hospital	nw Vryburg Hospital	120		61,516
NW total			**19**			

List of Designated Public Hospitals
Western Cape Province

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - District
Cape Town MM	CT Eastern SD	District Hospital	wc Eerste River Hospital	100	3,507,640	409,754
		District Hospital	wc Helderberg Hospital	162		
	CT Khayelitsha SD	District Hospital	wc Khayelitsha (Tygerberg) Hospital	230		391,823
	CT Klipfontein SD	District Hospital	wc GF Jooste Hospital	184		420,803
	CT Mitch Plain SD	District Hospital	wc Mitchells Plain Private Hospital	230		479,414
		Specialised Psychiatric Hospital	wc Lentegeur Hospital	740		
	CT Northern SD	Specialised TB Hospital	wc Brooklyn Chest Hospital	349		326,593
	CT Southern SD	District Hospital	wc False Bay Hospital	65		524,361
		District Hospital	wc Victoria Hospital	172		
		Specialised Hospital	wc Red Cross War Memorial Children	290		
		Specialised TB Hospital	wc DP Marais TB Hospital	260		
	CT Tygerberg SD	District Hospital	wc Karl Bremer Hospital	372		559,114
		Central Hospital	wc Tygerberg Hospital	1310		
		Specialised Psychiatric Hospital	wc Stikland Hospital	318		
	CT Western SD	Central Hospital	wc Groote Schuur Hospital	945		395,778
		Regional Hospital	wc Mowbray Maternity Hospital	205		
		Regional Hospital	wc Somerset Hospital	334		
		Specialised Hospital	wc Western Cape Rehabilitation Centre	208		
		Specialised Psychiatric Hospital	wc Alexandra Hospital	300		
		Specialised Psychiatric Hospital	wc Valkenberg Hospital	420		

District	Sub District	Facility level	Facility	No of beds	Population (DHIS)	
					District	Sub - Distric
Cape Winelands DM	Breede Valley LM	District Hospital	wc Robertson Hospital	52	742,766	172,950
		Regional Hospital	wc Worcester Hospital	275		
		Specialised TB Hospital	wc Brewelskloof TB Hospital	368		
	Drakenstein LM	Regional Hospital	wc Paarl Hospital	369		228,813
		Specialised TB Hospital	wc Sonstraal TB Hospital	90		
	Stellenbosch LM	District Hospital	wc Stellenbosch Hospital	99		140,424
	Witzenberg LM	District Hospital	wc Ceres Hospital	104		103,949
Central Karoo DM	Beaufort West LM	District Hospital	wc Beaufort West Hospital	86	65,361	44,631
Eden DM	George LM	Regional Hospital	wc George Hospital	303	548,482	167,831
		Specialised TB Hospital	wc Harry Comay TB Hospital	180		
	Hessequa LM	District Hospital	wc Riversdale Hospital	95		55,392
	Knysna LM	District Hospital	wc Knysna Hospital	160		64,463
	Mossel Bay LM	District Hospital	wc Mossel Bay Hospital	98		89,548
	Oudtshoorn LM	District Hospital	wc Oudtshoorn Hospital	189		105,051
Overberg DM	Swellendam LM	District Hospital	wc Swellendam Hospital	51	248,996	34,583
	Theewaterskloof LM	District Hospital	wc Caledon Hospital	71		112,981
West Coast DM	Matzikama LM	District Hospital	wc Vredendal Hospital	75	341,876	61,714
	Saldanha Bay LM	District Hospital	wc Vredenburg Hospital	80		86,145
	Swartland LM	District Hospital	wc Swartland Hospital	85		88,570
		Specialised TB Hospital	wc Malmesbury Infectious Disease Hospital	55		
WC Total			**40**			

Addendum 7: SA Public Sector Physiotherapy Survey

***1. Province in which hospital and ICU/s is based:**

***2. Name of state/public sector hospital in which your department is based (only for researcher record keeping)**

***3. Number of hospital beds**

***4. Who is responsible for the running and organization of the Physiotherapy Department (select the relevant one)?**

- ◯ Facility or Hospital Manager
- ◯ Physiotherapist
- ◯ Doctor
- ◯ Nurse
- ◯ Other (please specify)

***5. Number of physiotherapists working in your department**

***6. State the number of physiotherapists per level (insert a 0 where no one is available at a specific level):**

Physiotherapy Assistant Directors	
Chief Physiotherapists	
Senior Physiotherapists	
Junior Physiotherapists	
Community Service Physiotherapists	
Physiotherapy Assistants	
Permanent Full Time Physiotherapists	
Permanent Part Time Physiotherapists	
Contract Physiotherapists	
Locum Physiotherapists	

***7. Number of physiotherapists in your department with the following qualifications (please state number per degree or qualification and insert 0 is no one with a specific degree in list)**

Diploma in Physiotherapy	
Bachelor in Physiotherapy	
Bachelor of Science in Physiotherapy	
Master of Science in Physiotherapy (ICU specific)	
Master of Science in Physiotherapy (non-ICU specific)	
PhD (doctorate) in Physiotherapy (ICU specific)	
PhD (doctorate) in Physiotherapy (non-ICU specific)	

***8. Number of physiotherapists working in the department in each age category (if no physio in a particular category please insert 0)**

22 - < 25 years	
26 - < 30 years	
31 - < 35 years	
36 - < 40 years	
41 - < 45 years	
46 - < 50 years	
51 - < 55 years	
56 - < 60 years	
60 - < 65 years	

***9. Are all the physiotherapists working in the department trained in South Africa?**

◯ Yes

◯ No

10. If you answered no above, please state the number of physiotherapists trained internationally.

11. State the number of physiotherapists working in the department with experience working in international ICU's.

***12. Have any of the physiotherapists working in your department have post-graduate ICU training such as the following: (tick the relevant ones):**

- ☐ Cardiopulmonary Rehabilitation Course I
- ☐ ICU Refresher Course (Adult)
- ☐ ICU Refresher Course (Paediatrics)
- ☐ ICU or Cardiopulmonary Congresses/Conferences/Symposiums
- ☐ ICU or Cardiopulmonary Journal Club
- ☐ ICU or Cardiopulmonary Seminars/Workshops/CPD activities
- ☐ ICU or Cardiopulmonary Research participation (authorship of publications/research projects/presentations)
- ☐ Master's in the area of ICU or Cardiopulmonary Rehabilitation
- ☐ Doctorate/PhD in the area of ICU or Cardiopulmonary Rehabilitation
- ☐ Other (please specify)
- ☐ None

***13. Are there physiotherapists working in ICU that have not had an ICU clinical block as a student?**

- ◯ Yes
- ◯ No

***14. Is your department involved in training and/or supervising student physiotherapists in ICU?**

- ◯ Yes
- ◯ No

***15. Type of ICUs in the hospital you provide services to (tick the relevant one/s):**

- ☐ Burns
- ☐ Cardiopulmonary/thoracic
- ☐ Medical
- ☐ Medico-surgical
- ☐ Multidiscipilinary/Mixed
- ☐ Neonatal
- ☐ Neuro-surgical
- ☐ Paediatric
- ☐ Renal
- ☐ Respiratory
- ☐ Surgical
- ☐ Trauma
- ☐ Other

Addendum 8: Provincial DoH Survey Study Approval Letters

Eastern Cape Department of Health

Enquiries:	Zonwabele Merile	Tel No:	040 608 0830
Date:	10th February 2014	Fax No:	043 642 1409
e-mail address:	zonwabele.merile@impilo.ecprov.gov.za		

Dear Ms Farhana Karachi

Re: The implementation and evaluation of a validated evidence-based physiotherapy protocol in a surgical ICU: A controlled before and after Experimental Trial

The Department of Health would like to inform you that your application for conducting a research on the abovementioned topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.
2. You are advised to ensure, observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall remove or not collect any information which can be used to link the participants.
3. The Department of Health expects you to provide a progress on your study every 3 months (from date you received this letter) in writing.
4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Epidemiological Research & Surveillance Management. You may be invited to the department to come and present your research findings with your implementable recommendations.
5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

DEPUTY DIRECTOR: EPIDEMIOLOGICAL RESEARCH & SURVEILLANCE MANAGEMENT

PGDP EASTERN CAPE 2004 - 2014

Ikamva eliqaqambileyo!

health

Department of
Health
FREE STATE PROVINCE

17 January 2013

Ms F Karachi
Physiotherapy Department
Stellenbosh Univesity
Tygerberg
Parow

Dear Ms F Karachi

Subject: The implementation and evaluation of a validates evidence-based physiotherapy protocol in a surgical ICU: A controlled before and after Experimental Trial

The above mentioned correspondence bears reference.

- Permission is hereby granted for the above – mentioned research on the following conditions:
- Permission for phase two to be requested separately.
- Participation must be voluntary.
- Written consent by each participants.
- Ascertain that your data collection exercise neither interferes with the day to day running of the health facilities nor the performance of duties by the respondents.
- Serious Adverse events to be reported and/ or termination of the study.
- Confidentiality of information will be ensured and no names will be used.
- Research results and a complete report should be made available to the Free State Department of Health on completion of the study.
- Progress report must be presented not later than one year after approval of the project to the Free State Department of Health
- Signed permission letters must be obtained from various health institutions where research will be conducted
- Research may not be conducted before the above conditions has/have been met.
- Department of Health to be fully indemnified from any harm that patients and staff experiences in the study

Trust you find the above in order.

Kind Regards

Dr D Motau
HEAD: HEALTH
Date: 30/01/2014

Head : Health
PO Box 227, Bloemfotein, 9300
4th Floor, Executive Suite, Bophelo House, cnr Maitland and, Harvey Road, Bloemfotein
Tel: (051) 408 1646 Fax: (051) 408 1556 e-mail:khusemj@fshealth.gov.za@fshealth.gov.za/chikobvup@fshealth.gov.za

www.fs.gov.za

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

OUTCOME OF PROVINCIAL PROTOCOL REVIEW COMMITTEE (PPRC)

Researcher's Name (Principal investigator)	Farhana Karachi
Research Title	The implementation and evaluation of a validated evidence – based physiotherapy protocol in a surgical ICY: A controlled before and after Experimental Trial
Organization / Institution	University of Stellenbosch
Contact Number	0829524549
Protocol number	P10082014
Date submitted	2014/04/14
Date reviewed	13 August 2014
Outcome	Approved
Final outcome	**APPROVED**

It is a pleasure to inform that the Gauteng Health Department has approved your research on "The implementation and evaluation of a validated evidence – based physiotherapy protocol in a surgical ICY: A controlled before and after Experimental Trial ".

The Provincial Protocol Review Committee kindly requests that you to submit a report after completion of your study and present your findings to the Gauteng Health Department.

Data should be collected at the following Facilities:

Central Hospital: 10 Facilities
Regional Hospital: 38 Facilities
Tertiary: 13 Facilities

Approves / ~~not approves~~

Dr N Mazamisa
Chief Director: Hospital Services

Date 26/09/2014

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

OUTCOME OF PROVINCIAL PROTOCOL REVIEW COMMITTEE (PPRC)

Researcher's Name (Principal investigator)	Farhana Karachi
Research Title	The implementation and evaluation of a validated evidence – based physiotherapy protocol in a surgical ICY: A controlled before and after Experimental Trial
Organization / Institution	University of Stellenbosch
Contact Number	0829524549
Protocol number	P10082014
Date submitted	2014/04/14
Date reviewed	13 August 2014
Outcome	Approved
Final outcome	**APPROVED**

It is a pleasure to inform that the Gauteng Health Department has approved your research on "The implementation and evaluation of a validated evidence – based physiotherapy protocol in a surgical ICY: A controlled before and after Experimental Trial ".

The Provincial Protocol Review Committee kindly requests that you to submit a report after completion of your study and present your findings to the Gauteng Health Department.

Data should be collected at the following Facilities:

Central Hospital: 10 Facilities
Regional Hospital: 38 Facilities
Tertiary: 13 Facilities

Approves / ~~not approves~~

Dr N Mazamisa
Chief Director: Hospital Services

Date 26/09/2014

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH

Enquiries: Latif Shamila Ref:4/2/2

Karachi F
University of Stellenbosch
Western Cape

Greetings,

Re:The implementation and evaluation of a validated evidence-based Physiotherapy protocol in a surgical ICU: A controlled before and after experimental trial.

1. The above matter refers.
2. Permission to conduct the above mentioned study is hereby granted.
3. Kindly be informed that:-
   - Further arrangement should be made with the targeted institutions.
   - In the course of your study there should be no action that disrupts the services.
   - After completion of the study, a copy should be submitted to the Department to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.

Your cooperation will be highly appreciated.

Head of Department

12/05/2014
Date

18 College Street, Polokwane, 0700, Private Bag x9302, POLOLKWANE, 0700
Tel: (015) 293 6000, Fax: (015) 293 6211/20 Website: http/www.limpopo.gov.za

The heartland of Southern Africa – *development is about people*

MPUMALANGA PROVINCIAL GOVERNMENT

Building No.3
No. 7 Government Boulevard
Riverside Park Extension 2
Nelspruit
1200
Republic of South Africa

Private Bag X 11285
Nelspruit, 1200
Tel: 013 766 3429
int: +27 13 766 3429
Fax: 013 766 3458
int: +27 13 766 3458

Department of Health

Litiko Letemphilo | Umnyango WezaMaphilo | Departement van Gesondheid

Enquiries: Themba Mulungo (013) 766 3511

08 May 2014

Ms. Karachi Farhana
UWC Physiotherapy Department
Private Bag x17
Robert Sobukwe Road
Bellville
7535

Dear Ms. Karachi Farhana

APPLICATION FOR RESEARCH & ETHICS APPROVAL: THE IMPLEMENTATION AND EVALUATION OF A VALIDATED EVIDENCE-BASED PHYSIOTHERAPY PROTOCOL IN A SURGICAL ICU: A CONTROLLED BEFORE AND AFTER EXPERIMENT TRIAL. PHASE ONE PROPOSAL: A PROFILE OF CURRENT PHYSIOTHERAPY PRACTICE IN INTENSIVE CARE IN SOUTH AFRICA

The Provincial Research and Ethics Committee has approved your research proposal in the latest format that you sent.

Kindly ensure that you provide us with the soft and hard copies of the report once your research project has been completed.

Kind regards

MPUMALANGA PROVINCE
DEPARTMENT OF HEALTH
PLANNING & INFORMATION
2014 -05- 08
PRIVATE BAG X 11285
NELSPRUIT 1200

MR. MOLEFE MACHABA
RESEARCH AND EPIDEMIOLOGY

08/05/2014
DATE

We care. Do you?
Siyanakekela

MPUMALANGA
A Pioneering Spirit

DEPARTMENT OF HEALTH
LEFAPHA LA BOITEKANELO
ISEBE LEZEMPILO
DEPARTEMENT VAN GESONDHEID

Department of Health
Private Bag X5049
KIMBERLEY
8301

Enquiries : Dr. E. Worku
Dipatlisiso :
Imibuzo :
Navrae :

Reference :
Tshupelo :
Isalathiso :
Verwysings :

Tel: 053 830 2134
Fax: 053 830 0655

Date : 06 May 2014
Letlha :
Umhla :
Datum :

NC PHREC Reference Number: NC2014/006

TITLE: A Survey to Describe the Current Physiotherapy practices in the Public Sector Intensive Care Units in South Africa.

Dear: Ms. Farhana karachi

The application to conduct the study was received and has been considered by the Northern Cape Provincial Health Research and Ethics Committee.

Approval is hereby granted to conduct the above-mentioned study in the Northern Cape Province.

The following conditions have to be noted:

- The research project shall be conducted at no cost to the Northern Cape Department of Health.
- Northern Cape Senior Management Committee will be briefed on the outcome of the study prior the publishing.

The Committee wishes you the best as you conduct your study.

Yours sincerely

MS. PHYLLIS BAITSIWE
CHAIRPERSON: PHREC

06/05/2014
DATE

We are committed to achieving our vision through a decentralized, accountable, accessible and constantly improving health care system within available resources. Our caring, multi-skilled, effective personnel will use evidence-based, informative health care and maturing partnerships for the benefit of our clients and patients.

health
Department of
Health
North West Province
REPUBLIC OF SOUTH AFRICA

3801 First Street
New Office Park
MAHIKENG, 2735

Enq: Keitumetse Shogwe
kshogwe@nwpg.gov.za
www.nwhealth.gov.za

POLICY, PLANNING, RESEARCH, MONITORING AND EVALUATION

To : **Ms F Karachi**

From : **Policy, Planning, Research, Monitoring & Evaluation**

Subject : **Research Approval Letter- The implementation and evaluation of a validated evidence based physiotherapy protocol in a surgical ICU: A controlled before and after experimental trial.**

To inform the researcher that permission to undertake the above mentioned study has been granted by the North West Department of Health. The researcher is expected to arrange in advance with the chosen districts or facilities, and issue this letter as prove that permission has been granted by the provincial office.

Upon completion, the department expects to receive a final research report from the researcher.

Kindest regards

Acting Director: PPRM&E
Mr. B Redlinghys

2/7/14
Date

DEPARTMENT OF HEALTH
PRIVATE BAG x2068
2014 -07- 02
SUPERINTENDENT GENERAL

Healthy Living for All

Western Cape Government
Health

Tygerberg Hospital

REFERENCE: Research Projects
ENQUIRIES: Dr ~~K Maart~~ G Marinus
TELEFONE: 021 938-~~4141~~ 6267

ETHICS NO: S13/09/170

The implementation and evaluation of a validated evidence-based physiotherapy in a surgical ICU: A controlled before and after Experimental Trial.

Dear Ms Farhana Karachi

PERMISSION TO CONDUCT YOUR RESEARCH AT TYGERBERG HOSPITAL

In accordance with the Provincial Research Policy and Tygerberg Hospital Notice No 40/2009, permission is hereby granted for you to conduct the above-mentioned research here at Tygerberg Hospital.

DR D ERASMUS
CHIEF EXECUTIVE OFFICER
Date: 2 June 2014

P.S. Kindly refer to attached comment from the Head of Physiotherapy, TBH.

Administration Building, Francie van Zijl Avenue, Parow, 7500
tel: +27 21 938-4141 fax: +27 21 938-6698

Private Bag X3, Tygerberg, 7505
www.capegateway.gov.za

Western Cape Government
Health

TYGERBERG HOSPITAL
Physiotherapy
REFERENCE: Research project – ~~stroke patients~~ ICU.
ENQUIRIES: Anne-Marie Swart
Email: Annemarie.Swart@westerncape.gov.za
Tel: 021 938 4576 / 5152
DATE: 15 May 2014

Dear Dr Marinus

RE: Comments regarding proposed research study by Mrs Farhana Karachi with the title: "The implementation and evaluation of a validated evidence-based physiotherapy in a surgical ICU: A controlled before and after Experimental Trial."

Thank you for consulting the Physiotherapy Department regarding the above-mentioned research proposal. This is our first notification of this proposed research intervention.

The request from the researcher is for TBH Physiotherapy Department to assist her by completing a questionnaire regarding the services rendered in ICU's in Tygerberg Hospital.

The department does not object to this study in principle, but we would like to note the following comments:

- Participation in the completion of the questionnaire is stated to be voluntary. Each physiotherapist will still have the choice regarding his/her participation.
- The questionnaire is lengthy and requires information that we do not keep exact statistics of. It will be time-consuming to complete. The researcher will have to appreciate our operational requirements in terms of the timeframe within which the questionnaire is to be completed.

Thank you for your consideration.

Kind regards

Anne-Marie Swart
Assistant Director Physiotherapy

Noted. 26/5/2014

Physiotherapy, B5 West, Tygerberg Hospital, Tygerberg, 7505
Tel: +27 21 938 4576/5152 Fax: +27 21 938 6184

Private Bag X3, Tygerberg, 7505
www.capegateway.gov.za

TYGERBERG HOSPITAL

ETHICS REFERENCE NO: S13/09/170

The implementation and evaluation of a validated evidence-based physiotherapy protocol in a surgical ICU: A controlled before and after Experimental Trial.

BY _____
An authorized representative of
Tygerberg Hospital

NAME Dr DS Erasmus

TITLE CEO

DATE 2 June 2014

Western Cape Government
Health

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 6857: fax: +27 21 483 9895
5th Floor, Norton Rose House,, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za)

REFERENCE: RP 020 /2014
ENQUIRIES: Ms Charlene Roderick

University of the Western Cape
Physiotherapy Department
Private Bag X17
Bellville
7535

For attention: **Dr F Karachi, Dr SD Hanekom and Prof Rik Gosselink**

Re: A Profile of current Physiotherapy Practices in Intensive Care in South Africa

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.
Please contact the following people to assist you with any further enquiries in accessing the following sites:

Paarl Hospital	**B Kruger**	**Contact No. 021 860 2501**
George Hospital	**M Vonk**	**Contact No. 044 802 4533**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final report within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. The reference number above should be quoted in all future correspondence.

Yours sincerely

DR J EVANS
ACTING DIRECTOR: HEALTH IMPACT ASSESSMENT
DATE: 05/03/14
CC **L PHILLIPS** **DIRECTOR: CAPE WINELANDS**
CC **H SCHUMANN** **DIRECTOR: EDEN & CENTRAL KAROO**

GROOTE SCHUUR HOSPITAL
Enquiries: Dr Bernadette Eick
E-mail : *Bernadette.Schmitz@westerncape.gov.za*

Ms. F. Karachi
PhD Physiotherapy Student
Stellenbosch University

E-mail: fkarachi@uwc.ac.za

Dear Ms. Karachi

REQUEST: Permission To Obtain Information Of ICUs In The Hospital And To Contact With Physiotherapy Department To Participate In A Survey

Your recent letter to the hospital refers.

You are hereby granted permission to proceed in obtaining information.

Please note the following:

a) The gathering of information may not interfere with normal patient care
b) Hospital staff may not be asked to assist you.
c) No hospital consumables and stationary may be used.
d) **No patient folders may be removed from the premises or be inaccessible.**
e) Please introduce yourself to the person in charge of an area before commencing.
f) Please discuss the project with Dr Krajewski: Manager Medical Services and Ms. Davids: Assistant Director: Physiotherapy
g) Should you have an assistant, please provide the assistant/field worker with a copy of this letter as verification to obtain information.
h) Confidentiality must be maintained at all times.

I would like to wish you every success with the project.

