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2011-10-24

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A REPORT TO INFORM THE DEVELOPMENT OF A CLINICAL PRACTICE GUIDELINE FOR REHABILITATION POST TOTAL KNEE ARTHROPLASTY IN A SOUTH AFRICAN PUBLIC HOSPITAL

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A thesis submitted to the Faculty of Health Sciences, University of the Witwatersrand, in fulfillment of the requirements for the degree of Doctor of Philosophy

Johannesburg 2010

Abstract

There is no published research available that evaluates the outcome of TKA in South African public hospitals. Prior to this project, there was no South African published research on the role of physiotherapy in patients post TKA. There are also no clinical practice guidelines in South Africa for rehabilitation post TKA. International guidelines may not be appropriate within a South African public hospital context.

One of the issues raised in the literature pertaining to CPG development is that they lack practical detail and clarity of how decisions are made. In the current context, these problems may be compounded due to the lack of published research in the field in South Africa. The report that is presented is an attempt to combat these issues when a CPG for physiotherapy post TKA in a South African public hospital is developed.

The aim of this study was to draft a report that could inform a comprehensive physiotherapy intervention (in the form of a clinical practice guideline) for patients undergoing a TKA in a tertiary care public hospital in urban South Africa. This was achieved through a series of four studies.

The first study involved translating and establishing reliability of the Oxford Knee Score. The second study was a survey of current physiotherapy practice in the management of patients post TKA in South Africa. The third study was a prospective cohort study to establish the effect of an in-patient treatment protocol for use in the final study. The final study was an observational study to explore the outcome of patients post TKA and identify those who may be at risk for poor outcome.

The English and translated versions of the Oxford Knee Score was shown to be reliable in this sample. This provided an outcome measure that can be used in the validation and evaluation phases of CPG development. The survey of current practice highlighted the high rate of staff turnover and the relative inexperience of physiotherapists working with patients post TKA in the public sector. It identifies the junior physiotherapists as potential stakeholders in the CPG. The trial of the in-patient physiotherapy protocol rendered similar findings to other similar studies in that a specific physiotherapy intervention did not have any effect on short term outcomes. It puts forward clear clinical questions to facilitate the development of

the CPG, particularly relating to scheduling and delivery of weekend and out-patient therapy. The final study provided a demographic profile of the patients within the study context, who are potential stakeholders in the CPG development process. In addition it revealed that level of education, the presence of a caregiver at home, marital status and lack of previous exposure to physiotherapy form part of the profile of an ‘at risk’ patient.

When the contribution that this thesis has made thus far to the CPG development process, is appraised using the AGREE tool, it shows that the thesis has contributed to 11 out of 23 of the criteria on the AGREE tool. It has therefore resulted in a report that informs the development of a clinical practice guideline for the physiotherapy management of patients post total knee arthroplasty in a tertiary care public hospital in Gauteng, South Africa.

Declaration

I, Wendy-Ann Wood, declare that this research report is my own work. It is being submitted for the degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

Signed: ……

This…….day of ……., 2011

Dedication

To Brad and Indigo, for all you have sacrificed and for keeping me inspired

Acknowledgements

Prof Aimee Stewart for her excellent guidance, supervision and perseverance throughout this project.

Prof Anton Schepers for advice.

Statistical advice was generously provided by Dr Piet Becker of the Medical Research Council as well as Dr Witness Mudzi from the Physiotherapy Department.

The National Research Foundation for funding through the Thutuka programme

Sudhakar Gopal, Samantha Byrne and Benita Olivier for assistance with patient recruitment and data collection.

Simone Burgesmeir, Andrew Savviddes, Lauren Hill, for assistance in the wards.

Liza Pretorius from 3degree for data retrieval.

Joanne Potterton, for ongoing support an encouragement.

My parents, for endless hours of childcare.

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LIST OF ABBREVIATIONS

AIMS	Arthritis Impact Measurement Scales
CIRS	Cumulative Illness Rating Scale
CP	Clinical pathway
CPG	Clinical practice guideline
CPM	Continuous passive motion
FU	Follow-up
GDG	Guideline development group
HRQOL	Health related quality of life
ILOA	Iowa Level of Assistance Scale
KED	Knee Extension Deficit
KSCRS	Knee Society Clinical Rating System
KSKS	Knee Society Knee Score
LEFS	Lower Extremity Functional Scale
LOS	Length of hospital stay
MIP	Minimally invasive procedure
OPD	Out-patient physiotherapy (department)
POD	Post-operative day
QOL	Quality of life
RCT	Randomised controlled trial
ROM	Range of motion
SASP	South African Society of Physiotherapy
SF-36	Medical Outcomes Study 36-Item Short-Form Health Survey
SLR	Straight leg raise
SPWT	Self paced walk test
ST	Stair test
TKA	Total knee arthroplasty
TUG	Timed up-and-go
VAS	Visual Analogue Scale
WOMAC™	Western Ontario McMaster Osteoarthritis Index
6MWT	Six minute walk test