Yours sincerely

DR BERNADETTE EICK
CHIEF EXECUTIVE OFFICER
Date: 13th August 2014

C.C. Mr L. Naidoo
Ms C. Davids
Dr A. Krajewski
Mrs M. Sparks

G46 Management Suite, Old Main Building, Observatory 7925

Private Bag X, Observatory, 7935

Tel: +27 21 404 6288 fax: +27 21 404 6125

www.capegateway.go.v.za

Addendum 9: Email invitation requesting participation in the Physiotherapy Survey

From: survey-noreply@smo.surveymonkey.com [survey-noreply@smo.surveymonkey.com] on behalf of fkarachi@uwc.ac.za via surveymonkey.com [member@surveymonkey.com]
Sent: 07 April 2014 13:59
To:
Subject: Reminder: Physiotherapy Survey Urgent

Dear Physiotherapist.

As telephonically informed I am conducting a survey to determine the current role and practices of Intensive Care Physiotherapists in South Africa. Your input is extremely valuable in order for the results of this study to be generalizable to the South African ICU physiotherapy population as a whole.

Please note that this survey is conducted in two parts as PART I will provide information to me, the researcher as to the specific and number of surveys needed to be completed for PART II for your individual department. It will also provide me with demographic and Organisational data related to public sector physiotherapy departments in South Africa

Part I needs to be completed by the HOD or Physiotherapist in charge. Please click on the link below and complete PART I after which PART II will follow with specific instructions. You have 5 days to complete this survey(PART 1).

Here is a link to the survey:
https://www.surveymonkey.com/s.aspx?sm=coJZsbyXbU0zMrdRnWGTxQ_3d_3d
This link is uniquely tied to this survey and your email address. Please do not forward this message.

Please note participation is voluntary. Written consent is not required as completion of the survey will imply consent. All data will be held strictly anonymous and confidential. Please feel free to contact me via email (fkarachi@uwc.ac.za)or via cell: 0829524549 (if no answer please leave voicemail message and I will return your call asap).

Thank You in advance for your participation.
Farhana Karachi
PhD Physiotherapy (student)
Stellenbosch University
Physiotherapy Department
Tygerberg Medical Campus
Tygerberg, Parow
Cell: 0829524549
Email: fkarachi@uwc.ac.za

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
https://www.surveymonkey.com/optout.aspx?sm=coJZsbyXbU0zMrdRnWGTxQ_3d_3d
"All views or opinions expressed in this electronic message and its attachments are the view of the sender and do not necessarily reflect the views and opinions of the Western Cape Government (the WCG). No employee of the WCG is entitled to conclude a binding contract on behalf of the WCG unless he/she is an accounting officer of the WCG, or his or her authorised representative. The information contained in this message and its attachments may be confidential or privileged and is for the use of the named recipient only, except where the sender specifically states otherwise. If you are not the intended recipient, you may not copy or deliver this message to anyone."

Addendum 10: SA Public Sector ICU Physiotherapy Survey

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

(SPECIFIC TYPE) ICU GENERAL DATA

***1. Level of ICU* (tick the relevant one): ***

- ◯ Level I closed unit with dedicated medical intensivist
- ◯ Level II specialized unit (example cardiac, neurological)
- ◯ Level III step down facility or high care

***2. Number of ICU beds in the unit:**

***3. Multidisciplinary staff in the unit (tick the relevant one/s):**

- ☐ Dietician
- ☐ ICU Nurse
- ☐ ICU Technician
- ☐ Intensivist
- ☐ Medical Doctor
- ☐ Nurse
- ☐ Occupational Therapist
- ☐ Pharmacist
- ☐ Physiotherapist
- ☐ Psychologist
- ☐ Social Worker
- ☐ Speech Therapist
- ☐ Other (please specify)

(SPECIFIC TYPE) PHYSIOTHERAPY SERVICES AND WORKLOAD ALLOCATION

***4. Does the physiotherapy staff rotate in the unit? ***

5. How often does this rotation occur (tick the relevant block)?

***6. Do you have students working in the unit?**

Page 1

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

7. Number of students that work in the unit:

In the WEEK

On the WEEK-END

***8. The physiotherapy service provided in the unit on a daily basis (24 hour period) in the WEEK ON SITE is by:**

9. Percentage of the time spent by you (physiotherapist/s) in a 24hour period in the:

	0-25%	26-50%	51-75%	76-100%
ICU in the WEEK ON SITE	◯	◯	◯	◯
WARDS in the WEEK ON SITE	◯	◯	◯	◯

***10. Do you have an ON CALL roster?**

***11. Physiotherapists involved in ON CALL duty (tick the relevant one/s)?**

- ☐ Assistant Director/HOD
- ☐ Chief Physiotherapist
- ☐ Community Service Physiotherapist
- ☐ Junior Physiotherapist
- ☐ Physiotherapy Assistant
- ☐ Senior Physiotherapist
- ☐ Student Physiotherapist

Other (please specify)

***12. The physiotherapy service provided in the unit on a daily basis (24 hour period) in the WEEK at NIGHT ON SITE is by:**

- ◯ Exclusively allocated physiotherapist
- ◯ Exclusively allocated physiotherapist with ward duties
- ◯ A variety of physiotherapists allocated to the unit
- ◯ A variety of physiotherapists allocated to the unit and wards
- ◯ No physiotherapist/s at night on site

Page 2

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***13. Percentage of the time spent by you (physiotherapist/s) in a 24 hour period in the:**

	0-25%	26-50%	51-75%	76-100%
ICU in the WEEK at NIGHT ON SITE	◯	◯	◯	◯
WARDS in the WEEK at NIGHT ON SITE	◯	◯	◯	◯

***14. The physiotherapy service provided in the unit on a daily basis (24 hour period) on the WEEK-END ON SITE is by:**

- ◯ Exclusively allocated physiotherapist
- ◯ Exclusively allocated physiotherapist with ward duties
- ◯ A variety of physiotherapists allocated to the unit
- ◯ A variety of physiotherapists allocated to the unit and wards
- ◯ No physiotherapist/s on week-end on site

***15. Percentage of the time spent by you (physiotherapist/s) in a 24 hour period in the:**

	0-25%	26-50%	51-75%	76-100%
ICU on the WEEK-END ON SITE	◯	◯	◯	◯
WARDS on the WEEK-END ON SITE	◯	◯	◯	◯

***16. The physiotherapy service provided in the unit on a daily basis (24 hour period) on the WEEK-END at NIGHT ON SITE is by:**

- ◯ Exclusively allocated physiotherapist
- ◯ Exclusively allocated physiotherapist with ward duties
- ◯ A variety of physiotherapists allocated to the unit
- ◯ A variety of physiotherapists allocated to the unit and wards
- ◯ No physiotherapist/s on week-end at night on site

***17. Percentage of the time spent by you (physiotherapist/s) in a 24 hour period in the:**

	0-25%	26-50%	51-75%	76-100%
ICU on the WEEK-END at NIGHT ON SITE	◯	◯	◯	◯
WARDS on the WEEK-END at NIGHT ON SITE	◯	◯	◯	◯

***18. Are you exclusively allocated to this unit for weekdays?**

Page 3

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

RANK, ACADEMIC TRAINING AND QUALIFICATIONS OF THE (SPECIFIC TYPE) ICU PHYSIOTHERAPIST

***19. What is your (physiotherapist) RANK?**

***20. Your Qualification**

***21. Your total years of working experience as a physiotherapist**

***22. Your total years of working experience as an ICU physiotherapist**

***23. Do you have any post-graduate training related to Intensive Care?**

***24. What post-graduate training have you had (tick the relevant one/s)?**

- [ ] Cardiopulmonary Rehabilitation Course I
- [ ] ICU Refresher Course (Adult)
- [ ] ICU Refresher Course (Paediatrics)
- [ ] ICU or Cardiopulmonary Congresses/Conferences/Symposiums
- [ ] ICU or Cardiopulmonary Journal Club
- [ ] ICU or Cardiopulmonary Seminars/Workshops/CPD activities
- [ ] ICU or Cardiopulmonary Research participation (authorship of publications/research projects/presentations)
- [ ] Master's in the area of ICU or Cardiopulmonary Rehabilitation
- [ ] Doctorate/PhD in the area of ICU or Cardiopulmonary Rehabilitation
- [ ] Other (please specify)

***25. Are you interested in a specific ICU post-graduate training programme for further specialization in Intensive Care?**

Page 4

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***26. Did you have an ICU clinical block rotation during undergraduate studies?**

***27. Are you involved in training/supervising students in this ICU setting?**

(SPECIFIC TYPE) ICU PHYSIOTHERAPY WORKING HOURS)

***28. What are your working hours in unit for the following (eg 7:00 - 17:00 or hour/s per day):**

WEEK DAY ON SITE	
WEEK DAY ON CALL (off site)	
WEEK-END DAY ON SITE	
WEEK-END DAY ON CALL (off site)	

(SPECIFIC TYPE) ICU PHYSIOTHERAPY STAFF NUMBERS

***29. Number of physiotherapists working in the unit (please insert zero if none):**

on a WEEK DAY ON SITE	
on a WEEK DAY ON CALL (off site)	
on a WEEK-END DAY ON SITE	
on a WEEK-END DAY ON CALL (off site)	

(SPECIFIC TYPE) ICU PHYSIOTHERAPY PATIENT LOAD

***30. Percentage of on call referrals received from the unit on average**

	0%	less than and equal to 25%	less than and equal to 50%	less than and equal to 75%	100%
per WEEK	☐	☐	☐	☐	☐
on a WEEK-END	☐	☐	☐	☐	☐

***31. Percentage of patients receiving physiotherapy management in the unit on average**

	0%	less than and equal to 25%	less than and equal to 50%	less than and equal to 75%	100%
per day in the WEEK	☐	☐	☐	☐	☐
per day on a WEEK-END	☐	☐	☐	☐	☐

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***32. Average number of physiotherapy treatments received per patient in the unit (frequency):**

	No Treatment/day	One Treatment/day	Two Treatments/day	Three Treatments/day	More than Three Treatments/day
per day in the WEEK ON SITE	☐	☐	☐	☐	☐
per day in the WEEK ON CALL (off site)	☐	☐	☐	☐	☐
per day on a WEEK-END ON SITE	☐	☐	☐	☐	☐
per day on a WEEK-END ON CALL (off site)	☐	☐	☐	☐	☐

PHYSIOTHERAPY INDUCTION TRAINING FOR (SPECIFIC TYPE) ICU

***33. Is inductive training provided for the physiotherapist/s working in the unit? ***

	Yes	No
Training regarding Organisation/Operation of the ICU for physiotherapists working in the ICU	◯	◯
Training regarding Physiotherapy Services in terms of Physiotherapy Assessment, Treatment, Documentation and Referral Letters in the ICU	◯	◯
Training regarding emergency on call or call-out duties	◯	◯

***34. Who provides the training?**

	ICU Doctor/Physician/Intensivist	ICU Sister/Nurses	ICU Administrator	Physiotherapy Assistant Director/HOD	Previous Physiotherapist working in the ICU	Other	Not Applicable
Training regarding Organisation/Operation of the ICU for physiotherapists working in the ICU	◯	◯	◯	◯	◯	◯	◯
Training regarding Physiotherapy Services in terms of Physiotherapy Assessment, Treatment, Documentation and Referral Letters in the ICU	◯	◯	◯	◯	◯	◯	◯
Training regarding emergency on call or call-out duties	◯	◯	◯	◯	◯	◯	◯

Other (please specify)

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<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***35. Duration of the training?**

PHYSIOTHERAPY REFERRAL SYSTEM FOR (SPECIFIC TYPE) ICU

***36. Are patients referred for physiotherapy in this ICU?**

***37. Rank on a scale from 1 to 4 in order of the most used method to the least used method of referral to physiotherapy in the WEEK when ON SITE:**

- Medical Doctor/Intensivist/Physician
- Nurse Referral
- Routine Assessment
- ICU Team (Multidisciplinary)

***38. Rank on a scale from 1 to 4 in order of the most used method to least used method of referral to physiotherapy in the WEEK when ON CALL (off site):**

- Medical Doctor/Intensivist/Physician
- Nurse Referral
- Routine Assessment
- ICU Team (Multidisciplinary)

***39. Do all patients receive physiotherapy on a week-end in this ICU?**

***40. Rank on a scale from 1 to 4 the most used method to the least used method of referral to physiotherapy on the WEEK-END when ON SITE:**

- Medical Doctor/Intensivist/Physician
- Nurse Referral
- Routine Assessment
- ICU Team (Multidisciplinary)

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<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***41. Rank on a scale from 1 to 4 the most used method to the least used method of referral to physiotherapy on the WEEK-END when ON CALL (off site):**

- [ ] Medical Doctor/Intensivist/Physician
- [ ] Nurse Referral
- [ ] Routine Assessment
- [ ] ICU Team (Multidisciplinary)

***42. Does your physiotherapy department have their own referral guideline for patients in this ICU?**

[ ]

***43. Please elaborate on the referral guideline stated above.**

***44. Who developed and employed the Physiotherapy Referral guidelines for this ICU?**

	Doctors/Physicians/Intensivists	Nurses	ICU Team	Physio	Unknown	Other
ON SITE	○	○	○	○	○	○
ON CALL (off site)	○	○	○	○	○	○

Other (please specify)

PHYSIOTHERAPY MANAGEMENT OF THE (SPECIFIC TYPE) ICU PATIENT

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<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***45. The number of treatment sessions (frequency) required per patient per day is (Tick relevant one/s):**

- ☐ Decided Personally following structured physical examination
- ☐ By Physician/Intensivist/Doctors orders
- ☐ Decided by discussing with or together with Physician/Intensivist/doctors
- ☐ By Nurses orders
- ☐ Decided by discussing with or together with Nurse/s
- ☐ Decided by discussing with or together with the ICU Team
- ☐ Other (please specify)

***46. Prescription of positioning changes of the ICU patients is (Tick relevant one/s):**

- ☐ Decided Personally following structured physical examination
- ☐ Prescribed by Physician/Intensivist/Doctors
- ☐ Decided by discussing with or together with Physician/Intensivist/doctors
- ☐ By Nurses orders
- ☐ Decided by discussing with or together with Nurse/s
- ☐ Decided by discussing with or together with the ICU Team
- ☐ Other (please specify)

***47. Prescription of chest physiotherapy of the ICU patients is (Tick relevant one/s):**

- ☐ Decided Personally following structured physical examination
- ☐ Prescribed by Physician/Intensivist/Doctors
- ☐ Decided by discussing with or together with Physician/Intensivist/doctors
- ☐ By Nurses orders
- ☐ Decided by discussing with or together with Nurse/s
- ☐ Decided by discussing with or together with the ICU Team
- ☐ Other (please specify)

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***48. Prescription of mobilization of the ICU patients is (Tick relevant one/s): Mobilization = passive/active/strengthening exercises in bed, bed cycling, bridging, sitting over egde of bed, active/passive transfer to chair, sitting in chair**

- ☐ Decided Personally following structured physical examination
- ☐ Prescribed by Physician/Intensivist/Doctors
- ☐ Decided by discussing with or together with Physician/Intensivist/doctors
- ☐ By Nurses orders
- ☐ Decided by discussing with or together with Nurse/s
- ☐ Decided by discussing with or together with the ICU Team
- ☐ Other (please specify)

***49. Prescription of rehabilitation of the ICU patients is (Tick the relevant one/s): Rehabilitation = Exercises in chair, chair/stationary cycling, tilt table, standing frame, ambulation with/out ventilator on spot/away from bed**

- ☐ Decided Personally following structured physical examination
- ☐ Prescribed by Physician/Intensivist/Doctors
- ☐ Decided by discussing with or together with Physician/Intensivist/doctors
- ☐ By Nurses orders
- ☐ Decided by discussing with or together with Nurse/s
- ☐ Decided by discussing with or together with the ICU Team
- ☐ Other (please specify)

***50. Rank on a scale from 1-5 who is mainly involved in POSITIONING the ICU patient in this unit over a 24hour period?**
1 being MOST involved and 5 being LEAST involved

- ☐ Doctor/Physician/Intensivist
- ☐ Only the Nurse/s
- ☐ Only the Physiotherapist/s
- ☐ Nurse/s and Physiotherapist
- ☐ ICU Team (Multidisciplinary)

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***51. Rank on a scale from 1-5 who is mainly involved in MOBILIZATION of the ICU patient in this unit over a 24hour period?**
1 being MOST involved and 5 being LEAST involved
Mobilization = passive/active/strengthening exercises in bed, bed cycling, bridging, sitting over egde of bed, active/passive transfer to chair, sitting in chair

- ☐ Doctor/Physician/Intensivist
- ☐ Only the Nurse/s
- ☐ Only the Physiotherapist/s
- ☐ Nurse/s and Physiotherapist
- ☐ ICU Team (Multidisciplinary)

***52. Rank on a scale from 1-5 who is mainly involved in REHABILITATION of the ICU patient in this unit over a 24hour period?**
1 being MOST involved and 5 being LEAST involved
Rehabilitation = Exercises in chair, chair/stationary cycling, tilt table, standing frame, ambulation with/out ventilator on spot/away from bed

- ☐ Doctor/Physician/Intensivist
- ☐ Only the Nurse/s
- ☐ Only the Physiotherapist/s
- ☐ Nurse/s and Physiotherapist
- ☐ ICU Team (Multidisciplinary)

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***53. Tick which care protocols/clinical guidelines are used in this ICU and if they are evidence based or not.**

	Yes	No	Evidence Based (systematically developed, reviewed and appraised clinical research)	Non Evidence Based (clinical research or literature that has not gone through a rigorous, unbiased and transparent process of systematic review and appraisal, non peer reviewed and unpublished research)
Weaning for extubation	☐	☐	☐	☐
Suctioning	☐	☐	☐	☐
Positioning	☐	☐	☐	☐
Mobilization = passive/active/strengthening exercises in bed, bed cycling, bridging, sitting over egde of bed, active/passive transfer to chair, sitting in chair	☐	☐	☐	☐
Rehabilitation = Exercises in chair, chair/stationary cycling, tilt table, standing frame, ambulation with/out ventilator on spot/away from bed	☐	☐	☐	☐
Sedation	☐	☐	☐	☐
Analgesia	☐	☐	☐	☐
Decontamination	☐	☐	☐	☐
Other	☐	☐	☐	☐

Other (please specify)

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<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***54. Rank the following CHEST PHYSIOTHERAPY activities in order of the frequency they are prescribed or used by you in THIS ICU (1= most used and 11 being the least used activity or 12 = not used).**

	1	2	3	4	5	6	7	8	9	10	11	12
Manual Techniques - percussion, vibrations, shaking	○	○	○	○	○	○	○	○	○	○	○	○
Breathing techniques	○	○	○	○	○	○	○	○	○	○	○	○
Breathing Techniques with Equipment	○	○	○	○	○	○	○	○	○	○	○	○
Secretion Removal (active expectoration)	○	○	○	○	○	○	○	○	○	○	○	○
Secretion Removal (Suctioning)	○	○	○	○	○	○	○	○	○	○	○	○
Postural Drainage Positioning	○	○	○	○	○	○	○	○	○	○	○	○
Positioning to improve ventilation/perfusion ratios	○	○	○	○	○	○	○	○	○	○	○	○
Manual Hyperinflation (Bagging)	○	○	○	○	○	○	○	○	○	○	○	○
Assisted Coughing	○	○	○	○	○	○	○	○	○	○	○	○
Tracheal Stimulation	○	○	○	○	○	○	○	○	○	○	○	○
Tracheal Aspirate	○	○	○	○	○	○	○	○	○	○	○	○

***55. Rank the following VENTILATORY activities in order of the frequency they are prescribed or used by you in THIS ICU (1= most used and 4 being the least used activity or 5 = not used).**

	1	2	3	4	5
Weaning for Extubation	○	○	○	○	○
Extubation	○	○	○	○	○
Adjustment of ventilator settings	○	○	○	○	○
Supervision and implementation of non-invasive ventilator support (CPAP/mask intermittent positive pressure ventilation)	○	○	○	○	○

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<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***56. Rank the following MOBILIZATION activities in order of the frequency they are prescribed or used by you in THIS ICU (1= most used and 9 being the least used activity or 10 = not used).**

	1	2	3	4	5	6	7	8	9	10
Passive Movement	○	○	○	○	○	○	○	○	○	○
Continuous Passive Movement	○	○	○	○	○	○	○	○	○	○
Active Exercises in Bed	○	○	○	○	○	○	○	○	○	○
Bridging	○	○	○	○	○	○	○	○	○	○
Bed Cycling	○	○	○	○	○	○	○	○	○	○
Resisted Exercises in Bed	○	○	○	○	○	○	○	○	○	○
Sitting over edge of Bed	○	○	○	○	○	○	○	○	○	○
Active/Passive Transfer to Chair	○	○	○	○	○	○	○	○	○	○
Sitting out in Chair	○	○	○	○	○	○	○	○	○	○

***57. Rank the following REHABILITATION activities in order of the frequency they are prescribed or used by you in THIS ICU (1= most used and 9 being the least used activity or 10 = not used).**

	1	2	3	4	5	6	7	8	9	10
Active Exercises in Chair	○	○	○	○	○	○	○	○	○	○
Resisted Exercises in Chair	○	○	○	○	○	○	○	○	○	○
Cycling in Chair	○	○	○	○	○	○	○	○	○	○
Tilt Table	○	○	○	○	○	○	○	○	○	○
Standing Frame	○	○	○	○	○	○	○	○	○	○
Marching on the Spot	○	○	○	○	○	○	○	○	○	○
Stationary Cycling	○	○	○	○	○	○	○	○	○	○
Ambulation with Ventilator (away from bed)	○	○	○	○	○	○	○	○	○	○
Ambulation without Ventilator (away from bed)	○	○	○	○	○	○	○	○	○	○

***58. Percentage of time spent doing each of the following in this ICU:**

	0-25%	26-50%	51-75%	76-100%
CHEST PHYSIOTHERAPY	○	○	○	○
VENTILATION	○	○	○	○
MOBILIZATION	○	○	○	○
REHABILITATION	○	○	○	○

<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***59. Which of the following PHYSIOLOGICAL OUTCOME MEASURES do you utilize as a ICU Physiotherapist in this ICU?**

	Yes	No
Lung Auscultation	◯	◯
Pulmonary Function Tests	◯	◯
Saturation O2	◯	◯
Other	◯	◯

60. If other above please specify

***61. Which of the following PHYSICAL FUNCTIONING OUTCOME MEASURES do you utilize as a ICU Physiotherapist in this ICU?**

	Yes	No
Walk Test - Exercise Tolerance – 6 Minute Walk Test	◯	◯
Time up and Go Test (TUG)	◯	◯
Barthel Index	◯	◯
New York Heart Association (NYHA) Functional Classification	◯	◯
Functional Independence Measure - FIM	◯	◯
Physical Function ICU Test - PFIT	◯	◯
Other	◯	◯

62. If other above please specify

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<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***63. Which of the following HEALTH RELATED QUALITY OF LIFE OUTCOME MEASURES do you utilize as a ICU Physiotherapist in this ICU?**

	Yes	No
Sickness Impact Profile (SIP)	◯	◯
Perceived Quality of Life Scale (PQOL)	◯	◯
Nottingham Health Profile (NHP)	◯	◯
EuroQol 5Dimension Questionnaire (EQ5D)	◯	◯
Short Form 36 Surveys (SF-36)	◯	◯
Rosser's disability and distress categories	◯	◯
Spitzer's quality-of-life index and uniscale	◯	◯
Psychological Well Being Index (PGWB)	◯	◯
Fernandez's questionnaire	◯	◯
Whinston Hospital questionnaire	◯	◯
ICF - International Classification of Functioning Scale	◯	◯
Other	◯	◯

64. If other above please specify

***65. Are you, the physiotherapist in this ICU, involved in patient goal setting?**

***66. Involvement in patient goal setting.**

***67. Are you, the physiotherapist of this ICU involved in the discharge of patients from the ICU to other wards/home?**

***68. Do you have specific ICU physiotherapy discharge criteria in this unit?**

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<i><b>Current Physiotherapy Practice in Public Sector Intensive Care

***69. Please elaborate on the discharge criteria stated above.**

***70. Who is involved in the discharge of the ICU patient from this ICU?**

	Doctor/Physician/Intensivist	Nurse/s	Physio	Other
ON SITE	◯	◯	◯	◯
ON CALL (off site)	◯	◯	◯	◯

Other (please specify)

71. If other above please specify below

***72. In your opinion is referral for follow-up physiotherapy and rehabilitation for these ICU patients required?**

	Yes	No
In Ward	◯	◯
In an out-patient setting	◯	◯
In the Community (home visit)	◯	◯

***73. Are you aware of any follow-up physiotherapy and rehabilitation services for these ICU patients in your surrounding community**

74. If yes above, please provide details of these facilities.

***75. Who mainly refers this ICUs patients for follow-up physiotherapy and rehabilitation following hospital discharge?**

	Doctor/Physician/Intensivist	Nurse/s	Unit Physiotherapist	Other	Unknown
ON SITE	◯	◯	◯	◯	◯
ON CALL (off site)	◯	◯	◯	◯	◯

***76. Do you provide follow-up physiotherapy and rehabilitation in your hospital to this ICUs patients following hospital discharge?**

THANK YOU FOR YOUR PARTICIPATION !

Addendum 11: Email Invitation requesting participation in the Physiotherapy ICU Survey

- **FROM:** fkarachi@uwc.ac.za via surveymonkey.com
- **DATE:** Friday, July 25, 2014 11:50 AM
- **SENT TO:** recipient
- **SUBJECT:** Urgent response required: ICU Survey Part II
- **MESSAGE:**

Dear Participant

Thank you for completing part one of the ICU Physiotherapy survey. Please use the link below and complete PART II of the survey. The survey is one for your specific unit. Either the HOD or physiotherapist working in the specific unit must complete the survey. It will take you 20 to 30 minutes to complete. This information is vital to the ICU Physiotherapy Profession and thus your input will be greatly appreciated.

Here is a link to the survey:
https://www.surveymonkey.com/r/MULTIDISCIPLINARYICU

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Please note participation is voluntary. Written consent is not required as completion of the survey will imply consent. All data will be held strictly anonymous and confidential. Please feel free to contact me via email (fkarachi@uwc.ac.za) or via cell: 0829524549 (if no answer please leave voicemail message and I will return your call asap).

Thank You in advance for your participation. You will receive feedback on the results of the survey on completion of the study.

Farhana Karachi
PhD Physiotherapy (student)
Stellenbosch University
Physiotherapy Department
Tygerberg Medical Campus
Tygerberg
Parow
Cell: 0829524549
Email: fkarachi@uwc.ac.za

Thanks for your participation!

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
[Remove Link]

Addendum 12: ICU Survey raw response data on Referral Guidelines

Raw Response Data Open ended question: Elaborate on existing Referral Guidelines
We use a screening bases in the ICU for the relevance of the patient for physiotherapy
Referrals by registrars or consultants according to the SOP
Specific form completed by the doctor - detailing diagnosis and treatment required.
Contraindications to physiotherapy are noted in guideline.
All patients receive treatment post evaluation
We have a policy on management of ICU patients which covers the referral system. All ICU patients are screened and seen daily except on weekends and after hours. We used to have 24hour service to ICU and critical patients which was remunerated but when the new CEO took over, she stopped all Allied professionals' 24hr service except radiography saying it is waste of funds.
criteria for call-out over a weekend, by what time referrals should be done and by who limitations
Patient is screened in a daily basis by the physiotherapist in the cycle and if patient suitable for physiotherapy the patient will be seen.
Doctors call directly on physios phone, or call physio department.
No fixed policy or guideline
Standard Operational Procedure Policy Agreed Clinical Physiotherapy Guidelines
Screening of relevant patients done each morning
We have our own referral letter with which doctors can indicate the treatment that's required.
All patients in ICU get Physiotherapy treatment during the week. On weekends, the doctors choose two patients in the ICU for treatment who need treatment the most on the respective days.
All patients are treated daily by assessment from the physiotherapist in the unit. The physio communicates with the dr and nursing staff during ward rounds. Dr refer patients over weekend for respiratory complications.
n/a
The doctor will refer the patient by firstly mentioning it on the ward round (MDT) then writing out a compulsory physiotherapy referral letter. The clerk will then go and collect the referrals in the high care and wards. The doctor could contact the physio telephonically or bleep the physio although a referral letter needs to be given in order for the patient to be managed by the physio.
Physios working in ICU draw up a list of patients requiring weekend physiotherapy Daily screening during the week
All chest patients Neurological conditions
Pink referral card, telephonic followed by ref card

Addendum 13: Search Strategy for Systematic Review

METHOD FOR SEARCH STRATEGY FOR SYSTEMATIC REVIEW 22.05.2014

TOTAL = 624

PUBMED:

Limit on date: inception to 31.03.2014

(practice OR guideline* OR protocol* OR evidence-based care OR usual care OR standard care) AND (ICU OR intensive care unit* OR critical care unit*) AND (disseminat* OR implement* OR knowledge transfer* OR knowledge translation OR knowledge broker* OR knowledge management OR Organisation* OR organisation* OR professional) AND (strateg* OR intervention*) AND (quality improvement) AND (reminders OR educational material* OR mass media OR marketing OR patient mediated OR educational meeting* OR local consensus process* OR local opinion leaders OR educational outreach visit* OR professional substitution OR boundary encroachment OR clinical multidisciplinary teams OR formal integration of services OR continuity of care OR satisfaction of providers OR seamless care OR revision of professional roles OR audit and feedback)

TOTAL HITS = 33

EBSCOHOST (included ACADEMIC SEARCH PREMIER, AFRICA WIDE STUDIES, HEALTH SOURCE: NURSING/ACADEMIC EDITION, CINAHL AND MEDLINE

(practice OR guideline* OR protocol* OR evidence-based care OR usual care OR standard care) AND (ICU OR intensive care unit* OR critical care unit*) AND (disseminat* OR implement* OR knowledge transfer* OR knowledge translation OR knowledge broker* OR knowledge management OR Organisation* OR organisation* OR professional) AND (strateg* OR intervention*) AND (quality improvement) AND (reminders OR educational material* OR mass media OR marketing OR patient mediated OR educational meeting* OR local consensus process* OR local opinion leaders OR educational outreach visit* OR professional substitution OR boundary encroachment OR clinical multidisciplinary teams OR formal integration of services OR continuity of care OR satisfaction of providers OR seamless care OR revision of professional roles OR audit and feedback)

LIMIT date 31.03.2014

TOTAL HITS = 27 out of 41 after 14 duplicates were automatically removed

COCHRANE LIBRARY

(practice OR guideline* OR protocol* OR evidence-based care OR usual care OR standard care) AND (ICU OR intensive care unit* OR critical care unit*) AND (disseminat* OR implement* OR knowledge transfer* OR knowledge translation OR knowledge broker* OR knowledge management OR Organisation* OR organisation* OR professional) AND (strateg* OR intervention*) AND (quality improvement) AND (reminders OR educational material* OR

mass media OR marketing OR patient mediated OR educational meeting* OR local consensus process* OR local opinion leaders OR educational outreach visit* OR professional substitution OR boundary encroachment OR clinical multidisciplinary teams OR formal integration of services OR continuity of care OR satisfaction of providers OR seamless care OR revision of professional roles OR audit and feedback)

LIMIT TO Trials AND Inception to 31 March 2014

TOTAL HITS = 11

WEB OF SCIENCE

(practice OR guideline* OR protocol* OR evidence-based care OR usual care OR standard care) AND (ICU OR intensive care unit* OR critical care unit*) AND (disseminat* OR implement* OR knowledge transfer* OR knowledge translation OR knowledge broker* OR knowledge management OR Organisation* OR organisation* OR professional) AND (strateg* OR intervention*) AND (quality improvement) AND (reminders OR educational material* OR mass media OR marketing OR patient mediated OR educational meeting* OR local consensus process* OR local opinion leaders OR educational outreach visit* OR professional substitution OR boundary encroachment OR clinical multidisciplinary teams OR formal integration of services OR continuity of care OR satisfaction of providers OR seamless care OR revision of professional roles OR audit and feedback)

LIMIT date 1950 (inception to 2014 one-year embargo)

TOTAL HITS = 114

SCIENCE DIRECT

129 articles found for: docsubtype(FLA) and (practice OR guideline* OR protocol* OR evidence-based care OR usual care OR standard care) AND (ICU OR intensive care unit* OR critical care unit*) AND (disseminat* OR implement* OR knowledge transfer* OR knowledge translation OR knowledge broker* OR knowledge management OR Organisation* OR organisation* OR professional) AND (strateg* OR intervention*) AND (quality improvement) AND (clinical trial*) AND (clinical control* trial*) AND (randomi*ed control* trial*) AND LIMIT-TO(topics, "icu,intensive care,critical care")

Selected Medicine and Dentistry and Nursing and Health Professions, ticked ARTICLE AND ARTICLES IN PRESS LIMIT DATE: 2004 (inception) – 2014 one-year embargo

TOTAL HITS = 129

SCOPUS

(practice OR guideline* OR protocol* OR evidence-based care OR usual care OR standard care) AND (icu OR intensive care unit* OR critical care unit*) AND (disseminat* OR implement* OR knowledge transfer* OR knowledge translation OR knowledge broker* OR knowledge management OR Organisation* OR organisation* OR professional) AND (strateg* OR intervention*) AND (quality improvement) AND (clinical trial*) AND (clinical control*

trial*) AND (randomi*ed control* trial*) AND (LIMIT-TO(DOCTYPE, "ar")) AND (LIMIT-TO(SUBJAREA, "MEDI") OR LIMIT-TO(SUBJAREA, "NURS") OR LIMIT-TO(SUBJAREA, "MEDI") OR LIMIT-TO(SUBJAREA, "NURS")) AND (LIMIT-TO(EXACTKEYWORD, "Intensive care unit") OR LIMIT-TO(EXACTKEYWORD, "Intensive care unit"))

TOTAL HITS 112

PROQUEST MEDICAL LIBRARY

SEARCH 1: (practice OR guideline* OR protocol* OR evidence-based care OR usual care OR standard care) AND (ICU OR intensive care unit* OR critical care unit*) AND (disseminat* OR implement* OR knowledge transfer* OR knowledge translation OR knowledge broker* OR knowledge management OR Organisation* OR organisation* OR professional) AND (strateg* OR intervention*) AND (quality improvement) AND (reminders OR educational material* OR mass media OR marketing OR patient mediated OR educational meeting* OR local consensus process* OR local opinion leaders OR educational outreach visit* OR professional substitution OR boundary encroachment OR clinical multidisciplinary teams OR formal integration of services OR continuity of care OR satisfaction of providers OR seamless care OR revision of professional roles OR audit and feedback) AND (clinical trial*) AND (clinical control* trial*) AND (randomi*ed control* trial*)

LIMITS: PROQUEST DATABASE (9 databases within)

Databases:

- ProQuest Medical Library

Limited by:
Source type: Scholarly Journals
Document type: Article
Narrowed by: Document type: Article; MeSH subjects: Intensive Care; Subject: intensive care

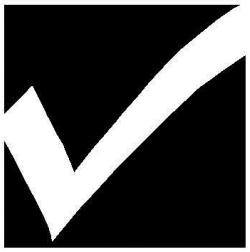
TOTAL HITS = 184

Addendum 14: EPOC Data Collection Checklist

(Includes Implementation Interventions (strategies) & Methodological and Quality Criteria)

Cochrane Effective Practice and Organisation of Care Review Group

DATA COLLECTION CHECKLIST



Cochrane Effective Practice and Organisation of Care Review Group (EPOC)

Data Collection Checklist

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Revised by Laura McAuley – with input from Craig Ramsay. June 2002.

Cochrane Effective Practice and Organisation of Care Review Group (EPOC)

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INTRODUCTION

The purpose of the data extraction checklist is to provide a guide to reviewers about the type of relevant information that could be extracted from primary studies. Each review is different and reviewers will need to adapt the checklist to suit their purposes. In order to make reviews useful to readers, certain types of information (for example quality assessments) should be available in all reviews. These standard items are marked with an asterisk (*).

METHODS

Once relevant studies have been identified for possible inclusion in a review, data regarding inclusion criteria (design, participants, interventions, and outcomes), quality criteria and results should be extracted independently by two reviewers. Other data can be extracted by one reviewer and checked by another. Reviewers should consider how data will be presented in the appropriate software, Review Manager (RevMan). Examples of the Table of Included Studies, and Results Tables are available from the editorial office. These examples illustrate the standard format used by EPOC.

Prior to entering data into RevMan, reviewers should check with their assigned contact editor.

Paper or electronic forms

Reviewers may choose from a number of different options to record data extraction, including the EPOC 'data collection template' (available in paper and electronic format) and an Idealist database (available from the Blackwell publishing group), incorporating the group's 'register' definition file which is available from the editorial office. Choice of format for data collection will depend upon strategies used for checking data. Reviewers should be aware that data tables created using word processing software cannot be readily transferred into RevMan (at present). If reviewers enter data directly into RevMan, then reviews should be exported frequently for safekeeping.

During data collection, it may be useful for reviewers to indicate the source page numbers against each item recorded as this facilitates later comparisons of extracted data.

Discrepancies between reviewers should be resolved by discussion and any decisions that cannot be resolved easily should be referred to the contact editor for the review.

Data that is missing or 'not clear' in a published report should be marked clearly on the data collection form. Missing information should be sought from the corresponding author of a paper.

checklist

1. INCLUSION CRITERIA

The items 1.1 - 1.2 (inclusive) in this section determine whether a study should be included in an EPOC review.

1.1 Study design

The design of the study is (state which):

1.1.1 *Randomised controlled trial (RCT)* i.e. a trial in which the participants (or other units) were definitely assigned prospectively to one or two (or more) alternative forms of health care using a process of random allocation (e.g. random number generation, coin flips).

1.1.2 *Controlled clinical trial (CCT)* may be a trial in which participants (or other units) were:

a) definitely assigned prospectively to one or two (or more) alternative forms of health care using a quasi-random allocation method (e.g. alternation, date of birth, patient identifier) or;

b) possibly assigned prospectively to one or two (or more) alternative forms of health care using a process of random or quasi-random allocation.

1.1.3 *Controlled before and after study (CBA)* i.e. involvement of intervention and control groups other than by random process, and inclusion of baseline period of assessment of main outcomes. There are three minimum criteria for inclusion of CBAs in EPOC reviews:

a) *Contemporaneous data collection*
Score DONE pre and post intervention periods for study and control sites are the same.
Score NOT CLEAR if it is not clear in the paper, e.g. dates of collection are not mentioned in the text. (N.B. the paper should be discussed with the contact editor for the review before data extraction is undertaken).
Score NOT DONE if data collection was not conducted contemporaneously during pre and post intervention periods for study and control sites.

b) *Appropriate choice of control site:*
Studies using second site as controls:
Score DONE if study and control sites are comparable with respect to dominant reimbursement system, level of care, setting of care and academic status.
Score NOT CLEAR if not clear from paper whether study and control sites are comparable. (N.B. the paper should be discussed with the contact editor for the review before data extraction is undertaken).
Score NOT DONE if study and control sites are not comparable.

c) Minimum number of sites:
Score DONE if there are a minimum of two intervention sites and two control sites.
Score NOT DONE if there are less than two intervention sites and two control sites.

1.1.4 *Interrupted time series (ITS)* i.e. a change in trend attributable to the intervention. There are two minimum criteria for inclusion of ITS designs in EPOC reviews:

a) *Clearly defined point in time when the intervention occurred.*
Score DONE if reported that intervention occurred at a clearly defined point in time.
Score NOT CLEAR if not reported in the paper (will be treated as NOT DONE if information cannot be obtained from the authors).

Score NOT DONE if reported that intervention did not occur at a clearly defined point in time.

b) *At least three data points before and three after the intervention.*
Score DONE if 3 or more data points before and 3 or more data points recorded after the intervention.
Score NOT CLEAR if not specified in paper e.g. number of discrete data points not mentioned in text or tables (will be treated as NOT DONE if information cannot be obtained from the authors).
Score NOT DONE if less than 3 data points recorded before and 3 data points recorded after intervention.

If the study is not any of the above designs, it should not be included in an EPOC review. If you scored NOT DONE for any of the above criteria in item 1.1, the study should not be included in an EPOC review. If reviewers are unsure of the study design, the paper should be discussed with the contact editor for the review before data extraction is undertaken.

1.2 **Methodological inclusion criteria**

The minimum methodological inclusion criteria across all study designs are:

a) *The objective measurement of performance/provider behaviour of health/patient outcome(s) in a clinical **not test** situation.*
Score DONE (e.g. drug levels assessed by a test, performance of providers against pre-set criteria, number of tests ordered, diastolic blood pressure, number of caesarean sections performed etc.). Outcome measures such as provider satisfaction with work or patient satisfaction with care may be included if they are assessed using a questionnaire with known reliability and validity.
Score NOT CLEAR (the paper should be discussed with the contact editor for the review before data extraction is undertaken).
Score NOT DONE (e.g. self-reported data, measurement of attitudes, beliefs, perceptions or satisfaction).

b) *Relevant and interpretable data presented or obtainable.*
Score DONE if data was presented or obtainable.
Score NOT CLEAR (the paper should be discussed with the contact editor for the review before data extraction is undertaken).
Score NOT DONE if relevant data was not presented and is clearly unobtainable.

If either of the above criteria in item 1.2 is scored as NOT DONE, the study should not be included in an EPOC review.

2. INTERVENTIONS

EPOC reviews include professional, financial, organisational or regulatory interventions.

State all interventions for each comparison/study group. (The categories are not mutually exclusive.)

2.1 Type of intervention

2.1.1 *Professional interventions*

a) Distribution of educational materials (Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audio-visual materials and electronic publications. The materials may have been delivered personally or through mass mailings.)

b) Educational meetings (Health care providers who have participated in conferences, lectures, workshops or traineeships.)

c) Local consensus processes (Inclusion of participating providers in discussion to ensure that they agreed that the chosen clinical problem was important and the approach to managing the problem was appropriate.)

d) Educational outreach visits (Use of a trained person who met with providers in their practice settings to give information with the intent of changing the provider's practice. The information given may have included feedback on the performance of the provider(s).

e) Local opinion leaders (Use of providers nominated by their colleagues as 'educationally influential'. The investigators must have explicitly stated that their colleagues identified the opinion leaders.)

f) Patient mediated interventions (New clinical information (not previously available) collected directly from patients and given to the provider e.g. depression scores from an instrument.)

g) Audit and feedback (Any summary of clinical performance of health care over a specified period of time. The summary may also have included recommendations for clinical action. The information may have been obtained from medical records, computerised databases, or observations from patients.)

The following interventions are excluded:

- Provision of new clinical information not directly reflecting provider performance which was collected from patients e.g. scores on a depression instrument, abnormal test results. These interventions should be described as patient mediated.
- Feedback of individual patients' health record information in an alternate format (e.g. computerised). These interventions should be described as organisational.

h) Reminders (Patient or encounter specific information, provided verbally, on paper or on a computer screen, which is designed or intended to prompt a health professional to recall information. This would usually be encountered through their general education; in the medical records or through interactions with peers, and so remind them to perform or avoid

some action to aid individual patient care. Computer aided decision support and drugs dosage are included.)

i) Marketing (Use of personal interviewing, group discussion ('focus groups'), or a survey of targeted providers to identify barriers to change and subsequent design of an intervention that addresses identified barriers.)

j) Mass media ((i) varied use of communication that reached great numbers of people including television, radio, newspapers, posters, leaflets, and booklets, alone or in conjunction with other interventions; (ii) targeted at the population level.)

k) Other (Other categories to be agreed in consultation with the EPOC editorial team.)