CHAPTER 1

INTRODUCTION

Total knee arthroplasty (TKA) is effective in the treatment of osteoarthritis. It has been shown to relieve pain (McAuley et al 2002, König et al 2000, Hawker et al 1998), improve physical function (McAuley et al 2002, Walsh et al 2001, König et al 2000, Hawker et al 1998) and improve quality of life (McAuley et al 2002, March et al 1999).

In South Africa, the vast majority of the population are dependent on the public healthcare system, with a relative minority having access to private health care. Currently in Gauteng tertiary care public hospitals, patients undergoing TKA are seen by a physiotherapist in hospital. There is no protocol for post-operative physiotherapy management post TKA. The treatment that the patients receive is at the discretion of whoever is administering it. This could be a physiotherapy assistant, a physiotherapy student or a qualified physiotherapist. Junior physiotherapists comprise the majority of the workforce in the public sector. The junior physiotherapists work on a rotation system and usually stay in one ward for no more than four months. The patients are discharged home and followed-up by the surgeon at six weeks. Patients are referred to out-patient physiotherapy only if the surgeon is concerned about their progress. This is done only at the discretion of the surgeon, as physiotherapists do not attend the follow-up clinic. Patients often do not attend out-patient therapy because attendance at the tertiary care hospital regularly is not feasible and patients have limited knowledge of services at their local clinics. There is no referral to step-down facilities for in-patient rehabilitation.

Current international trends show that the number of knee arthroplasties performed per year is on the increase (AOA 2009). As public health care in South Africa develops, a similar trend can be expected. The implication for the physiotherapy profession is an increased demand for rehabilitation services which are efficacious as well as efficient.

There is no research available that evaluates the outcome post TKA in South Africa. Particularly, there is no mechanism in place to evaluate the role of physiotherapy in the rehabilitation of patients post TKA. It is not even clear what the research priorities within this field are. In order to establish the efficacy of physiotherapy interventions, randomised controlled trials would be the studies of choice. For such studies to be soundly conducted, the intervention should be carefully designed to ensure feasibility and accessibility while encompassing current and evidence-based practice. Since the South African context is different from the countries where previous research has been conducted, it would be impractical and irrelevant to impose such programmes on our patients.

A clinical practice guideline (CPG) is one method of designing a comprehensive rehabilitation programme. If developed according to recommended procedures, a clinical practice guideline can provide researchers with a standardised, evidence-based intervention that can then be subjected to clinical trials. This will facilitate local research in the field. A CPG can provide a clinical pathway which will assist the inexperienced physiotherapists who are employed in the public sector in their clinical decision making when treating patients undergoing TKA.

The World Confederation of Physiotherapy endorses six phases of CPG development. Section 2.2 of the literature review provides descriptions of each of the six phases with an overview of what each phase entails. In order to facilitate the development of a good clinical practice guideline, a certain level of baseline knowledge of the clinical context is essential to inform each of these six phases.

1.1 PROBLEM STATEMENT

Once the phases of CPG development are to be applied in a specific clinical context, certain questions arise (as shown in Table 1.1), which if clarified, could better inform the CPG development process. Since no South African literature exists regarding physiotherapy management post TKA, there is no local knowledge base to inform the CPG development process.

1.2 SIGNIFICANCE OF THE STUDY

Since there is no published literature on rehabilitation post TKA in South Africa, this thesis will provide baseline knowledge which will inform the CPG development process. On a more practical level, the CPG can provide a clinical pathway that will assist our inexperienced physiotherapists who make up the majority of the physiotherapists working in the public sector.

1.3 AIM

The aim of this study was to draft a report that informs the process of clinical practice guideline development for the rehabilitation of patients post total knee arthroplasty in the South African public healthcare system.

1.4 DEVELOPMENT AND ORGANISATION OF THE THESIS

1.4.1 The development of the thesis

The development of the thesis is illustrated by Figure 1.1.