2.1.2 *Financial interventions*

2.1.2.1 *Provider interventions*

a) Fee-for-service (provider has been paid for number and type of service delivered)

b) Prepaid (no other description)

c) Capitation (provider was paid a set amount per patient for providing specific care)

d) Provider salaried service (provider received basic salary for providing specific care)

e) Prospective payment (provider was paid a fixed amount for health care in advance)

f) Provider incentives (provider received direct or indirect financial reward or benefit for doing specific action)

g) Institution incentives (institution or group of providers received direct or indirect financial rewards or benefits for doing specific action)

h) Provider grant/allowance (provider received direct or indirect financial reward or benefit not tied to specific action)

i) Institution grant/allowance (institution or group of providers received direct or indirect financial reward or benefit not tied to specific action)

j) Provider penalty (provider received direct or indirect financial penalty for inappropriate behaviour)

k) Institution penalty (institution or group of providers received direct or indirect financial penalty for inappropriate behaviour)

l) Formulary (added or removed from reimbursable available products)

m) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.2.2 *Patient interventions*

checklist

a) Premium (Patient payment for health insurance. It is important to determine if the patient paid the entire premium, or if the patient's employer paid some of it. This includes different types of insurance plans.)

b) Co-payment (Patient payment at the time of health care delivery in addition to health insurance e.g. in many insurance plans that cover prescription medications the patient may pay 5 dollars per prescription, with the rest covered by insurance.)

c) User-fee (Patient payment at the time of health care delivery.)

d) Patient incentives (Patient received direct or indirect financial reward or benefit for doing or encouraging them to do specific action.)

e) Patient grant/allowance (Patient received direct or indirect financial reward or benefit not tied to specific action.)

f) Patient penalty (Patient received direct or indirect financial penalty for specified behaviour e.g. reimbursement limits on prescriptions.)

g) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.3 *Organisational interventions*

2.1.3.1 *Provider orientated interventions*

a) Revision of professional roles (Also known as 'professional substitution', 'boundary encroachment' and includes the shifting of roles among health professionals. For example, nurse midwives providing obstetrical care; pharmacists providing drug counselling that was formerly provided by nurses and physicians; nutritionists providing nursing care; physical therapists providing nursing care. Also includes expansion of role to include new tasks.)

b) Clinical multidisciplinary teams (creation of a new team of health professionals of different disciplines or additions of new members to the team who work together to care for patients)

c) Formal integration of services (bringing together of services across sectors or teams or the organisation of services to bring all services together at one time also sometimes called 'seamless care')

d) Skill mix changes (changes in numbers, types or qualifications of staff)

e) Continuity of care (including one or many episodes of care for inpatients or outpatients)
- Arrangements for follow-up.
- Case management (including co-ordination of assessment, treatment and arrangement for referrals)

f) Satisfaction of providers with the conditions of work and the material and psychic rewards (e.g. interventions to 'boost morale')

g) Communication and case discussion between distant health professionals (e.g. telephone links; telemedicine; there is a television/video link between specialist and remote nurse practitioners)

checklist

h) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.3.2 *Patient orientated interventions*

a) Mail order pharmacies (e.g. compared to traditional pharmacies)

b) Presence and functioning of adequate mechanisms for dealing with patients' suggestions and complaints

c) Consumer participation in governance of health care organisation

d) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.3.3 *Structural interventions*

a) Changes to the setting/site of service delivery (e.g. moving a family planning service from a hospital to a school)

b) Changes in physical structure, facilities and equipment (e.g change of location of nursing stations, inclusion of equipment where technology in question is used in a wide range of problems and is not disease specific, for example an MRI scanner.)

c) Changes in medical records systems (e.g. changing from paper to computerised records, patient tracking systems)

d) Changes in scope and nature of benefits and services

e) Presence and organisation of quality monitoring mechanisms

f) Ownership, accreditation, and affiliation status of hospitals and other facilities

g) Staff organisation

h) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.4 *Regulatory interventions*

Any intervention that aims to change health services delivery or costs by regulation or law. (These interventions may overlap with organisational and financial interventions.)

a) Changes in medical liability

b) Management of patient complaints

c) Peer review

d) Licensure

e) Other (other categories to be agreed in consultation with the EPOC editorial team)

checklist

checklist

2.2 **Controls**

The study used was (specify):

a) No intervention control group

b) Standard practice control group (if different to (a) above)

c) Untargeted activity

d) Other (e.g. another intervention)

3. **TYPE OF TARGETED BEHAVIOUR (state more than one where appropriate)**

a) Clinical prevention services

b) Diagnosis

c) Test ordering

d) Referrals

e) Procedures

f) Prescribing

g) General management of a problem (e.g. the treatment of hypertension)

h) Patient education/advice

i) Professional-patient communication

j) Record keeping

k) Financial (resource use)

l) Discharge planning

m) Patient outcome

n) Other (specify)

o) NOT CLEAR

4. PARTICIPANTS

4.1 Characteristics of participating providers

4.1.1 *Profession*

a) Physicians

b) Nurses

c) Pharmacists

d) Physiotherapists

e) Dentists

f) Psychologists

g) Mixed (specify)

h) Other provider (specify)

i) NOT CLEAR

4.1.2 *Level of training*

a) In training (practising under supervision)

b) Accredited/licensed (i.e. fully trained, able to practice without supervision)

c) Mixed

d) NOT CLEAR

4.1.3 *Clinical speciality (list all as appropriate)*

a) General/family practice

b) Internal medicine

c) Surgery

d) Psychiatry

e) Paediatrics

f) Obstetrics and gynaecology

g) Laboratory medicine

h) Radiology

i) Other (specify)

j) Not applicable

k) NOT CLEAR

4.1.4 *Age*

State the mean age of participating providers (score NOT CLEAR if information is not available)

4.1.5 *Time since graduation (or years in practice)*

Score NOT CLEAR if information is not available.

4.2 **Characteristics of participating patients**

4.2.1 *Clinical problem*

State the area(s) that the intervention targets (e.g. hypertension, oncology, preventive services etc). (Score NOT CLEAR if information is not available.)

4.2.2 *Other patient characteristics (for each, score NOT CLEAR if information not available)*

a) Age

b) Gender

c) Ethnicity

d) Other (specify)

4.2.3 *Number of patients included in the study (e.g. those who entered the study) (for each, score NOT CLEAR if information not available)*

a) Episodes of care

b) Patients

c) Providers

d) Practices

e) Hospitals

f) Communities or regions

5. SETTING

5.1 Reimbursement system

a) Fee for service (provider was paid for the number and type of services delivered)

b) Capitation (provider was paid a set amount per patient for providing specific care)

c) Prospective payment

d) Global budget

e) Mixed

f) Other (specify)

g) NOT CLEAR

5.2 Location of care

a) Inpatient care

b) Outpatient care (e.g. ambulatory care provided by specialists/hospitals)

c) Community based care

d) Mixed

e) NOT CLEAR

5.3 Academic status

a) University based/teaching setting (i.e. not simply university affiliation)

b) Non-teaching setting

c) Mixed

d) NOT CLEAR

5.4 Country

Score NOT CLEAR if information is not available.

5.5 Proportion of eligible providers (or allocation units)

Proportion of eligible providers (or allocation units) who participated in the evaluation out of the total number in the sampling frame (state/calculate the percentage of providers in the target population who were allocated to study groups). (Score NOT CLEAR if information is not available.)

6. METHODS

6.1 Unit of allocation (i.e. who or what was allocated to study groups)

a) Patient

b) Provider

c) Practice

d) Institution

e) Community

f) Firm

g) Clinic day

h) Other (specify)

i) NOT CLEAR

6.2 Unit of analysis (i.e. results analysed as events per practice)

a) Patient

b) Provider

c) Practice

d) Institution

e) Community

f) Firm

g) Clinic day

h) Other (specify)

i) NOT CLEAR

6.3 Power calculation

Score DONE if study has sufficient statistical power to detect clinically important effects as statistically significant and record power.
Score NOT CLEAR if not reported.
Score NOT DONE if authors specifically report that the study was under-powered

6.4 Quality criteria

6.4.1 *Quality criteria for randomised controlled trials (RCTs & CCTs)*

(N.B. See 6.4.2 and 6.4.3 for quality criteria for CBA and ITS respectively.)

Seven standard criteria are used for randomised controlled trials and controlled clinical trials included in EPOC reviews:

a) Concealment of allocation (protection against selection bias)
Score DONE if
- the unit of allocation was by institution, team or professional and any random process is described explicitly, e.g. the use of random number tables or coin flips;
- the unit of allocation was by patient or episode of care and there was some form of centralised randomisation scheme, an on-site computer system or sealed opaque envelopes were used.

Score NOT CLEAR if
- the unit of allocation is not described explicitly;
- the unit of allocation was by patient or episode of care and the authors report using a 'list' or 'table', 'envelopes' or 'sealed envelopes' for allocation.

Score NOT DONE if
- the authors report using alternation such as reference to case record numbers, dates of birth, day of the week or any other such approach (as in CCTs);
- the unit of allocation was by patient or episode of care and the authors report using any allocation process that is entirely transparent before assignment such as an open list of random numbers or assignments;
- allocation was altered (by investigators, professionals or patients).

b) Follow-up of professionals (protection against exclusion bias)
Score DONE if outcome measures obtained for 80-100% of subjects randomised. (Do not assume 100% follow up unless stated explicitly.);
Score NOT CLEAR if not specified in the paper;
Score NOT DONE if outcome measures obtained for less than 80% of subjects randomised.

c) Follow-up of patients or episodes of care
Score DONE if outcome measures obtained for 80-100% of subjects randomised or for patients who entered the trial. (Do not assume 100% follow up unless stated explicitly.) Score DONE if there is an objective data collection system;
Score NOT CLEAR if not specified in the paper;
Score NOT DONE if outcome measures obtained for less than 80% of subjects randomised or for less than 80% of patients who entered the trial.

d) Blinded assessment of primary outcome(s)* (protection against detection bias)
Score DONE if the authors state explicitly that the primary outcome variables were assessed blindly OR the outcome variables are objective, e.g. length of hospital stay, drug levels as assessed by a standardised test;
Score NOT CLEAR if not specified in the paper;
Score NOT DONE if the outcome(s) were not assessed blindly.

Primary outcome(s) are those variables that correspond to the primary hypothesis or question as defined by the authors. In the event that some of the primary outcome variables were assessed in a blind fashion and others were not, score each separately and label each outcome variable clearly.

e) Baseline measurement
Score DONE if performance or patient outcomes were measured prior to the intervention, and no substantial differences were present across study groups;

Score NOT CLEAR if baseline measures are not reported, or if it is unclear whether baseline measures are substantially different across study groups;
Score NOT DONE if there are differences at baseline in main outcome measures likely to undermine the post intervention differences (e.g. are differences between the groups before the intervention similar to those found post intervention).

f) Reliable primary outcome measure(s)*
Score DONE if two or more raters with at least 90% agreement or kappa greater than or equal to 0.8 OR the outcome is obtained from some automated system e.g. length of hospital stay, drug levels as assessed by a standardised test;
Score NOT CLEAR if reliability is not reported for outcome measures that are obtained by chart extraction or collected by an individual;
Score NOT DONE if agreement is less than 90% or kappa is less than 0.8.

In the event that some outcome variables were assessed in a reliable fashion and others were not, score each separately on the back of the form and label each outcome variable clearly.

g) Protection against contamination
Score DONE if allocation was by community, institution or practice and it is unlikely that the control received the intervention;
Score NOT CLEAR if professionals were allocated within a clinic or practice and it is possible that communication between experimental and group professionals could have occurred;
Score NOT DONE if it is likely that the control group received the intervention (e.g. cross-over trials or if patients rather than professionals were randomised).

6.4.2 *Quality criteria for controlled before and after (CBA) designs*

Seven standard criteria are used for CBAs included in EPOC reviews:

a) Baseline measurement
Score DONE if performance or patient outcomes were measured prior to the intervention, and no substantial differences were present across study groups (e.g. where multiple pre intervention measures describe similar trends in intervention and control groups);
Score NOT CLEAR if baseline measures are not reported, or if it is unclear whether baseline measures are substantially different across study groups;
Score NOT DONE if there are differences at baseline in main outcome measures likely to undermine the post intervention differences (e.g. are differences between the groups before the intervention similar to those found post intervention).

b) Characteristics for studies using second site as control
Score DONE if characteristics of study and control providers are reported and similar;
Score NOT CLEAR if it is not clear in the paper e.g. characteristics are mentioned in the text but no data are presented;
Score NOT DONE if there is no report of characteristics either in the text or a table OR if baseline characteristics are reported and there are differences between study and control providers.

c) Blinded assessment of primary outcome(s)* (protection against detection bias)

Score DONE if the authors state explicitly that the primary outcome variables were assessed blindly OR the outcome variables are objective e.g. length of hospital stay, drug levels as assessed by a standardised test;
Score NOT CLEAR if not specified in the paper;
Score NOT DONE if the outcomes were not assessed blindly.

Primary outcome(s) are those variables that correspond to the primary hypothesis or question as defined by the authors. In the event that some of the primary outcome variables were assessed in a blind fashion and others were not, score each separately and label each outcome variable clearly.

d) Protection against contamination
Studies using second site as control
Score DONE if allocation was by community, institution, or practice and is unlikely that the control group received the intervention;
Score NOT CLEAR if providers were allocated within a clinic or practice and communication between experimental and group providers was likely to occur;
Score NOT DONE if it is likely that the control group received the intervention (e.g. cross-over studies or if patients rather than providers were randomised).

e) Reliable primary outcome measure(s)
Score DONE if two or more raters with at least 90% agreement or kappa greater than or equal to 0.8 OR the outcome is obtained from some automated system e.g. length of hospital stay, drug levels as assessed by a standardised test;
Score NOT CLEAR if reliability is not reported for outcome measures that are obtained by chart extraction or collected by an individual;
Score NOT DONE if agreement is less than 90% or kappa is less than 0.8.

In the event that some outcome variables were assessed in a reliable fashion and others were not, score each separately and label each outcome variable clearly.

f) Follow-up of professionals (protection against exclusion bias)
Score DONE if outcome measures obtained 80-100% subjects allocated to groups. (Do not assume 100% follow-up unless stated explicitly.);
Score NOT CLEAR if not specified in the paper;
Score NOT DONE if outcome measures obtained for less than 80% of patients allocated to groups.

g) Follow-up of patients
Score DONE if outcome measures obtained 80-100% of patients allocated to groups or for patients who entered the study. (Do not assume 100% follow-up unless stated explicitly.);
Score NOT CLEAR if not specified in the paper;
Score NOT DONE if outcome measures obtained for less than 80% of patients allocated to groups or for less than 80% of patients who entered the study.

6.4.3 *Quality criteria for interrupted time series (ITSs)*

The following seven standard criteria should be used to assess the methodology quality of ITS designs included in EPOC reviews. Each criterion is scored DONE,

NOT CLEAR or NOT DONE. The results of the quality assessment for each study are reported in the Table of Included Studies in RevMan. Examples can be obtained from the EPOC review group co-ordinator.

a) Protection against secular changes
- The intervention is independent of other changes.
  Score DONE if the intervention occurred independently of other changes over time;
  Score NOT CLEAR if not specified (will be treated as NOT DONE if information cannot be obtained from the authors);
  Score NOT DONE if reported that intervention was not independent of other changes in time.

b) Data were analysed appropriately
  Score DONE if ARIMA models were used **OR** time series regression models were used to analyse the data and serial correlation was adjusted/tested for;
  Score NOT CLEAR if not specified (will be treated as NOT DONE if information cannot be obtained from the authors);
  Score NOT DONE if it is clear that neither of the conditions above not met.

c) Reason for the number of points pre and post intervention given
  Score DONE if rationale for the number of points stated (eg monthly data for 12 months post-intervention was used because the anticipated effect was expected to decay) **OR** sample size calculation performed;
  Score NOT CLEAR if not specified (will be treated as NOT DONE if information cannot be obtained from the authors);
  Score NOT DONE if it is clear that neither of the conditions above met.

d) Shape of the intervention effect was specified
  Score DONE if a rational explanation for the shape of intervention effect was given by the author(s);
  Score NOT CLEAR if not specified (will be treated as NOT DONE if information cannot be obtained from the authors);
  Score NOT DONE if it is clear that the condition above is not met

e) Protection against detection bias
- Intervention unlikely to affect data collection
  Score DONE if reported that intervention itself was unlikely to affect data collection (for example, sources and methods of data collection were the same before and after the intervention);
  Score NOT CLEAR if not reported (will be treated as NOT DONE if information cannot be obtained from the authors);
  Score NOT DONE if the intervention itself was likely to affect data collection (for example, any change in source or method of data collection reported).

- Blinded assessment of primary outcome(s)*
  Score DONE if the authors state explicitly that the primary outcome variables were assessed blindly OR the outcome variables are objective e.g. length of hospital stay, drug levels as assessed by a standardised test;
  Score NOT CLEAR if not specified (will be treated as NOT DONE if information cannot be obtained from the authors);
  Score NOT DONE if the outcomes were not assessed blindly.

Primary outcome(s) are those variables that correspond to the primary hypothesis or question as defined by the authors. In the event that some of the primary outcome variables were assessed in a blind fashion and others were not, score each separately and label each outcome variable clearly.

c) Completeness of data set
Score DONE if data set covers 80-100% of total number of participants or episodes of care in the study;
Score NOT CLEAR if not specified (will be treated as NOT DONE if information cannot be obtained from the authors);
Score NOT DONE if data set covers less than 80% of the total number of participants or episodes of care in the study.

d) Reliable primary outcome measure(s)*
Score DONE if two or more raters with at least 90% agreement or kappa greater than or equal to 0.8 OR the outcome is obtained from some automated system e.g. length of hospital stay, drug levels as assessed by a standardised test;
Score NOT CLEAR if reliability is not reported for outcome measures that are obtained by chart extraction or collected by an individual (will be treated as NOT DONE if information cannot be obtained from the authors);
Score NOT DONE if agreement is less than 90% or kappa is less than 0.8.

In the event that some outcome variables were assessed in a reliable fashion and others were not, score each separately.

6.4.4 *Consumer involvement*

Were consumers (i.e. potential patients) involved at any point of the design, conduct or interpretation of the study? (E.g., consumers involved in clinical practice guideline development, or their views collected.)

Score DONE if specified in paper, and give details;
Score NOT CLEAR if not reported;
Score NOT DONE if consumers explicitly not involved.

7. PROSPECTIVE IDENTIFICATION BY INVESTIGATORS OF BARRIERS TO CHANGE

Investigators identified specific barriers to change in the target population, which were addressed by the intervention

a) Information management

b) Clinical uncertainty

c) Sense of competence

d) Perceptions of liability

e) Patient expectations

f) Standards of practice

g) Financial disincentives

h) Administrative constraints

i) Other (please specify)

j) NOT DONE

k) NOT CLEAR

8. INTERVENTION

8.1 Characteristics of the intervention

a) Evidence base of recommendation.
Score DONE if recommendations appear to be based on good evidence (e.g. there is clear reference to a systematic review or at least one randomised controlled trial);
Score NOT CLEAR if not specified in the paper;
Score NOT DONE if explicitly not evidence based.

b) Purpose of recommendations
- Appropriate management.
- Cost containment.
- Other (specify).
- NOT CLEAR

8.2 Nature of desired change

a) Initiation of new management (i.e. the introduction of a new technology)

b) Stopping introduction of new management

c) Reduction of established management

d) Increase established management

e) Cessation of established management

f) Modification of established management (e.g. increased management in one activity, reduction in another)

g) NOT CLEAR

8.3 Format

For each intervention state the medium employed

a) Interpersonal

b) Paper

c) Audio/visual

d) Computer/interactive

e) Multiple media used

f) Other (specify)

g) NOT CLEAR

8.4 **Source**

a) Local clinicians

b) Local expert body

c) National professional expert body

d) National government expert body

e) International professional expert body

f) International government expert body

g) Other (specify)

h) NOT CLEAR

8.5 **Intervention based upon implementation of clinical practice guidelines (i.e. based upon clear recommendations for practice**

Score DONE if specified in the paper;
Score NOT CLEAR if not specified in the paper;
Score NOT DONE if explicitly not based upon implementation of clinical practice guidelines.

8.6 **Clinical practice guidelines developed through formal consensus process**

Score DONE if formal consensus process described;
Score NOT CLEAR if not specified in the paper, or if intervention did not appear to be based on the implementation of clinical guidelines;
Score NOT DONE if explicitly not done.

8.7 **Recipient**

State whether each intervention was delivered to:

a) Individual

b) Group

c) NOT CLEAR

8.8 **Deliverer**

State who (or what) delivered the intervention (score all relevant):

a) Pharmacist

b) Local expert (state profession)

c) Research worker

d) Management representative

e) Computer system

f) Other (specify)

g) NOT CLEAR

8.9 **Timing**

For each intervention, state the following (for each score NOT CLEAR if information is not available):

a) Proximity to clinical decision-making (this item may be particularly relevant to audit and feedback and reminder interventions)

b) Frequency/number of intervention events

c) Duration of intervention

8.10 **Setting of intervention**

a) In practice setting

b) Not in practice setting

c) NOT CLEAR

8.11 **Source of funding**

a) Governmental organisation

b) Commercial organisation

c) Health-care provider organisation

d) Voluntary body (e.g. American Medical Association, British Medical Association)

e) Charitable trust

f) Research funding body (e.g. Medical Research Council)

g) Other (specify)

h) NOT CLEAR

8.12 **Ethical approval**

a) Score DONE if ethical approval sought and obtained for the study

b) Score NOT CLEAR if not reported

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9. OUTCOMES

9.1 Description of the main outcome measure(s)

Report all the main outcomes described by the authors.

a) Health professional outcomes/process measures (e.g. the number of drugs prescribed)

b) Patient outcomes (e.g. the number of adverse drug events)

c) Economic variables

- Costs of the intervention:
  Score DONE if reported, and describe costs;
  Score NOT DONE if not reported

- Changes in direct health care costs as a result of the intervention (e.g. drugs, hospital stays etc):
  Score DONE if reported, and describe costs;
  Score NOT DONE if not reported

- Changes in non health care costs as a result of the intervention (e.g. patient travel or time off work for hospital visits):
  Score DONE if reported, and describe costs;
  Score NOT DONE if not reported

- Costs associated with the intervention are linked with provider or patient outcomes in an economic evaluation (e.g. net cost per unit change in rate of prescribing, or cost per life year saved):
  Score DONE if reported, and describe ratio;
  Score NOT CLEAR if not adequately described in the paper;
  Score NOT DONE if there was no economic evaluation reported.

9.2 Length of time during which outcomes were measured after initiation of the intervention

9.3 Length of post-intervention follow-up period

Score DONE if reported in the paper (specify length of follow-up period)
Score NOT CLEAR if not reported in the paper
Score NOT DONE if there was no follow-up period.

9.4 Identify a possible ceiling effect

For example, there was little room for improvement in provider performance, because it was adequate without the intervention (based on baseline measurements or control group performance).

a) Identified by investigator
- Yes
- No
- NOT CLEAR

b) Identified by reviewer
- Yes
- No
- NOT CLEAR

checklist

10. RESULTS

State the results as they will be entered in the review, and describe how these were calculated (e.g. relative percentage differences attributable to the intervention).

10.1 For RCTs and CCTs

a) State the main results of the main outcome(s), for each study group, in natural units.

b) For each available comparison, report the baseline and post intervention differences between study and control groups, in natural units. Include statistical significance if reported. Indicate if the unit of randomisation and analysis were different.

In all cases, report a more favourable provider/patient outcome in the more active intervention group as a positive (+) finding (i.e. where differences in the groups are in the intended direction).

10.2 For CBAs

a) State the main results of the main outcome(s), for each study group, in natural units.

b) For each study group, report baseline and post intervention results. Calculate the pre-post intervention difference for each outcome in natural units (i.e. the post-intervention outcome minus the pre-intervention outcome).

c) For each available comparison, calculate the difference across study groups of the pre-post intervention change (i.e. if, for an outcome measure ΔE is the pre-post intervention change in the experimental/intervention group, and ΔC is the pre-post intervention change in the control group, this will be ΔE-ΔC).

Include statistical significance if reported.

In all cases, report a more favourable provider/patient outcome in the more active intervention group as a positive (+) finding (i.e., where differences in the groups are in the intended direction).

10.3 For ITSs

State the main results of the main outcome(s) in natural units.

In all cases, report a more favourable provider/patient outcome attributable to the intervention as a positive (+) finding (i.e. where changes in the outcomes are in the intended direction).

a) Number of points pre and post
b) Number of patients or measurement units (eg laboratory tests) in whole series
c) Time interval between points
d) Report pre and post intervention means
e) Report absolute change in natural units
f) Report percentage relative change
g) Report the model used and statistical significance

h) ***Is information on the value of individual observations over time only reported graphically in the original paper?*** YES / NO

In all cases, report a more favourable provider/patient outcome in the more active intervention group as a positive (+) finding (i.e., where differences in the groups are in the intended direction).

Notes: did you have to do any re-analysis. If yes,

i) Report change in level and p-value in natural units

j) Report change in slope and p-value in natural units

k) Report the autocorrelation coefficient

Addendum 15: EPOC Data Abstraction Form

Cochrane Effective Practice and Organisation of Care Group (EPOC)[1]

Data Abstraction Form

This form can be used to record the results of data extraction and is intended for use in conjunction with the **EPOC Data Collection Checklist**.

Data collection

Name of reviewer:
Date:
Study reference:

EPOC scope:

The effect(s) of a behavioural/educational, financial, organisational or regulatory intervention(s) is evaluated

1. Inclusion criteria

1.1 Study design

1.1.1 RCT designs

1.1.2 CCT designs

1.1.3 CBA designs

a) Contemporaneous data collection

b) Appropriate choice of control site/activity

- Studies should contain a minimum of two intervention and two control groups

1.1.4 ITS designs

a) Clearly defined point in time when the intervention occurred

b) At least 3 data points before and 3 after the intervention

[1]**EPOC Editorial Base:**

Alain Mayhew, Managing Editor
Cochrane Effective Practice and Organisation of Care Group
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501 Smyth Avenue, Box 711
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1.2 Methodological inclusion criteria

a) The objective measurement of performance/provider behaviour or health/patient outcomes

b) Relevant and interpretable data presented or obtainable

N.B. A study must meet the minimum criteria for EPOC scope, design, and methodology for inclusion in EPOC reviews. If it does not, COLLECT NO FURTHER DATA.

2. Interventions

2.1 Type of intervention
(state all interventions for each comparison/study group)

Group 1:

Group 2:

Group 3:

Group 4:

2.2 Control(s)

3. Type of Targeted Behaviour (state more than one where appropriate)

4. Participants

4.1 Characteristics of participating providers

4.1.1 Profession

4.1.2 Level of training

4.1.3 Clinical specialty

4.1.4 Age

4.1.5 Time since graduation (or years in practice)

4.2 Characteristics of Participating patients

4.2.1 Clinical problem

4.2.2 Other patient characteristics

a) Age

b) Gender

c) Ethnicity

d) Other (specify)

4.2.3 Number of patients included in the study

a) Episodes of care

b) Patients

c) Providers

d) Practices

e) Hospitals

f) Communities or regions

5. Setting

5.1 Reimbursement system

5.2 Location of Care

5.3 Academic status

5.4 Country

5.5 Proportion of eligible providers (or allocation units)

6. Methods

6.1 Unit of allocation

6.2 Unit of analysis

6.3 Power calculation

6.4 Quality criteria

6.4.1 Quality criteria for randomised controlled trials (RCTs) and controlled clinical trials (CCTs)

(Go to 6.4.2 and 6.4.3 for the quality criteria for CBA and ITS, respectively)

a) Concealment of allocation

b) Follow-up of professionals

c) Follow-up of patients or episodes of care

d) Blinded assessment of primary outcome(s)

e) Baseline measurement

f) Reliable primary outcome measure(s)

g) Protection against contamination

6.4.2 Quality criteria for controlled before and after (CBA) designs

a) Baseline measurement

b) Characteristics for studies using second site as control

c) Blinded assessment of primary outcome(s)* (protection against detection bias)

d) Protection against contamination (studies using second site as control)

e) Reliable primary outcome measure(s)

f) Follow-up of professionals (protection against exclusion bias)

g) Follow-up of patients

6.4.3 Quality criteria for interrupted time series (ITS) designs

Protection against secular changes:

a) The intervention is independent of other changes

b) Data were analysed appropriately

c) Reason for the number of points pre- and post-intervention given

d) Shape of the intervention effect was specified

Protection against detection bias:

a) Intervention unlikely to affect data collection

b) Blinded assessment of primary outcome(s)

c) Completeness of data set

d) Reliable primary outcome measure(s)

6.4.4 Consumer involvement

7. Prospective identification by investigators of barriers to change

8. Intervention

8.1 Characteristics of the intervention

a) Evidence base of recommendation

b) Purpose of recommendations

8.2 Nature of desired change

8.3 Format (Medium for each intervention)

8.4 Source

8.5 Intervention based upon implementation of clinical practice guidelines

8.6 Clinical practice guidelines developed through formal consensus process

8.7 Recipient

8.8 Deliverer

8.9 Timing

a) Proximity to clinical decision-making

b) Frequency/number of intervention events

c) Duration of intervention

8.10 Setting of intervention

8.11 Source of funding

8.12 Ethical approval

9. Outcomes

9.1 Description of the main outcome measure(s).

a) Health professional outcomes/process measures

b) Patient outcomes

c) Economic variables

- Costs of the intervention
- Changes in direct health care costs as a result of the intervention
- Changes in non-health care costs as a result of the intervention
- Costs associated with the intervention are linked with provider or patient outcomes in an economic evaluation

9.2 Length of time during which outcomes were measured after initiation of the intervention.

9.3 Length of post- intervention follow-up period.

9.4 Identify a possible ceiling effect:

a) Identified by investigator

b) Identified by reviewer

10. Results (use extra page if necessary)

10.1.1 For RCTs and CCTs

10.1.2 For CBAs

10.1.3 For ITSs

Addendum 16: Cochrane Risk of Bias Tool

The Cochrane Collaboration's tool for assessing risk of bias

Domain	Description	Review authors' judgement
Sequence generation	Describe the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.	Was the allocation sequence adequately generated?
Allocation concealment	Describe the method used to conceal the allocation sequence in sufficient detail to determine whether intervention allocations could have been foreseen in advance of, or during, enrolment.	Was allocation adequately concealed?
Blinding of participants, personnel and outcome assessors *Assessments should be made for each main outcome (or class of outcomes)*	Describe all measures used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. Provide any information relating to whether the intended blinding was effective.	Was knowledge of the allocated intervention adequately prevented during the study?
Incomplete outcome data *Assessments should be made for each main outcome (or class of outcomes)*	Describe the completeness of outcome data for each main outcome, including attrition and exclusions from the analysis. State whether attrition and exclusions were reported, the numbers in each intervention group (compared with total randomized participants), reasons for attrition/exclusions where reported, and any re-inclusions in analyses performed by the review authors.	Were incomplete outcome data adequately addressed?
Selective outcome reporting	State how the possibility of selective outcome reporting was examined by the review authors, and what was found.	Are reports of the study free of suggestion of selective outcome reporting?
Other sources of bias	State any important concerns about bias not addressed in the other domains in the tool. If particular questions/entries were pre-specified in the review's protocol, responses should be provided for each question/entry.	Was the study apparently free of other problems that could put it at a high risk of bias?

Possible approach for *summary assessments* outcome (across domains) within and across studies

Risk of bias	Interpretation	Within a study	Across studies
Low risk of bias	Plausible bias unlikely to seriously alter the results.	Low risk of bias for all key domains.	Most information is from studies at low risk of bias.
Unclear risk of bias	Plausible bias that raises some doubt about the results	Unclear risk of bias for one or more key domains.	Most information is from studies at low or unclear risk of bias.
High risk of bias	Plausible bias that seriously weakens confidence in the results.	High risk of bias for one or more key domains.	The proportion of information from studies at high risk of bias is sufficient to affect the interpretation of the results.

Criteria for judging risk of bias in the 'Risk of bias' assessment tool

SEQUENCE GENERATION **Was the allocation sequence adequately generated? [Short form: *Adequate sequence generation*?]**	
Criteria for a judgement of 'YES' (i.e. low risk of bias).	The investigators describe a random component in the sequence generation process such as: ▪ Referring to a random number table; Using a computer random number generator; Coin tossing; Shuffling cards or envelopes; Throwing dice; Drawing of lots; Minimization*. *Minimization may be implemented without a random element, and this is considered to be equivalent to being random.
Criteria for the judgement of 'NO' (i.e. high risk of bias).	The investigators describe a non-random component in the sequence generation process. Usually, the description would involve some systematic, non-random approach, for example: ▪ Sequence generated by odd or even date of birth; ▪ Sequence generated by some rule based on date (or day) of admission; ▪ Sequence generated by some rule based on hospital or clinic record number. Other non-random approaches happen much less frequently than the systematic approaches mentioned above and tend to be obvious. They usually involve judgement or some method of non-random categorization of participants, for example: ▪ Allocation by judgement of the clinician; ▪ Allocation by preference of the participant; ▪ Allocation based on the results of a laboratory test or a series of tests; ▪ Allocation by availability of the intervention.
Criteria for the judgement of 'UNCLEAR' (uncertain risk of bias).	Insufficient information about the sequence generation process to permit judgement of 'Yes' or 'No'.
ALLOCATION CONCEALMENT **Was allocation adequately concealed? [Short form: *Allocation concealment*?]**	
Criteria for a judgement of 'YES' (i.e. low risk of bias).	Participants and investigators enrolling participants could not foresee assignment because one of the following, or an equivalent method, was used to conceal allocation: ▪ Central allocation (including telephone, web-based, and pharmacy-controlled, randomization); ▪ Sequentially numbered drug containers of identical appearance; ▪ Sequentially numbered, opaque, sealed envelopes.
Criteria for the judgement of 'NO' (i.e. high risk of bias).	Participants or investigators enrolling participants could possibly foresee assignments and thus introduce selection bias, such as allocation based on: ▪ Using an open random allocation schedule (e.g. a list of random numbers); ▪ Assignment envelopes were used without appropriate safeguards (e.g. if envelopes were unsealed or non-opaque or not sequentially numbered); ▪ Alternation or rotation; ▪ Date of birth; ▪ Case record number; ▪ Any other explicitly unconcealed procedure.

Criteria for the judgement of 'UNCLEAR' (uncertain risk of bias).	Insufficient information to permit judgement of 'Yes' or 'No'. This is usually the case if the method of concealment is not described or not described in sufficient detail to allow a definite judgement – for example if the use of assignment envelopes is described, but it remains unclear whether envelopes were sequentially numbered, opaque and sealed.
BLINDING OF PARTICIPANTS, PERSONNEL AND OUTCOME ASSESSORS **Was knowledge of the allocated interventions adequately prevented during the study? [Short form: *Blinding*?]**	
Criteria for a judgement of 'YES' (i.e. low risk of bias).	Any one of the following: ▪ No blinding, but the review authors judge that the outcome and the outcome measurement are not likely to be influenced by lack of blinding; ▪ Blinding of participants and key study personnel ensured, and unlikely that the blinding could have been broken; ▪ Either participants or some key study personnel were not blinded, but outcome assessment was blinded and the non-blinding of others unlikely to introduce bias.
Criteria for the judgement of 'NO' (i.e. high risk of bias).	Any one of the following: ▪ No blinding or incomplete blinding, and the outcome or outcome measurement is likely to be influenced by lack of blinding; ▪ Blinding of key study participants and personnel attempted, but likely that the blinding could have been broken; ▪ Either participants or some key study personnel were not blinded, and the non-blinding of others likely to introduce bias.
Criteria for the judgement of 'UNCLEAR' (uncertain risk of bias).	Any one of the following: ▪ Insufficient information to permit judgement of 'Yes' or 'No'; ▪ The study did not address this outcome.
INCOMPLETE OUTCOME DATA **Were incomplete outcome data adequately addressed? [Short form: *Incomplete outcome data addressed*?]**	
Criteria for a judgement of 'YES' (i.e. low risk of bias).	Any one of the following: ▪ No missing outcome data; ▪ Reasons for missing outcome data unlikely to be related to true outcome (for survival data, censoring unlikely to be introducing bias); ▪ Missing outcome data balanced in numbers across intervention groups, with similar reasons for missing data across groups; ▪ For dichotomous outcome data, the proportion of missing outcomes compared with observed event risk not enough to have a clinically relevant impact on the intervention effect estimate; ▪ For continuous outcome data, plausible effect size (difference in means or standardized difference in means) among missing outcomes not enough to have a clinically relevant impact on observed effect size; ▪ Missing data have been imputed using appropriate methods.
Criteria for the judgement of 'NO' (i.e. high risk of bias).	Any one of the following: ▪ Reason for missing outcome data likely to be related to true outcome, with either imbalance in numbers or reasons for missing data across intervention groups; ▪ For dichotomous outcome data, the proportion of missing outcomes compared with observed event risk enough to induce clinically relevant bias in intervention effect estimate; ▪ For continuous outcome data, plausible effect size (difference in means or standardized difference in means) among missing outcomes enough to induce clinically relevant bias in observed effect size; ▪ 'As-treated' analysis done with substantial departure of the intervention received from that assigned at randomization; ▪ Potentially inappropriate application of simple imputation.

Criteria for the judgement of 'UNCLEAR' (uncertain risk of bias).	Any one of the following: ▪ Insufficient reporting of attrition/exclusions to permit judgement of 'Yes' or 'No' (e.g. number randomized not stated, no reasons for missing data provided); ▪ The study did not address this outcome.
SELECTIVE OUTCOME REPORTING **Are reports of the study free of suggestion of selective outcome reporting? [Short form: *Free of selective reporting*?]**	
Criteria for a judgement of 'YES' (i.e. low risk of bias).	Any of the following: ▪ The study protocol is available and all of the study's pre-specified (primary and secondary) outcomes that are of interest in the review have been reported in the pre-specified way; ▪ The study protocol is not available but it is clear that the published reports include all expected outcomes, including those that were pre-specified (convincing text of this nature may be uncommon).
Criteria for the judgement of 'NO' (i.e. high risk of bias).	Any one of the following: ▪ Not all of the study's pre-specified primary outcomes have been reported; ▪ One or more primary outcomes is reported using measurements, analysis methods or subsets of the data (e.g. subscales) that were not pre-specified; ▪ One or more reported primary outcomes were not pre-specified (unless clear justification for their reporting is provided, such as an unexpected adverse effect); ▪ One or more outcomes of interest in the review are reported incompletely so that they cannot be entered in a meta-analysis; ▪ The study report fails to include results for a key outcome that would be expected to have been reported for such a study.
Criteria for the judgement of 'UNCLEAR' (uncertain risk of bias).	Insufficient information to permit judgement of 'Yes' or 'No'. It is likely that the majority of studies will fall into this category.
OTHER POTENTIAL THREATS TO VALIDITY **Was the study apparently free of other problems that could put it at a risk of bias? [Short form: *Free of other bias*?]**	
Criteria for a judgement of 'YES' (i.e. low risk of bias).	The study appears to be free of other sources of bias.
Criteria for the judgement of 'NO' (i.e. high risk of bias).	There is at least one important risk of bias. For example, the study: ▪ Had a potential source of bias related to the specific study design used; or ▪ Stopped early due to some data-dependent process (including a formal-stopping rule); or ▪ Had extreme baseline imbalance; or ▪ Has been claimed to have been fraudulent; or ▪ Had some other problem.
Criteria for the judgement of 'UNCLEAR' (uncertain risk of bias).	There may be a risk of bias, but there is either: ▪ Insufficient information to assess whether an important risk of bias exists; or ▪ Insufficient rationale or evidence that an identified problem will introduce bias.

Addendum 17: Table of Excluded Studies with Reasons

Table of Excluded Review Studies and Reasons for Exclusions

No.	Author & Year	Title	Reason for Exclusion
1	Larson et al., 2000	An Organisational Climate Intervention Associated with increased hand washing and Decreased Nosocomial Infections.	Study design and no implementation process or strategy.
2	Horbar et al., 2001	Collaborative Quality Improvement for Neonatal Intensive Care.	Study design.
3	Iregui et al., 2002	Use of a handheld computer by respiratory care practitioners to improve the efficiency of weaning patients from mechanical ventilation.	Study design, not professional nor Organisational strategy.
4	de Jonge et al., 2003	Effects of selective decontamination of digestive tract on mortality and acquisition of resistant bacteria in intensive care of randomised controlled trial.	Intervention effectiveness, no implementation process, nor strategy.
5	Coopersmith et al., 2004	The impact of bedside behavior on catheter-related bacteremia in the intensive care unit.	Study design.
6	Krinsley, 2004	Effect of an intensive glucose management protocol on the mortality of critically ill adult patients.	Intervention effectiveness, no implementation process nor strategy.
7	Misset et al., 2004 .	A continuous quality-improvement program reduces nosocomial infection rates in the ICU	Study design, no implementation process nor strategy.
8	McLean et al., 2006	Improving adherence to a mechanical ventilation weaning protocol for critically ill adults: Outcomes after an implementation program.	Study design.
9	Thursky et al., 2006	Reduction of broad-spectrum antibiotic use with computerized decision support in an intensive care unit.	Study design.
10	Baxter et al., 2007	Protocol implementation in anaesthesia: Beta blockade in non-cardiac surgery patients.	Study design, not only ICU, post-anaesthetic unit also.
11	Diby & Romand, 2008	Reducing pain in patients undergoing cardiac surgery after implementation of a quality improvement postoperative pain treatment program.	Study design.
12	Owen et al., 2008	Implementing and assessing an evidence-based electrolyte dosing order form in the medical ICU.	Study design, no implementation process nor strategy.
13	Robertson et al., 2008	Multi-centre implementation of a consensus-developed, evidence-based, spontaneous breathing trial protocol.	Study design, Intervention effectiveness.
14	Gerlach et al., 2009	A new dosing protocol reduces dexmedetomidine-associated hypotension in critically ill surgical patients.	Study design, no implementation process nor strategy.
15	Hawe et al., 2009	Reduction of ventilator-associated pneumonia: Active versus passive guideline implementation.	Study design.
16	Johnson et al., 2009	Is There a Benefit to Multidisciplinary Rounds in an Open Trauma Intensive Care Unit Regarding Ventilator-Associated Pneumonia?	Study design, no implementation process, nor strategy.
17	Kumar et al., 2009	Impact of 24-hour in-house intensivists on a dedicated cardiac surgery intensive care unit.	Study design, no implementation process, nor strategy.

18	Patman et al., 2009	Physiotherapy does not prevent, or hasten recovery from, ventilator-associated pneumonia in patients with acquired brain injury.	Intervention effectiveness, no implementation process nor strategy.
19	Arabi et al., 2010	Mortality reduction after implementing a clinical practice guidelines–based management protocol for severe traumatic brain injury.	Intervention effectiveness, no implementation process nor strategy.
20	Jaber et al., 2010	An intervention to decrease complications related to endotracheal intubation in the intensive care unit: a prospective, multiple-centre study.	Study design and no implementation process or strategy.
21	Jackson et al., 2010	Long-term cognitive and psychological outcomes in the awakening and breathing controlled trial.	Intervention effectiveness, no implementation process nor strategy.
22	Spence & Henderson-Smart, 2010	Closing the evidence-practice gap for new born pain using clinical networks.	Study design.
23	de Mestral et al., 2011	Impact of a specialized multidisciplinary tracheostomy team on tracheostomy care in critically ill patients.	No implementation process.
24	Erasmus et al., 2011	The ACCOMPLISH study. A cluster randomised trial on the cost-effectiveness of a multicomponent intervention to improve hand hygiene compliance and reduce healthcare associated infections.	Study design, not only ICU.
25	Martinuzzi et al, 2012	Impacto de un proceso de mejora de la calidad en el estado del soporte nutricional en una unidad de cuidados intensivos. Impact of quality improvement process upon the state of nutritional support in a critical care unit.	Study design
26	Radtke et al., 2012	How to implement monitoring tools for sedation, pain and delirium in the intensive care unit: An experimental cohort study.	Study design.
27	Schädler et al., 2012	Automatic control of pressure support for ventilator weaning in surgical intensive care patients.	No implementation process nor strategy.
28	Soguel et al., 2012	Energy deficit and length of hospital stay can be reduced by a two-step quality improvement of nutrition therapy: The intensive care unit dietician can make the difference.	Study design, no implementation process nor strategy.
29	Bérubé et al., 2013	Impact of a preventive programme on the occurrence of incidents during the transport of critically ill patients.	Intervention effectiveness, no implementation process, nor strategy.
30	Ceballos et al., 2013	Nurse-driven quality improvement interventions to reduce hospital-acquired infection in the NICU.	Not ICU, study design, intervention effectiveness.
31	Engel et al., 2013	ICU early mobilization: From recommendation to implementation at three medical centres.	Study design.
32	Fisher et al., 2013	Reducing central line-associated bloodstream infections in North Carolina NICUs.	Study design.
33	Gutsche et al., 2013	Impact of guideline implementation on transfusion practices in a surgical intensive care unit.	Study design.
34	Hanekom et al., 2013	Implementation of a protocol facilitates evidence-based physiotherapy practice in intensive care units.	Intervention effectiveness, Study design, no implementation process evaluation.

35	Iacobelli et al., 2013	Successful control of a methicillin-resistant staphylococcus aureus outbreak in a neonatal intensive care unit: A retrospective, before-after study.	Study design.
36	Kher et al., 2013	Development, implementation, and evaluation of an institutional daily awakening and spontaneous breathing trial protocol.	Study design, post-protocol implementation evaluation.
37	Malouf-Todaro et al., 2013	Impact of enhanced ventilator care bundle checklist on nursing documentation in an intensive care unit.	Study design, no implementation process only use of checklist.
38	Mansouri et al., 2013	Implementation of a protocol for integrated management of pain, agitation , and delirium can improve clinical outcomes in the intensive care unit: A randomised clinical trial.	Intervention effectiveness, Study design, no implementation process evaluation.
39	Romero et al., 2013	Effects of the implementation of a preventive interventions program on the reduction of medication errors in critically ill adult patients.	Study design, no implementation process, nor strategy.
40	Su et al., 2013	A randomized controlled trial of the effects of listening to non-commercial music on quality of nocturnal sleep and relaxation indices in patients in medical intensive care unit	No implementation process nor strategy.
41.	Kurosawa et al., 2014	A Randomized, Controlled Trial of In Situ Pediatric Advanced Life Support Recertification (“Pediatric Advanced Life Support Reconstructed”) Compared with standard Pediatric Advanced Life Support Recertification for ICU Frontline Providers.	no implementation process nor strategy.

Addendum 18: NGT Method Summary

NGT STAGES ((McMillan et al., 2016).

Silent generation at the beginning of the meeting requires participants to silently reflect or record their individual ideas in response to a question which can take up to twenty minutes (McMillan et al., 2016). The **"round robin"** is when the facilitator then asks one participant at a time to state a single idea to the group in a 'round robin' fashion enabling participants to think of new ideas but sharing in turns until no new ideas are generated. Therefore, this stage can take as much time as is required however a minimum of 30 minutes is usually stated. Generally, it is recommended that there is no discussion in this stage and that ideas are recorded verbatim using a flipchart or white board (McMillan et al., 2016). **Clarification** of the ideas provides the opportunity for a grouping step, where similar ideas are grouped together with agreement from all participants and where ideas can be included or altered. In this stage all ideas are discussed to ensure understanding of and clarity to all participants in order for them to make an informed decision during the stage of voting on ideas (McMillan et al., 2016). The facilitator must emphasise to participants that they do not have to agree with all the listed ideas. It should be emphasized that participants are able to ignore ideas as at the end of the clarification stage they will vote based on personal preferences. This stage also can take up to 30 minutes. The clarification stage is particularly difficult for facilitators who are encouraged not to direct participants during this process (McMillan et al., 2016). Lastly in the **voting (rating or ranking)** stage, participants are then provided with a ranking sheet. They are asked to select their top preferences from the generated ideas. The topic of discussion determines the number of items chosen by participants but the ranking of five ideas is common in the literature (McMillan, Kelly, Sav, Kendall, King & Whitty et al., 2014). The facilitator specifies that a number be allocated to each selected item, with larger numbers reflecting greater importance (McMillan et al., 2014). This can be explained where if there are five ideas for a given topic, then the most important idea is scored five points to the least important idea which will be scored 1 (McMillan et al., 2014). There is no anonymity for participants during nominal group discussions, however individual scoring on a ranking sheet is confidential. The scores for each idea are summed and then presented to the group for discussion. Depending on a number of factors such as the complexity of the topic and how many items need to be prioritized the timing of this stage can be variable. The more items there are to be ranked, the more difficult the process and thus the process can become time consuming. However, Dening, Jones, Sampson, (2012) noted that voting could take up to 10 minutes to complete.

Addendum 19: NGT Participant Information and Consent Form

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT: Implementation and evaluation of a validated evidence based physiotherapy protocol in a surgical ICU: A controlled before and after study.

REFERENCE NUMBER: S13/09/170

PRINCIPAL INVESTIGATOR: Ms Farhana Karachi

ADDRESS: University of Stellenbosch
Physiotherapy Department
Tygerberg Medical Campus
Tygerberg,

CONTACT NUMBER: 082 952 4549

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the researcher any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the Health Research Ethics Committee at Stellenbosch University (S13/09/170) and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

- *The study is a control before after study trial evaluating the implementation of a validated evidence based physiotherapy protocol in a surgical ICU in which you work. For this reason, as a health care professional working in the unit you have been invited to participate in the study as your input is invaluable in the success in the process of implementation.*
- *You, as the physiotherapist will be requested to assist in providing your opinion and knowledge with regards to the best practice educational strategy/ies that will allow you to adopt and use the validated evidence based physiotherapy protocol in the surgical ICU. Your input will provide the researcher with facilitators and barriers related to the identified best practice educational strategies so that the researcher together with you as the physiotherapist can reach consensus as to an implementation plan (specifically an educational implementation plan) that will be most effective in allowing uptake of the protocol by the physiotherapists in this department in order to assist in effectively change practice. You will thus be requested to participate in a 2hour CPD accredited consensus meeting or session. The information obtained will be used in the implementation process however confidentiality will be maintained by not making direct reference to the role players and any research papers published will not directly identify information provided by you*

specifically. As you are participating in a group you will also be required to sign to state that you will maintain the confidentiality of the information discussed in the session. You may benefit from the research in the following ways: i) the outcome of the research may support your role as a physiotherapist in the process of implementation of evidence based protocols and clinical guidelines and also advocate for increased resources for this unit; ii) it will provide valuable information with regards to an effective implementation plan to be used to implement evidence based protocols in ICU but also in other wards or outpatient departments your unit provides services too and iii) you will obtain CPD points for participating in this consensus meeting.

- *There are no risks in you and your staff in taking part in this survey.*
- *You will not be paid to take part in the study. There will be no costs involved for you, if you do take part.*
- *The session will be recorded so that the researcher is able to go back to the information for writing up the process for the dissertation or for planning the implementation plan/strategy. The recordings and transcripts used for facilitating the implementation process will be password protected and scrambled for confidentiality. You are thus also asked to sign giving consent for the session to be recorded for the purpose of research only.*

If there is anything else that you should know or do?

- You can contact Ms Farhana Karachi at 082 952 4549 if you have any further queries or encounter any problems.
- You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by the researcher.
- You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I …… agree to take part in a research study entitled: Implementation and evaluation of a validated evidence based physiotherapy protocol in a surgical ICU: A controlled before and after study.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
- I agree to maintain the confidentiality of the information shared in the group session.

2

- I agree to the interview being recorded for the researcher to be able to go back to check on information required by her for the implementation process.

Signed at (*place*) ..... on (*date*) ……..……

……. …….

Signature of participant Signature of witness

Declaration by investigator

I *(name)* ……..…… declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use an interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) ..... on (*date*) ……..……

……. …….

Signature of investigator Signature of witness

Declaration by interpreter (Not Applicable for this Study)

I *(name)* ……..…… declare that:

- I assisted the investigator (*name*) …… to explain the information in this document to (*name of participant*) ……..……., using the language medium of Afrikaans/Xhosa.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (*place*) ..... on (*date*) ……..……

……. …….

Signature of interpreter Signature of witness

3

Addendum 20: NGT Sample Attendance Register

S13/09/170

CPD ACTIVITY 4: Implementation and evaluation of a validated evidence based physiotherapy protocol in a Surgical ICU PROTOCOL TRAINING & EDUCATION WORKSHOP SERIES: Workshop 3: PRACTICAL APPLICATION OF THE PULMONARYALGORITHM

Tuesday, 29 September 2015 @ 12h00 – 14h00

Dear Participants

Please print clearly your details as requested below for the necessary paperwork to be completed for the CPD Activity held today 29 September 2015. You are required to sign at the start and end of the session.

Thank You

ATTENDANCE REGISTER

No.	FULL NAME (AS ON ID)	SURNAME (AS ON ID)	HPCSA NUMBER	SIGNATURE 12h00	SIGNATURE 14h00
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

S13/09/170

No.	FULL NAME (AS ON ID)	SURNAME (AS ON ID)	HPCSA NUMBER	SIGNATURE 12h00	SIGNATURE 14h00
12					
13					
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15					
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24					
25					

Addendum 21: NGT Participant Profile Questionnaire

NGT PARTICIPATING PHYSIOTHERAPIST PROFILE DETAILS

AGE:_____ **GENDER: Male or Female** (circle)

JOB DESCRIPTION LEVEL: _____

Qualification and Year obtained Degree (please tick and write in year):

- B Tech Physiotherapy Year Obtained:_____
- BSc Physiotherapy Year Obtained:_____
- MSc Physiotherapy Year Obtained:_____
- PhD Physiotherapy Year Obtained:_____

How many years of general clinical experience do you have?

_____

How many years of ICU experience do you have? (circle)

- Less than 1year
- 1 year
- 2-5 years
- 5 years
- 5-10 years
- More than 10 years

Do you have a specific interest in ICU clinical practice? (circle)

Yes **No**

Addendum 22: Definitions of the best practice Educational Implementation Strategies

EDUCATIONAL IMPLEMENTATION STRATEGIES

DEFINITIONS FOR PARTICIPANTS OF THE NOMINAL GROUP SESSION

1. **Didactic lecture:** involving lecture and textbook instruction rather than, demonstration and laboratory study (https://www.merriam-webster.com/dictionary/didactic - accessed 20 July 2015).

2. **Academic detailing** is a service by which a trained health educator visits a physician or health care provider in his/her office to provide a 20-minute educational session on a specific clinical topic. It is a targeted one-on-one educational program by the trained physiotherapist/developer of the protocol or clinician in ICU (https://en.wikipedia.org/wiki/Academic_detailing - accessed 20 July 2015).

3. **Workshop:** a meeting at which a group of people engage in intensive discussion and activity on a particular subject or project (discuss the clinical algorithms) (https://en.oxforddictionaries.com/definition/workshop - accessed 20 July 2015).

   Workshops have several advantages over meetings by:

   - Creating momentum
   - Producing a sense of shared purpose
   - Covering in one day what can take weeks or months of meetings to accomplish
   - Allowing everyone to collaborate on a solution

4. **Workshop Series** – continuous education sessions → These workshops are offered at times convenient to practicing professionals with the same advantages as single workshops and has a practical component. (https://www.collinsdictionary.com/dictionary/english/workshop - 20 July 2015).

5. **Grand rounds** are an important teaching tool and ritual of medical education and inpatient care, consisting of **presenting** the medical problems and treatment of a particular patient to an audience consisting of doctors, residents and medical students. Similar to **Ward round sessions** (one on one) at patient bedside (https://en.wikipedia.org/wiki/Grand_rounds - accessed 20 July 2015).

6. **Hardcopy or electronic copy** of evidence and clinical algorithms (only this without explanation so therapist must read and understand)

Addendum 23: Barriers and Facilitators of Implementation Strategies Raw Data

DIDACTIC LECTURE: →SINGLE LECTURE + TEXTBOOK INSTRUCTION

FACILITATORS (GREEN)	BARRIERS (PINK)
Less time consuming vs. a series of workshops	Once off – nothing to fall back on if you forget
Once of lecture	Can be difficult to hold people's attention
Time saving	Might not cover all info
Organize schedule according day; less time consuming; Good session to hear questions from other participants and answer from researcher	Too much information to take in on 1 session; not sufficient time to be well familiar with information; reference
Time saving; Educational	Concepts may not be understood with a single lecture. Information overload
Not very time consuming; once off; Formal, in depth	Can lose interest of listeners at times as its passive
Lots of information can be carried over	Repeating "known" information
Time saving; Educational	Once off; Doesn't allow for reminders; Easy to forget info due to single contact
Once off; time saving	Once off lecture, does not address flu questions once had time to process
Ability to interact with facilitator	No interaction + discussion of problems
Guidelines clearer when textbook style	Does not provide opportunity to address issues/ concerns that may arise
Textbook: good for referencing/ for referring back to information when needed	Information over load with single lecture; Not understanding all concepts
Good information	Difficulty = communication/ reading facilitator @ later time period
Awareness; Information regarding concept	Too time consuming; will not include practical; What if textbook instructions not understood
Ensures that all members receive the same information	Group setup: concept might get lost or not all topics covered
Follows clear format; Limited time set out	Implementation – people will tend to forget what was said; Too much information at once
Sharing the current appropriate information for study/ protocol	1x session = longer lecture time; Time constraints

WORKSHOP: → MEETING WHERE GROUP OF PEOPLE ENGAGE IN DISCUSSIONS AND ACTIVITY ON TOPIC

FACILITATORS (GREEN)	**BARRIERS (PINK)**
Good interaction + discussion of problems/ queries; allows for discussion and group interaction, assists & problem solving	May not suit everybody @ the same time; Difficult scheduling as people have different routines; Same workshop on more than 1 day
Interaction encouraged which makes it easier to understand or gain as much info as needed	Workshops can get long & stretched out → time consuming
Good interaction opportunity	Time consuming
Can engage/ brainstorm as a group; once –off; 20 min so there is time to get into it	Time consuming – fortunately a once off
Excellent choice/ platform for discussions; Practical's included; once-off (time wise)	Can take lots of time (time consuming)
Good session for gaining information/ feedback from researcher and other participants	Some people take advantage of the situation and don't partake in discussions; riding others coattails; round robin anonymous
Group activity encouraged; Different opinions given	Time consuming of which might directly affect PT time
We all think/interpret differently – good to share different ideas or learn from one another	Time consuming
Learning from one another; people may feel more comfortable learning in groups.	Possibility of being time- consuming as input is given by all participants
Learning through others in group; Interaction → sharing ideas / concepts → feedback → learning	May need more than one to resolve all issues
Allows interaction between educator + people being educated	Getting everyone together might be problematic
More info/ perceptions/ ideas could be shared which could improve the study	Once off basis won't address concerns that arise during implementation
Easier to concentrate with interaction; Allows for stimulation of ideas due to different opinions	Round robbing anonymous ideas; thoughts/ ideas of some could be missed if people aren't comfortable sharing in group setting
Interaction, lots of different inputs to stimulate thought process	Can be lengthy; Too many irrelevant topics brought up hindering workshop progress
Time saving for both parties; Issues discussed by whole group	Social interaction ≥ Academic learning experience

WORHSHOP SERIES: →CONTINUOUS EDUCATION SESSIONS OFFERED AT CONVEIENT TIMES FOR HCP

FACILITATORS (GREEN)	BARRIERS (PINK)
Opportunity to continue discussion re ongoing problems/ issues	Can be time consuming
Continuous discussions in case issues arises allows improvement in the implementation & participation of trainee's	Time consuming to have regular sessions
Provides opportunity for continued discussions which allows ideas + info to be processed/ understood at a deeper level	Takes longer, but might be best for this outcome
More time to engage + resolve all questions	Time consuming
Helpful if needed/ appropriate –will address new info/ concerns	Time consuming
Allows for group discussion provides opportunity for regular feedback and chances to address problems/ concerns that may arise	Time consuming
Allows for follow up for: questions; process & progress of study/ implementation of study; Allows for updates in actual study or literature; Allows you to build on your knowledge base & to interact with other professionals	None
Gives participants time to implement protocols & gives feedback; better understanding	Time consuming
In detail very educational; good for learning; Group discussions stimulate thought process	Time consuming
Continuous feedback	None
Convenient; follow ups; can resolve unsolved issues	Takes too long; time consuming
Educational opportunities	Time consuming
Able to break up info/ workload over sessions to prevent feelings of information overload	Multiple sessions are time consuming could lead to needless repetitions
Repetitions will make learning process easier; people may understand after few workshops	Time consuming
CPD points; knowledge/ feedback; organize day to attend session	Time consuming
Good knowledge/ feedback; time to discuss barriers and time to discuss overcoming barriers	Time consuming
Will assist in better understanding of concepts	None

ACADEMIC DETAILING: →TRAINING EDUCATOR PRIVIDES 20min – EDUCATION SESSION TOPIC → ONE ON ONE SESSION

FACILITATORS (GREEN)	**BARRIERS (PINK)**
Good info + time to interact	None
Gain good knowledge of protocol; good session to ask questions to researcher particular concerns you and get appropriate feedback your scenario	Time consuming no feedback from other also involve in the study which could have valid points that also affect you
Problems can be solved quickly as sessions are one-on-one; No distractions comfortable learning environment	Important info might be left out/ not all concepts covered
Less intimidating to ask questions in one on one session; especially if unable to understand a concept	Time consuming; Will 20 min time be enough to explain & answer questions
More free to ask questions as it is more informal; Gives opportunity to clarify areas of uncertainty	Time consuming for facilitator; not necessary uniform information; No benefit from others input
Provides opportunities to address individual concerns	Intimidating; Short period of time to do training
Individual attention given thus more understanding of protocol; free to ask questions	Time consuming for educator
Allows better understanding & openness for questions	None known or amore of
Specific issues discussed (not generic) → time saving	None
Time saving – will a standing on the topic, what's important; Comfortable to ask questions and give feedback with the one on one session	Not enough time to cover certain topics in detail?
Can iron out finer details in non- intimidating 1-on-1 session; convenient	Time management; Availability of staff/ educators
Ability to discuss one-on-one problems/ concerns	Can be time consuming
Informative; concepts maybe better understood in one-on-one interactions	Time consuming if used with a large group
Very in depth, able to answer individual answers; 20 min=short time; 20 min able to fit in during clinical work	Time consuming & many contact sessions; Time in contact session is limited → questions enough time for understanding & questions
In depth knowledge/ training; Good feedback opportunities; Discussions	Clashes = day –to- day job; Time consuming
Easier to understand/ get trainee to understand; better to keep trainee's attention	Way too time consuming for whole dept. to go through; unless option for just the 1 therapist

GRAND ROUNDS: EG ON ROUND/ WARD ROUND HAVE ONE ON ONE EDUCATION SESSIONS: →PATIENT SPECIFIC

FACILITATORS (GREEN)	**BARRIERS (PINK)**
None	Time Consuming; Might not find relevant patients
None	Time consuming; Availability of patients
None	Time consuming
Good discussion; maybe an option for follow-up; unit PT/ discussion in ICU	Intimidating in participation
Patient specific	Intimidating; Stress full
Allows learning & implementation opportunity at bedside	Time consuming
Great learning opportunity; deal with patient specific situations; Get help from facilitator in clinical setting	Time consuming; Limit amount of people able to attend round; Can feel stressed/under pressure to perform
Theory & implementation in one; learn + apply; Development/ improving clinical skills; small groups	Time consuming; Compete for space in ICU-other rounds; Infection control
Good environment for applying theory into clinical environment; makes it relevant to clinical practice	Impractical; Infection prevention + control (IPC) issues; Time consuming
Educational; Good learning opportunity	Too time consuming to cover whole dept. staff for initial training
Will be more patient specific; More interesting	Time consuming; not always idea; platform to discuss in details certain scenarios ; stressful if you put on the spot
Theory & practical experience; easier to understand	Space @ bedside which limits amount of people to join; Stressful
Physically see how algorithm are applied; " Monkey see monkey do"	Have to complete my own workload; No time to attend extra rounds
Educational	None
Educational & informative; various teaching methods learned	Distracting environment @ times
Different opinions & inputs given; Practical application of Algorithm	Academic detailing might address this need better than a grand round

HARDCOPY/ ELECTRONIC COPY OF EVIDENCE AND CLINICAL ALGORITHMS: → FOR YOU TO READ & USE

FACILITATORS (GREEN)	**BARRIERS (PINK)**
Less time consuming; Can refer back at your own leisure	No interaction
Could be used as a reference for future purpose	No interaction cannot ask questions; Not ideal way to introduce new "regime"
Written explanation that one can always refer back to	No interaction; Might be difficult to understand
Electronic copy always handy as reference	Might have high volume of reading which will limit or deter people of reading the study; No explanation of study process or definitions of jargon if uncertain or confused
Learning at your own time; Reference can refer back to hardcopy; Current research →effective patient treatment	If too much information, unlikely to be properly read
Allows you to go through information in your own time; Gives you information to refer back to	Gives the participants the responsibility of reviewing the data; trustworthy (readers interpretation)
Maybe to hand out before workshop to have to engage with it at own time	Impersonal can be forgotten/ not read properly
Easy to fall back on if some theory maybe forgotten	Who to ask if you have question/ wants more info
Always have info sheet available to refer back to; Can do on your own time	No-one to explain difficult concepts
Read on my own time	Might be difficult to understand information
Good reference guide if user friendly; Can read it as you have time available	Problematic may need clarification/ explanation; No platform to discuss/ advice/ question
Time to apply individually; Theory based/ evidence based; Be able to revise information	Electronic copy limits access to pc/printing etc.; Hardcopy none
Able to read through information at your own pace to gain understanding of in-depth of study	Hardcopy wasting money + paper; Except your copy in area of research for immediate access
Good to have hardcopy for referencing	Might not understand some concepts/ info; no access to internet
Fall back on if needed	Not motivated to read in my own time; Explanation of Algorithm
Good way to re-inforce info given during different methods of education; can always refer back to it	Concepts difficult to understand thus people not using hardcopies; Access (Limited)
Can go through it on your own time; Something to fall back on	Won't have time to read it; Clarification / explanation given; difficult putting it in practice; No access to computers/ printing

Addendum 24: CPD Attendance Certificate NGT

Certificate awarded to

Initial Surname

Accreditation number
PPB004-MD121-0025-7-2015

2 Points in Level 1

PT #######

Implementation Strategy Development for Physiotherapy Protocol Implementation in Intensive Care

23 July 2015

Presenter

Farhana Karachi

_____
Signature

Addendum 25: Discussion Schedule Guide: Protocol Characteristics

Discussion Schedule: Protocol Characteristics

Guide for meeting/interview with key contacts (unit doctor, unit senior nurses and unit physiotherapist) to determine the intervention (validated evidence-based physiotherapy protocol) characteristics (Damschroder et al., 2009).

Introduction

Thank you for agreeing to the meeting. We are currently conducting a research project in the unit to implement a protocol for the physiotherapeutic management of surgical ICU patients (pulmonary dysfunction, upper abdominal surgery and rehabilitation for sedated, awake and deconditioned patients). We are planning to evaluate the implementation process for its effectiveness in achieving change in practice. You were given a package which included three published clinical algorithms of the protocol. The discussion today is to address one domain related to implementation namely the characteristics of this protocol for successful implementation in this particular surgical ICU. I want to address key aspects related to the characteristics of the protocol being used to implement change in this particular surgical ICU in order to tailor it to your unit and require your input on these aspects including comments and questions you may have.

Tables 1. Protocol Characteristics – aspects to discuss (adapted from Damschroder 2009)

Intervention Characteristics	Short description
A Protocol Source (1)	Perception of key stakeholders about whether the protocol is externally or internally developed.
B Evidence Strength & Quality (3)	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the protocol will have desired outcomes.
C Relative advantage (4)	Stakeholders' perception of the advantage of implementing the protocol versus an alternative solution.
D Adaptability (2)	The degree to which the protocol can be adapted, tailored, refined, or reinvented to meet local needs.
E Trialability (3, 4)	The ability to test the protocol on a small scale in the organization [8], and to be able to reverse course (undo implementation) if warranted.
F Complexity (5)	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement
G Design Quality and Packaging (6)	Perceived excellence in how the protocol is bundled, presented, and assembled
H Cost (7)	Costs of the protocol and costs associated with implementing that protocol including investment, supply, and opportunity costs.

Points of Discussion linked to the Constructs in Table 1.

1. The validated evidence based clinical algorithms have been ***externally*** developed through a rigorous process of systematically reviewing and synthesising the literature and then validation through an expert Delphi Panel.

   1.1. Are you willing to accept the implementation of this protocol in this unit following necessary ***internally developed*** adaptations or tailoring of the protocol for your unit?

2. The content cannot be adapted or changed however we can adapt the periphery of the protocol.
   2.1. What parts of this protocol do you think you need to tailor or adapt to suit the organisation, work processes and management of the patients in your unit?
   2.2. How do you want the parts of the protocol you stated to be tailored or adapted for your unit?

3. The strength and quality of the evidence is established since the clinical algorithms have been developed through a rigorous process and has been published. The protocol has also been successfully piloted in this unit and thus has the necessary trial ability.

   3.1. Do you have any comments on this that will affect successful implementation in the unit?

4. In terms of relative advantage:
   4.1. Do you perceive there to be a clear, unambiguous advantage (having only one meaning or interpretation and one conclusion) in the effectiveness or efficiency of this protocol based on the previous pilot which showed effective cost saving and improved patient outcomes?

   4.2. Do you observe clear or visible benefits of this protocol for your unit?

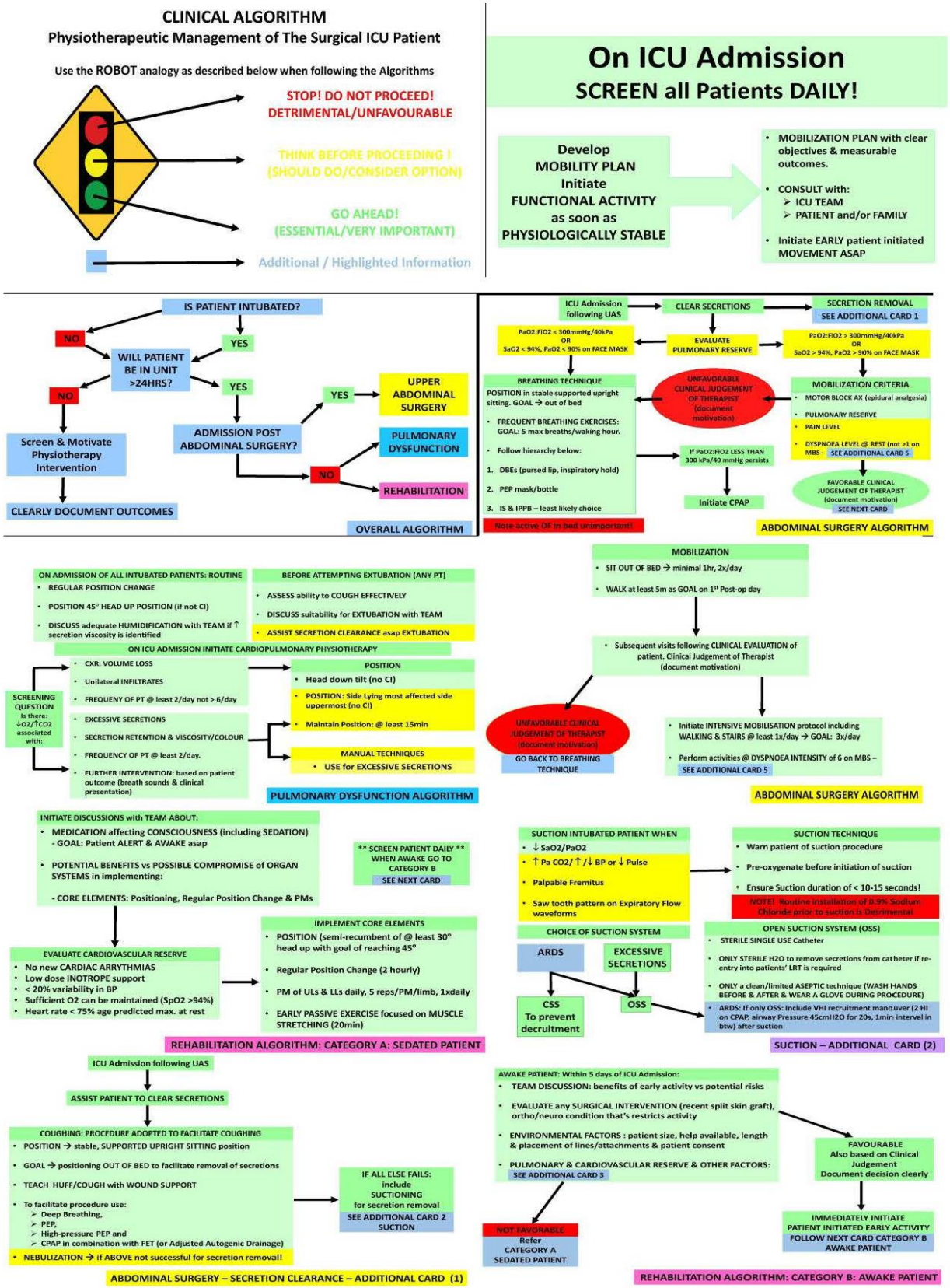
5. In terms of complexity:
   5.1. Do you perceive the protocol to be complex or simplistic in implementing change in your practices – for example when to mobilise a particular patient or when to use suction or hyperinflation techniques?
   5.2. Are the steps easy to follow or intricate, is there any disruption due to the process and what can be changed to improve this for successful implementation?

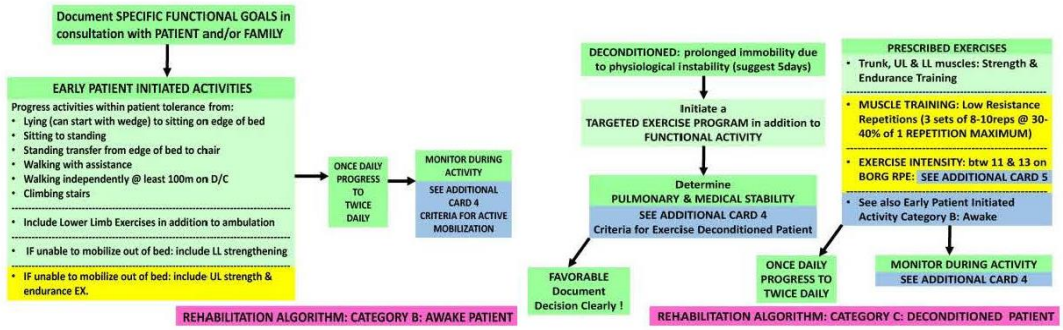
6. What are your suggestions for packaging and presenting the protocol bundle for your ease of access, use and satisfaction to improve implementation of the protocol in your unit (pocket book, posters, electronic?)

7. What cost implications would there be associated with the cost of the protocol and cost of implementation of the protocol in your unit in terms of investment, supply and opportunity that will affect successful implementation?

   Thank you for your time & assistance in contributing to a successful implementation process!

Addendum 26: Reminder Pocket Cards of Protocol (Sample View)





PULMONARY RESERVE	CARDIOVASCULAR RESERVE	OTHER FACTORS
• PaO2 : FiO2>300 • SpO2 > 94 variations less than 4% • Satisfactory respiratory pattern • Able to maintain adequate respiratory support • FiO2 < 0.6 • PEEP <10cmH2O	• Resting HR <50% age predicted max. • BP < 20% variability • ECG normal vs arrhythmias • Excluded major cardiac pathologies • Absence of orthostatic hypotension • Low dose catecholamine drips	• Consider Hb > 8.5gm/dl • Platelets > 30000 cells/m^2 • White Cells 4300 – 10800 cells/m^2 • Temp < 38.5° C or > 36 ° C • Blood Glucose 3.5 – 20mmol/L

REHABILITATION ALGORITHM: AWAKE PATIENT: ADDITIONAL CARD (3)

CRITERIA FOR ACTIVE MOBILIZATION

MONITOR DURING ACTIVITY AWAKE AND DECONDITIONED PATIENT

- Changes in heart rate should be appropriate
- Maintain Sufficient SaO2>90% or SpO2>94% can increase FiO2
- BP remains stable
- Consider: PATIENTS PHYSICAL APPEARANCE: conscious state, respiratory pattern, pallor, flushing, sweating, clamminess, cyanosis, visible or patient reported PAIN, DISCOMFORT or FATIGUE
- Consider: Presence of ↑ ectopic beats; arrhythmias

CRITERIA FOR EXERCISE IN THE DECONDITIONED PATIENT

FIRST: MEDICAL STABILITY

- SEPSIS controlled
- NO uncontrolled HEMORRHAGE
- NO uncontrolled ARRHYTHMIAS
- NO HEART FAILURE or unstable ANGINA
- Secure PARENTERAL LINE

SECOND: PULMONARY STABILITY

- Stable & Secure Airway
- Minimal Aspiration
- Secretions: management with infrequent suctioning
- Oxygenation: adequate oxygenation with FiO2 < 50%
- PEEP: ≤ 5cm H2O, SpO2 > 92%
- Ventilator Settings: stable, no sophisticated modes
- Patient Ax: comfortable, no ↑ work of breathing/dyspneoa

REHABILITATION ALGORITHM : ADDITIONAL CARD (4)

RATING OF PERCEIVED EXERTION (RPE)
Measures patients' feelings of effort, strain, discomfort and/or fatigue during both aerobic and resistance training

Borg's Scale (Gunner Borg 1982)	Modified Borg Scale
6 – 7 – very, very light 8 – 9 – very light 10 –	0 – Nothing at all 0.5 – Very, very slight (just noticeable) 1 – Very slight 2 – Slight (light)
11 – fairly light (52 – 66 % MHR) 12 – 13 – somewhat hard (61 – 85 % HR)	3 – Moderate 4 – Somewhat severe
14 – 15 – hard 16 – 17 – very hard 18 – 19 – very, very hard 20 –	5 – Severe (heavy) 6 – 7 – Very severe 8 – 9 – 10 – Very, very severe (maximal)

REHABILITATION ALGORITHM –ADDITIONAL CARD (5)

POCKET CARDS DESIGNED BY: FARHANA KARACHI : PHD PHYSIOTHERAPY – PROJECT NUMBER S13/09/170 IMPLEMENTATION AND EVALUATION OF A VALIDATED EVIDENCE BASED PHYSIOTHERAPY PROTOCOL IN A SURGICAL ICU - COPYRIGHT 2015

REFERENCED FROM:

- Hanekom S, Berney S, Morrow B, Ntoumenopoulos G, Paratz J, Patman S, Louw QA. The validationof a clinical algorithm for the prevention and management of pulmonary dysfunction in intubated adults – a synthesis of evidence and expert opinion. Journal of Evaluation in Clinical Practice 17 (2011) 801–810 doi:10.1111/j.1365-2753.2010.01480.x
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FOR FURTHER INFORMATION CONTACT

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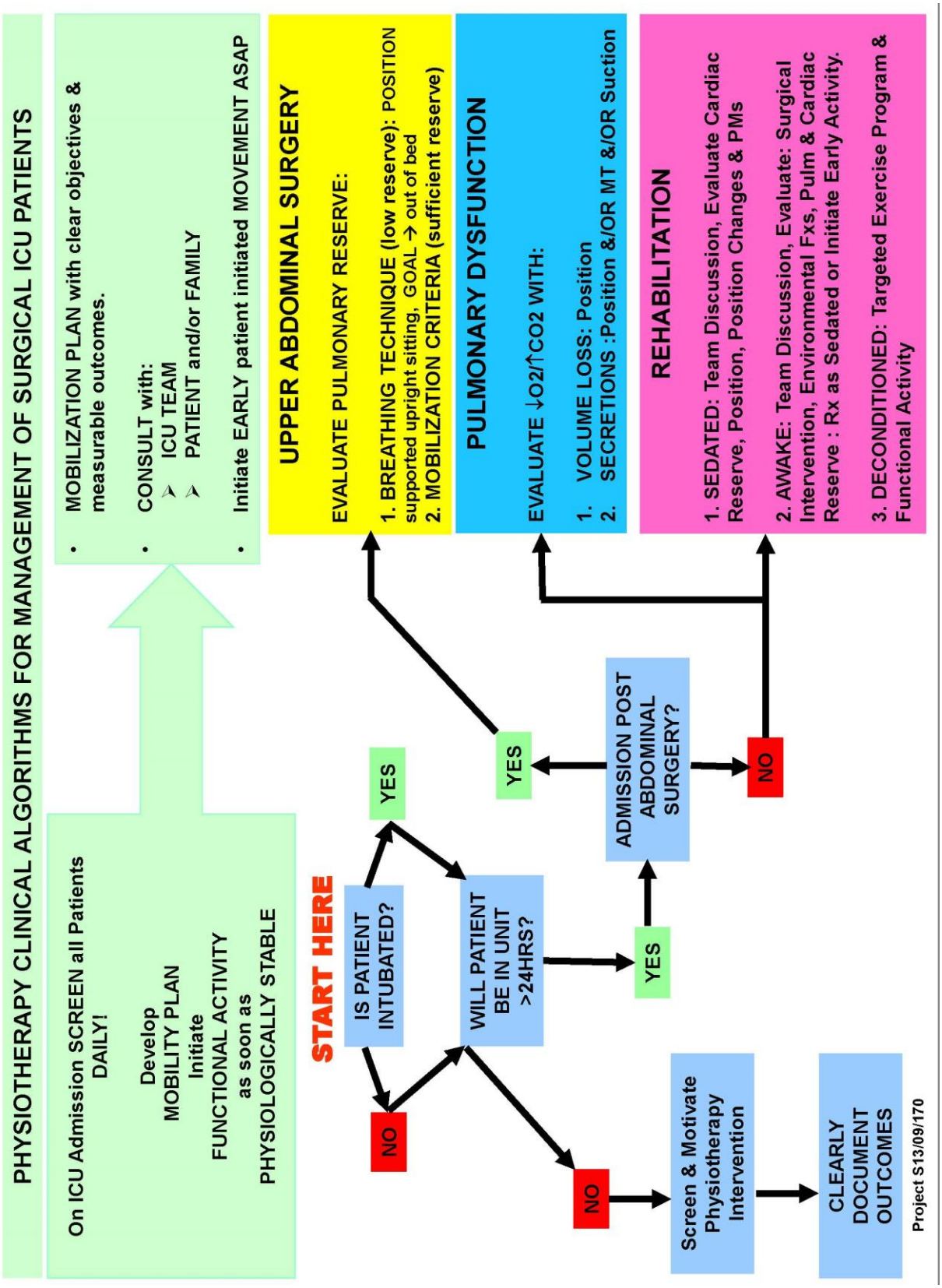
Office:
Division of Physiotherapy
Department of Interdisciplinary Health Sciences
Faculty of Health Sciences
Stellenbosch University

Addendum 27: Reminder Poster of Protocol



Addendum 28: Sample Attendance Register for Implementation Sessions

CPD ACTIVITY 1: Implementation Strategy Development for Physiotherapy Protocol Implementation in Intensive Care

Thursday, 23 July 2015 @ 12h00 – 14h00

Reaching Consensus on an Implementation Strategy for effective implementation of Physiotherapy Protocols in Intensive Care using the Nominal Group Technique

Dear Participants

Please print clearly your details as requested below for the necessary paperwork to be completed for the CPD Activity held today 23 July 2015. You are required to sign at the start and end of the session.

Thank You

ATTENDANCE REGISTER

No.	FULL NAME (AS ON ID)	SURNAME (AS ON ID)	HPCSA NUMBER	SIGNATURE 12h00	SIGNATURE 14h00
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

S13/09/170

No.	FULL NAME (AS ON ID)	SURNAME (AS ON ID)	HPCSA NUMBER	SIGNATURE 12h00	SIGNATURE 14h00
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

Addendum 29: CPD Attendance Certificate Implementation Sessions

Certificate awarded to

Initial Surname

Accreditation number
[PPB004-MD121-0024-2-2017]

10 Points in Level 1

PT #######

Attendance and Participation in Surgical ICU Physiotherapy Implementation Workshop Series and Grand Round Session

Dates
2015

Presenter

Farhana Karachi

_____
Signature

Addendum 30: Additional Baseline Patient Data Implementation Trial

Additional Descriptive Patient Admission Data (% - percentage, n – frequency)

VARIABLE	UNIT A	UNIT B
PRE-IMPLEMENTATION	**% (n)**	**%(n)**
Comorbidities (as stated in patient folder): (YES)	**N=295**	**N=166**
ASTHMA	0% (n=0)	11.6% (n=7)
CA (Cancer)	12.5% (n=37)	7.8% (n=2)
COPD (Chronic Obstructive Pulmonary Disease)	8.5% (n=25)	21.6% (n=13)
CRF (Chronic Renal Failure)	0% (n=0)	0.6% (n=1)
CVA (Cerebral Vascular Accident)	2.4% (n=7)	3.6% (n=6)
DM (Diabetes Mellitus)	9.8% (n=29)	14.5% (n=24)
ETOH (Alcohol Use)	0% (n=0)	15.7% (n=26)
HF (Heart Failure)	0% (n=0)	0% (n=0)
HIV (Human Immune Virus)	6.1% (n=18)	9.6% (n=16)
HPT (Hypertension)	14.2% (n=42)	22.3% (n=37)
IHD (Ischemic Heart Disease)	4.4% (n=13)	3.6% (n=6)
NONE	56.9% (n=168)	40.4% (n=67)
RA (Rheumatoid Arthritis)	0% (n=0)	0% (n=0)
SMOKING	1% (n=3)	26.5% (n=44)
TB (Tuberculosis)	2.7% (n=8)	10.8% (n=18)
Surgical Status prior to ICU Admission (YES)	9% (n=25/295)	43% (n=73/168)
Intubation Type		
ETT (endotracheal tube)	96% (n=195)	95% (n=126)
Tracheostomy	4% (n=9)	5% (n=6)
Mode of Ventilation on ICU Admission	**N=296**	**N=166**
Face Mask	21.6% (n=64)	15.1% (n=25)
Nasal Cannula	2.7% (n=8)	2.4% (n=4)
SIMV (Synchronised Intermittent Mechanical Ventilation)	2.7% (n=8)	75.9% (n=126)
CMV (Continuous Mandatory Ventilation)	0% (n=0)	0% (n=0)
CPAP (Continuous Positive Pressure Breathing)	4.4% (n=13)	1.8% (n=3)
BIPAP (Biphasic positive airway pressure)	59.1% (n=175)	0% (n=0)
Room Air	9.5%(n=28)	4.8%(n=8)
IMPLEMENTATION	**% (n)**	**%(n)**
Comorbidities (as stated in patient folder): (YES)	**N=291**	**N=226**
ASTHMA	2.7% (n=8)	2.7% (n=6)
CA (Cancer)	13.4% (n=39)	2.7% (n=6)
COPD (Chronic Obstructive Pulmonary Disease)	7.2% (n=21)	5.3% (n=12)
CRF (Chronic Renal Failure)	0.7% (n=2)	0.4% (n=1)
CVA (Cerebral Vascular Accident)	1.4% (n=4)	2.7% (n=6)
DM (Diabetes Mellitus)	11.7% (n=34)	13.3% (n=30)
ETOH (Alcohol Use)	2.7% (n=8)	16.4% (n=37)
HF (Heart Failure)	1% (n=3)	0% (n=0)
HIV (Human Immune Virus)	5.2% (n=15)	10.2% (n=23)
HPT (Hypertension)	26.8% (n=78)	24.8% (n=56)
IHD (Ischemic Heart Disease)	7.2% (n=21)	2.7% (n=6)
NONE	49.8% (n=145)	36.3% (n=82)
RA (Rheumatoid Arthritis)	0.7% (n=2)	0.9% (n=2)
SMOKING	11.7% (n=35)	24.8% (n=56)
TB (Tuberculosis)	0.34% (n=1)	8.4% (n=19)
Surgical Status prior to ICU Admission (YES)	19% (n=54/287)	42% (n=95/226)
Intubation Type		
ETT (endotracheal tube)	96% (n=201)	96% (n=165)
Tracheostomy	4% (n=9)	4% (n=6)

Mode of Ventilation on ICU Admission	**N=288**	**N=225**
Face Mask	22.6% (n=65)	13.8% (n=31)
Nasal Cannula	2.4% (n=7)	2.7% (n=6)
SIMV (Synchronised Intermittent Mechanical Ventilation)	3.8% (n=11)	71.6% (n=161)
CMV (Continuous Mandatory Ventilation)	0% (n=0)	0.4% (n=1)
CPAP (Continuous Positive Pressure Breathing)	0.7% (n=2)	3.1% (n=7)
BIPAP (Biphasic positive airway pressure)	67.7% (n=195)	0% (n=0)
Room Air	2.8%(n=8)	8.4%(n=19)
POST-IMPLEMENTATION	**% (n)**	**%(n)**
Comorbidities (as stated in patient folder): (YES)	**N=162**	**N=172**
ASTHMA	1.9% (n=3)	4.1% (n=7)
CA (Cancer)	15.4% (n=25)	5.8% (n=10)
COPD (Chronic Obstructive Pulmonary Disease)	6.8% (n=11)	5.8% (n=10)
CRF (Chronic Renal Failure)	0.6% (n=1)	1.7% (n=3)
CVA (Cerebral Vascular Accident)	0% (n=0)	4.1% (n=7)
DM (Diabetes Mellitus)	15.4% (n=25)	14% (n=24)
ETOH (Alcohol Use)	4.3% (n=7)	12.2% (n=21)
HF (Heart Failure)	1.9% (n=3)	0% (n=0)
HIV (Human Immune Virus)	6.2% (n=10)	8.1% (n=14)
HPT (Hypertension)	37.7% (n=61)	26.7% (n=46)
IHD (Ischemic Heart Disease)	9.3% (n=15)	4.1% (n=7)
NONE	38.3% (n=62)	37.8% (n=65)
RA (Rheumatoid Arthritis)	0.6% (n=1)	1.2% (n=2)
SMOKING	15.4% (n=25)	31.4% (n=54)
TB (Tuberculosis)	1.9% (n=3)	6.4% (n=11)
Surgical Status prior to ICU Admission (YES))	70% (n= 112/159)	46% (77/167)
Intubation Type		
ETT (endotracheal tube)	93% (n=117)	95% (n=118)
Tracheostomy	7% (n=9)	5% (n=6)
Mode of Ventilation on ICU Admission	**N=161**	**N=168**
Face Mask	21.7% (n=35)	15.5% (n=26)
Nasal Cannula	0.6% (n=1)	2.4% (n=4)
SIMV (Synchronised Intermittent Mechanical Ventilation)	0.6% (n=1)	70.2% (n=118)
CMV (Continuous Mandatory Ventilation)	0% (n=0)	0% (n=0)
CPAP (Continuous Positive Pressure Breathing)	1.2% (n=2)	1.8% (n=3)
BIPAP (Biphasic positive airway pressure)	73.9% (n=119)	0.6% (n=1)
Room Air	2%(n=3)	9.5%(n=16)

Addendum 31: Standardized TISS-28 Data Scoring Sheet

Adapted from Hanekom et al., 2010

T1

TISS 28:

- *Definition of terms: Unit day 07:00 – 06:59*
- *Complete daily based on patient records of previous 24 hrs*
- *Can only be completed if there is a record of the entire 24 hr period*
- *Use the most intensive intervention documented over the time period to score*

PT STICKER

DATE: D D / M M / 200Y UNIT DAY:

BASIC ACTIVITIES:		TOTAL		SCORE
1	**Standard monitoring:** *Hourly vital signs, regular registration and calculation of fluid balance*	Y	N	5
2	**Laboratory:** *Biochemical and microbiological investigations*	Y	N	1
3	**Single medication:** *Intravenously, intramuscularly, subcutaneously and/or orally (e.g. gastric tube)*	Y	N	2
4	**Multiple intravenous medication:** *More than one drug, single shots or continuously*	Y	N	3
5	**Routine dressing changes:** *Care and prevention of decubitus, daily dressing change*	Y	N	1
6	**Frequent dressing changes:** *Frequent dressing change (at least one time in each nursing shift) and/or extensive wound care*	Y	N	1
7	**Care of drains:** *All (except gastric tube)*	Y	N	3

VENTILATORY SUPPORT:		TOTAL		SCORE
8	**Mechanical ventilation:** *Any form of mechanical ventilation/assisted ventilation with or without PEEP, with or without muscle relaxants; spontaneous breathing with PEEP*	Y	N	5
9	**Supplementary ventilatory support:** *Breathing spontaneously through endotracheal tube without PEEP; supplementary oxygen any method, except if 8) applies*	Y	N	2
10	**Care of artificial airways:** *Endotracheal tube or tracheostomy*	Y	N	1
11	**Treatment for improving lung function:** *Thoraxphysiotherapy, incentive spirometry, inhalation therapy, intra-tracheal suctioning*	Y	N	1

CARDIO-VASCULAR SUPPORT:		TOTAL		SCORE
12	**Single vaso-active medication:** *Any vaso-active drug*	Y	N	3
13	**Multiple vaso-active medication:** *More than one vaso-active drug, disregarded type and dose*	Y	N	4
14	**IV replacement of large fluid losses:** *Fluid administration _3L/m2/day, disregarded type of fluid administered*	Y	N	4
15	**Peripheral artery line**	Y	N	5
16	**Left atrium monitoring:** *Swan Ganz catheter with or without cardiac output measurement*	Y	N	8
17	**Central venous line**	Y	N	2
18	**Cardiopulmonary resuscitation after arrest:** *In the past 24 hours (single precordial percussion not included)*	Y	N	3

RENAL SUPPORT:		TOTAL		SCORE
19	**Hemofiltration techniques:** *All*	Y	N	3
20	**Quantitative urinary output measurement:** *Eg by urinary catheter a` demeure*	Y	N	2
21	**Active diuresis:** *Eg. Lasix*	Y	N	3

NEUROLOGIC SUPPORT:		TOTAL		SCORE
22	**Measurement intracranial pressure**	Y	N	4

METABOLIC SUPPORT:		TOTAL		SCORE
23	**Treatment of complicated metabolic acidosis/alkalosis**	Y	N	4
24	**Intravenous hyperalimentation**	Y	N	3
25	**Enteral feeding:** *Through gastric tube or other GI route (eg jejunostomy)*	Y	N	2

SPECIFIC INTERVENTIONS:		TOTAL		SCORE
26	**Single specific intervention in the ICU:** *Such as: naso- or orotracheal intubation, introduction of pacemaker, cardioversion, endoscopies, emergency surgery in the past 24 hours, gastric lavage, CVP; Swan-Ganz; dialysis catheter Routine interventions without direct consequences to the clinical condition of the patient, such as X-rays, echography, ECG, dressings, introduction of peripheral lines, are not included*	Y	N	3
27	**Multiple specific interventions in the ICU:** *More than one as described above (item 26)*	Y	N	5
28	**Specific interventions outside the ICU:** Eg surgery or diagnostic procedures. Any procedure that patient needs to leave unit (CT;Bronchoscopy)	Y	N	5

FOR OFFICE USE
TISS-28 = SUM (points for activities performed)

One TISS-28 point equals 10.6 minutes of each 8 h nurse's shift

Data captured by ..... on .....

Addendum 32: CBA Trial Approval Letter Groote Schuur Hospital

Western Cape Government
Health

GROOTE SCHUUR HOSPITAL
Enquiries: Dr Bernadette Eick
E-mail : *Bernadette.Schmitz@westerncape.gov.za*

Ms. F. Karachi
Physiotherapy Department
Stellenbosch University
TYGERBERG MEDICAL CAMPUS

E-mail: fkarachi@uwc.ac.za

Dear Ms. Karachi

RESEARCH PROJECT: The Implementation and Evaluation of a Validated Evidence-based Physiotherapy Protocol in a Surgical ICU: A Controlled Before and After Experimental Trial

Your recent letter to the hospital refers.

You are hereby granted permission to proceed with your research.

Please note the following:

a) Your research may not interfere with normal patient care.
b) Hospital staff may not be asked to assist with the research.
c) No hospital consumables and stationary may be used.
d) **No patient folders may be removed from the premises or be inaccessible.**
e) Please introduce yourself to the person in charge of an area before commencing.
f) Please discuss the study with HOD before commencing.
g) Please provide the research assistant/field worker with a copy of this letter as verification of approval.
h) Confidentiality must be maintained at all times.

I would like to wish you every success with the project.

Yours sincerely

DR BERNADETTE EICK
CHIEF OPERATIONAL OFFICER
Date: 25th February 2015

C.C. Mr. L. Naidoo
Ms. C. Davids

G46 Management Suite, Old Main Building,
Observatory 7925

Tel: +27 21 404 6288 fax: +27 21 404 6125

Private Bag X,
Observatory, 7935

www.capegateway.go.v.za

Addendum 33: CBA Trial Approval Letter Tygerberg Hospital

Western Cape Government
Health

Tygerberg Hospital

REFERENCE: Research Projects
ENQUIRIES: Dr G Marinus
TELEFONE: 021 938-6267

ETHICS NO: S13/09/170

The implementation and evaluation of a validated evidence-based physiotherapy protocol in a surgical ICU: A controlled before and after Experimental Trial.

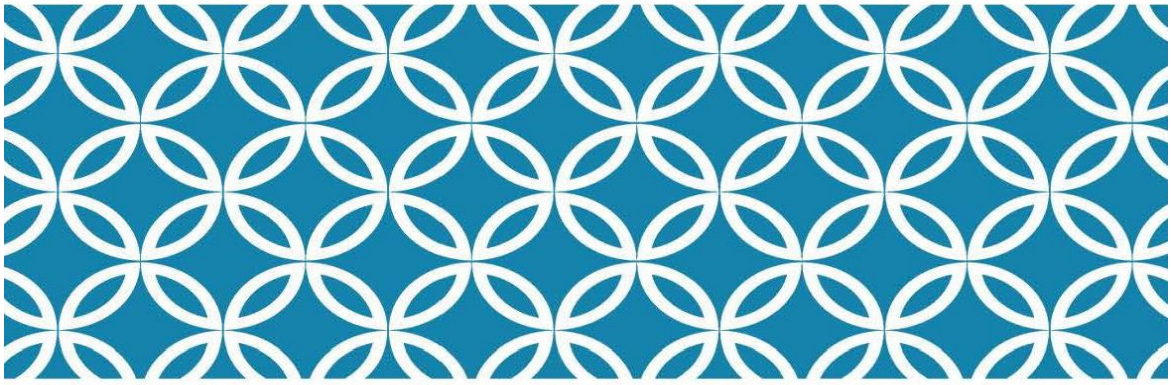
Dear Mrs Farhana Karachi

PERMISSION TO CONDUCT YOUR RESEARCH AT TYGERBERG HOSPITAL

In accordance with the Provincial Research Policy and Tygerberg Hospital Notice No 40/2009, permission is hereby granted for you to conduct the above-mentioned research here at Tygerberg Hospital.

DR D ERASMUS
CHIEF EXECUTIVE OFFICER
Date: 6 February 2015

Addendum 34: TISS-28 and Data Collection Training Notes



TISS-28 TRAINING AND EDUCATION 2015

PHD PHYSIOTHERAPY RESEARCH PROJECT

The implementation and evaluation of a validated evidence-based physiotherapy protocol in a surgical intensive care unit: A controlled before-after experimental trial.

TRAINER AND PROJECT LEADER:
FARHANA KARACHI
ETHICS NO.: S13/09/170
TRAINING 2015

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THERAPEUTIC INTERVENTION SCORING SYSTEM – 28
TISS – 28
BACKGROUND

- TISS – 76: Developed by Cullan et al. 1974, later reduced to TISS-28
- Documents therapeutic interventions used in the ICU
- Score is a reliable indicator of nurse manpower in the care of ICU patients – eg 40-50 points can correspond to the workload of three nurses or one nurse/ 8 hour shift
- It also correlates well with severity of illness of the patient
- Can be used to compare nursing manpower between groups of patients

Miranda et al 1996

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TISS – 28 SCORING INSTRUCTIONS

- TISS 28 can only be completed if the patient has been in the ICU for 1 full unit day
- A unit day is defined as: 07:00 – 06:59 – therefore when capturing only look at activities documented in that time period for that day. *All information will and must be taken from the notes available.*
- Complete daily based on the patients records of previous 24 hours
- Can only be completed if there is a record of the entire 24 hour period
- Use the most intensive intervention documented over the time period to score

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INTERVENTIONS

Discussion of the Sections and the Specific Section Items: What they are and how to score, as well as agreement on where to find the data.

BASIC ACTIVITIES

VENTILATORY SUPPORT

CARDIOVASCULAR SUPPORT

RENAL SUPPORT

NEUROLOGICAL SUPPORT

METABOLLIC SUPPORT

SPECIFIC INTERVENTIONS

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TISS INTERPRETATION

❑ ***Item 23:*** Treatmment of complex etabolic acidosis/ alkalosis.

- The condition to be treated implies additional monitoring and titration, for example the infusion of bicarbonate or acetazolamide.
- More general interventions should not be included in this item, for example intravenous fluids to resolve a contraction alkalosis, or treatment of diarrhoea that is causing metabolic acidosis, or giving potassium to help resolve a metabolic alkalosis.
- These might be included in item 14 – IV replacement of large fluid losses.

Hanekom 2010

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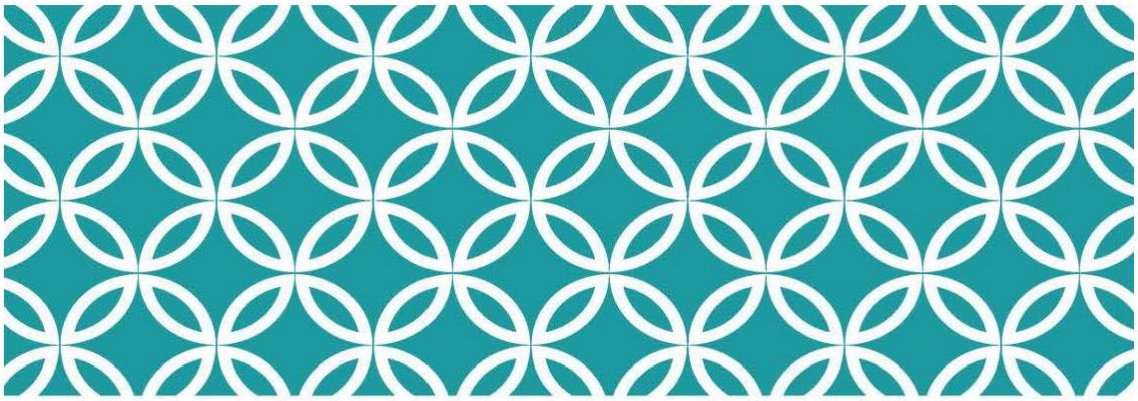

PATIENT ADMISSION AND DAILY MANAGEMENT DATA COLLECTION

S13/09/170

DATA COLLECTION PROCEDURE — GENERAL

- Use the patient list to keep record of patients in the unit during data collection so that you are able to follow up and not miss out patients. You can check your list with the ward list (statistics book).
- New patient – complete admission data and daily management form and complete a TISS-28 if the patient has been in the unit for one full unit day 07:00 – 06:59
- Even if there is a patient admitted but discharged or died before a TISS-28 can be included still capture the admission and daily management form for the patient.
- Please follow the patient if discharged or died and get the notes to complete the daily management and TISS-28.
- Make notes of anything you are unsure of and discuss with Principle Researcher for clarity timeously so we do not miss data.
- The data needs to be as accurate as possible thus you must be accountable for the data as the outcome will and can affect the results and ultimately patient care and false results may be detrimental to patient care or the process of implementation.

DISCUSSION OF ITEMS ON FORMS & QUESTIONS

- ADMISSION DATA
- DAILY MANAGEMENT DATA
- ROUTINE RANDOM DATA CHECKS WILL BE CARRIED OUT BY THE PRINCIPLE RESEARCHER TO MAKE SURE DATA IS COMPLETE AND ALL PATIENTS ACCOUNTED FOR.

EXPLANATION OF ABBREVIATIONS ON FORMS

CO-MORBIDITIES:

ETOH - Alcoholism

CVA – Cerebral Vascular Incident

IHD – Ischemic heart disease – Angina, Myocardial infarct

CA – any form of Cancer

DM – diabetes mellitus

RA – rheumatoid Arthritis

COPD – Chronic obstructive airway disease – Asthma and emphysema included

HIV – Human Immune Virus

TB – Tuberculosis – pulmonary or other

CRF – Chronic Renal failure (kidneys)

HF – Heart Failure – Cardiac Failure

OTHER :

L.E – Lower Extremity

U.E – Upper Extremity

ENT – Ear, Nose and Throat

MVA – Motor Vehicle Accident

GSW – Gunshot Wound

ET - Endotracheal Tube

NIVV – Non Invasive Ventilation

TRACHI – Tracheostomy

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THANK YOU FOR YOUR ASSISTANCE!

Any concerns or problems please contact:

PRINCIPLE RESEARCHER

FARHANA KARACHI

CELL: 0829524549 – call, text or watsapp

EMAIL: fkarachi@uwc.ac.za

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TISS INTERPRETATION

- ***Items 26 and 27:*** The inclusion of specific intervention(s) in the ICU should consider the general comments 1) and 2) above about methods.

In other words, the item should be included if it causes additional consumption of nursing work for assisting the patient or the physician.

Interventions that make an extra demand on manpower in the ICU are related to the severity of illness of the patient.

Examples: a chest X-ray is a common routine in the ICU and does not cause an extra demand on nursing time; an echocardiogram usually does not cause extra work for the nursing staff, and it is often not related to severity of illness.

The inclusion of these items in TISS-28 proved to be instrumental in the stabilization of the scoring system.

Hanekom 2010

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TISS INTERPRETATION

- ***Items 12 and 13:*** Vasoactive drugs may be 'vasoconstrictor' (such as adrenalin) and 'vasodilator' (such as nitrates).
- These drugs can be given singly (item 12) or in combination (item 13).
- These drugs, given for specific vasoactive purposes, require close monitoring and titration.
- Other drugs, such as lidocaine or salbutamol, though not given primarily for vasoactive purposes may have important vasoactive side effects.
- Their eventual vasoactive side effects may require the additional monitoring of the patient (item 12) or the titration of these effects with specific vasoactive drugs (item 13).

Hanekom 2010

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INTERVENTIONS AND SCORING

CRITERIA OF EXCLUSION ARE APPLIED IN FOUR CONDITIONS:

1. Multiple intravenous medication *excludes* single intravenous medication
2. Mechanical Ventilation *excludes* Supplementary Ventilatory Support
3. Multiple vasoactive medications *excludes* Single vasoactive medications
4. Multiple specific interventions in the ICU *excludes* Single specific interventions in the ICU

Miranda et al 1996

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Addendum 35: ICU Patient Admission Data Extraction Sheet

Adapted from Hanekom et al., 2010

DATA EXTRACTION SHEET FOR PATIENT DATA **A1**

BED:

HISTORY NOTE: All information is with reference to current hospitalization period

APACHE SCORE	**PT STICKER**
HOSPITAL ADMISSION Date of Admission DD / MM / 20YY Time of Admission HH : MM	
SURGERY PRIOR TO ICU ADMISSION: ABDOMINAL THORACIC ENT OBGYN ORTHO NEURO DATE: DD / MM / 20YY	**OFFICE USE ONLY: HOSPITALDISCHARGE / DEATH** Date of Discharge / Death DD / MM / 20YY Time Discharge / Death HH : MM
CO MORBIDITIES: Alcoholism CA COPD CRF CVA DM HIV HF IHD RA TB HPT ASTHMA Smoking NONE	**PREVIOUS ICU HISTORY:** Previously admitted to ICU Y N Discharge date from ICU DD / MM / 20YY Unit: .....

ICU ADMISSION

OFFICE USE: Data captured by: ..... on	**ICU ADMISSION FROM WARD:**..... Date of Admission DD / MM / 20YY Time of Admission HH : MM
	ICU DISCHARGETO WARD: ..... Date of Discharge / Death DD / MM / 20YY Time of Discharge / Death HH : MM

ICU ADMISSION DIAGNOSES: Note: *Choose options in each category based on admission notes.*

1	MONITOR	SUPPORT			
2	ELECTIVE SURGERY	EMERGENCY SURGERY	TRAUMATIC INJURY		NONE
	THORACIC	NEURO	MVA	GSW	
	ABDOMINAL	OBS & GYNEA	ASSAULT		
	ENT	ORTHO U.E.	BLUNT TRAUMA		
	ORTHO L.E.	ORTHO SPINE	FALL	STAB	
3	INFECTIVE *	NON-INFECTIVE	NOT APPLICABLE		

O2 SUPPORT ON ICU ADMISSION:

Face Mask Nasal Cannula SIMV
CMV CPAP BIPAP

REASON FOR INTUBATION

Airway protection Post Operative
Mechanical insufficiency Pulmonary insufficiency

INTUBATION ET TRACHI NIVV	**DATE OF INTUBATION** DD / MM / 20YY

** Infective if all 3 criteria are met: Temp >38 or <36; WBC >12 or <4; Puss present in body cavity or tissues*

DAILY MANAGEMENT

DATE	**DAY IN UNIT**	**NOTE: Please circle correct options & document time**

DAILY ICU PHYSIOTHERAPY MANAGEMENT

SESSION 1:
Physiotherapy Yes / No **Time:** HH:MM
Mobilisation (out in chair) Yes / No **Time:** HH:MM

SESSION 2:
Physiotherapy Yes / No **Time:** HH:MM
Mobilisation (out in chair) Yes / No **Time:** HH:MM

SESSION 3:
Physiotherapy Yes / No **Time:** HH:MM
Mobilisation (out in chair) Yes / No **Time:** HH:MM

NURSE MOBILISATION (out in chair): Yes / No **Time:** HH:MM

EXTUBATION TIME: HH:MM	**REASON FOR EXTUBATION** Self Planned
RE-INTUBATION ET TRACHI TIME: HH:MM	**REASON FOR RE-INTUBATION (Tick row)** Airway Protection Mechanical Insufficiency Post-Operative Pulmonary insufficiency
ADVERSE EFFECTS DURING MOBILISATION (tick below) 1.Unplanned extubation; linesdislodged 2.Haemodynamic instability 3.Pulmonary instability 4. Falls 5.Other	**Describe**

Addendum 36: Daily Physiotherapy and Ventilation Management Data Extraction Sheet

Adapted from Hanekom et al., 2010

PT STICKER

NOTE: Continue from A1.

OFFICE USE:
Data captured by……on……..

A2

BED:

DAILY MANAGEMENT

DATE | DAY IN UNIT | NOTE: Please circle correct options & document time

DAILY ICU PHYSIOTHERAPY MANAGEMENT

SESSION 1:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

SESSION 2:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

SESSION 3:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

NURSE MOBILISATION (out in chair): Yes / No Time: HH:MM

EXTUBATION
TIME: HH:MM

REASON FOR EXTUBATION
Self Planned

RE-INTUBATION
ET TRACHI
TIME: HH:MM

REASON FOR RE-INTUBATION (Tick row)
Airway Protection
Mechanical Insufficiency
Post-Operative
Pulmonary insufficiency

ADVERSE EFFECTS DURING MOBILISATION (tick below)
1.Unplanned extubation; linesdislodged
2.Haemodynamic instability
3.Pulmonary instability
4.Falls 5.Other

Describe

DAILY MANAGEMENT

DATE | DAY IN UNIT | NOTE: Please circle correct options & document time

DAILY ICU PHYSIOTHERAPY MANAGEMENT

SESSION 1:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

SESSION 2:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

SESSION 3:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

NURSE MOBILISATION (out in chair): Yes / No Time: HH:MM

EXTUBATION
TIME: HH:MM

REASON FOR EXTUBATION
Self Planned

RE-INTUBATION
ET TRACHI
TIME: HH:MM

REASON FOR RE-INTUBATION (Tick row)
Airway Protection
Mechanical Insufficiency
Post-Operative
Pulmonary insufficiency

ADVERSE EFFECTS DURING MOBILISATION (tick below)
1.Unplanned extubation; linesdislodged
2.Haemodynamic instability
3.Pulmonary instability
4. Falls 5.Other

Describe

DAILY MANAGEMENT

DATE | DAY IN UNIT | NOTE: Please circle correct options & document time

DAILY ICU PHYSIOTHERAPY MANAGEMENT

SESSION 1:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

SESSION 2:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

SESSION 3:
Physiotherapy Yes / No Time: HH:MM
Mobilisation (out in chair) Yes / No Time: HH:MM

NURSE MOBILISATION (out in chair): Yes / No Time: HH:MM

EXTUBATION
TIME: HH:MM

REASON FOR EXTUBATION
Self Planned

RE-INTUBATION
ET TRACHI
TIME: HH:MM

REASON FOR RE-INTUBATION (Tick row)
Airway Protection
Mechanical Insufficiency
Post-Operative
Pulmonary insufficiency

ADVERSE EFFECTS DURING MOBILISATION (tick below)
1.Unplanned extubation; linesdislodged
2.Haemodynamic instability
3.Pulmonary instability
4. Falls 5.Other

Describe