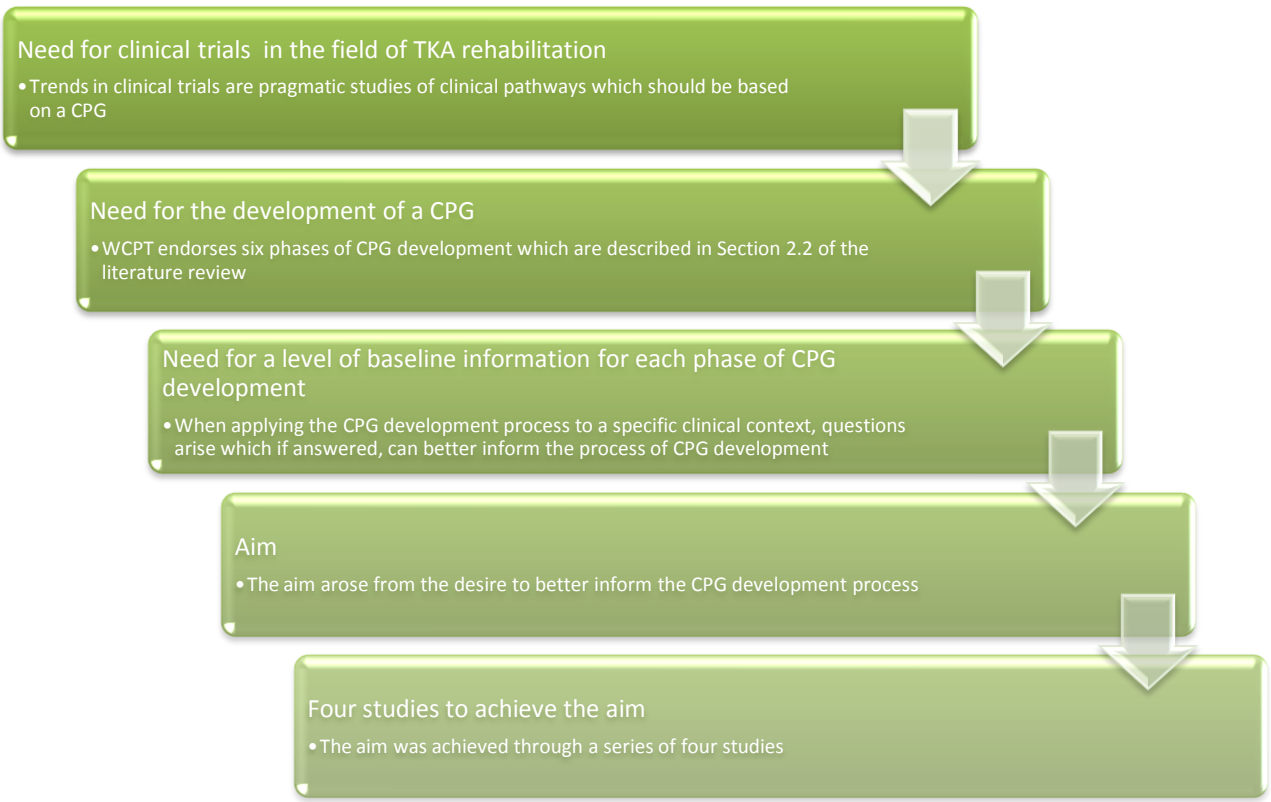


Figure 1.1 Development of the thesis

The four studies designed to achieve the aim of the thesis were:

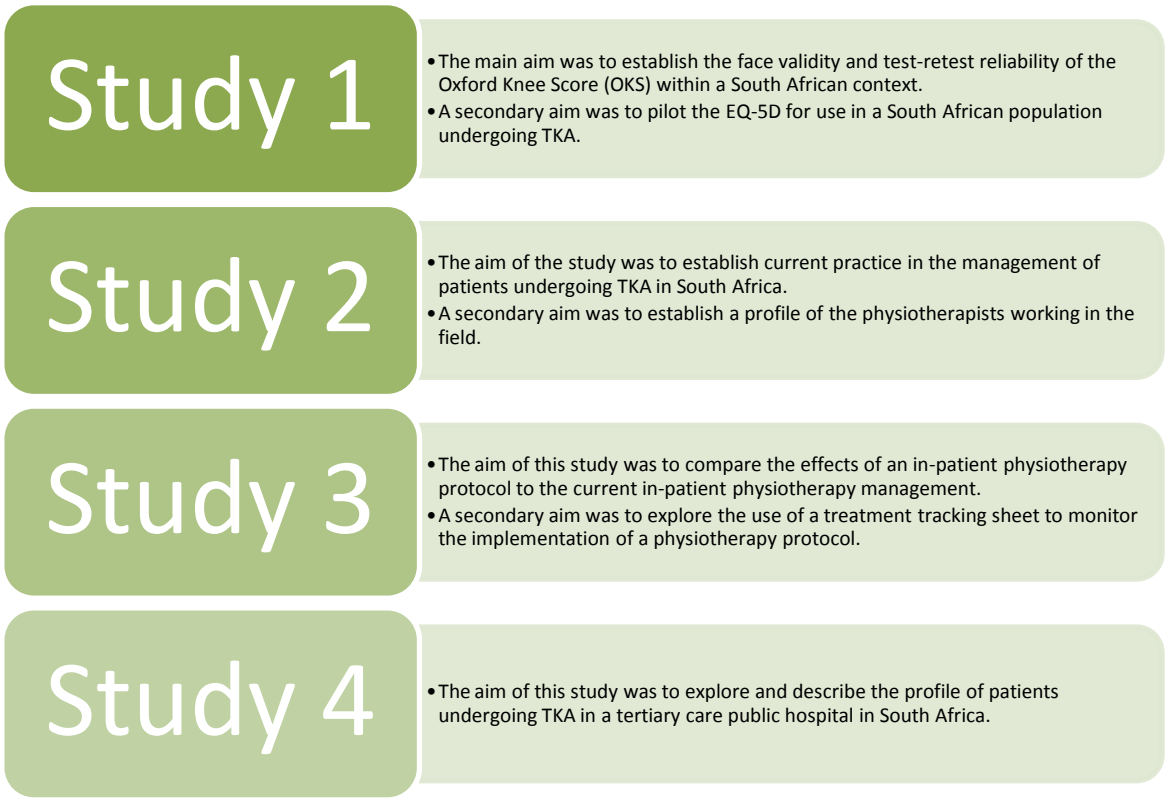


Figure 1.2 Overview of the four studies

1.4.2 Organisation of the thesis

Table 1.1 shows questions that apply to the development of a CPG for rehabilitation post TKA in a South African tertiary care public hospital, and which study attempted to answer each question. How each study answered each question is described within each relevant chapter. The literature review contributed in some way to most of the questions.

Table 1.1 Link between the phases of CPG development (van der Wees & Mead 2004) and the studies in this thesis

Phase of CPG development	Questions arising	Link between question and relevant study	Relevant chapters
Organisation and structure	Who will co-ordinate and drive the process?	Discussed in Chapter 7	Chapter 7
	Who are the potential stakeholders?	Study 2 and Study 4	Chapters 4 and 6
Preparation and initiation	Is there a need for a CPG?	Study 2	Chapter 4
CPG development	What clinical questions are important for this population?	Study 3 and Study 4	Chapters 5 and 6
Validation	If validated by a clinical pilot study, what outcome measures can be used?	Study 1	Chapter 3
Implementation	Who will be implementing it?	Study 2	Chapter 4
	How can implementation be monitored?	Study 3	Chapter 5
Review and evaluation	How can the impact be evaluated?	Study 1	Chapter 3
	How can the CPG be appraised?	Literature review	Chapter 2

1.4.3 Following the main aim throughout the thesis

Throughout the thesis, findings that have direct implications for informing the guideline development process are highlighted under the heading ‘Guideline implication’ and appear in ***bold italics***. Findings that may be worth investigating further prior to informing guideline development are highlighted under the heading ‘Topic for further investigation’ and appear in *italics*. The rationale for this distinction is that only findings with a substantial evidence base should be considered to inform the guideline development process, but there are some findings that cannot be ignored despite the fact that they do not have the strength to contribute to the aim of the thesis.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION AND METHOD

This review of the literature provides the necessary background for the main output of this thesis – a report to inform the development of a clinical practice guideline (CPG) for the rehabilitation of patients post TKA in a South African public hospital. This includes a review of current publications on the aetiology, pathophysiology and conservative management of osteoarthritis, review of current literature on the physiotherapy management of patients undergoing total knee arthroplasty (TKA) as well as recent literature on clinical practice guideline development. In addition, it reviews the evidence that pertains to the design of this thesis as well as the outcome measures and interventions that were used. Regular searches were conducted in Pubmed. PEDRO and the Cochrane databases were also used. Various keywords were used, depending on the topic required –the keywords included 'total knee arthroplasty rehabilitation', physiotherapy post total knee arthroplasty', 'physiotherapy post total knee replacement', 'outcome measures for total knee arthroplasty', 'outcomes post total knee replacement rehabilitation', 'factors affecting outcome post total knee replacement', 'patient expectations post total knee arthroplasty', 'utilisation studies knee replacement'. Papers were also resourced using the 'related articles' function and by 'hand searching' references in reviewed articles.

2.2 CLINICAL PRACTICE GUIDELINES

2.2.1 Introduction

Clinical practice guidelines are widely used in modern clinical practice and physiotherapy is no exception. While a CPG should take a multi-disciplinary approach (Turner et al 2008) it is not uncommon to find a CPG developed within a particular profession. The Chartered Society of Physiotherapy endorses an extensive list of CPG's for various fields within the profession and the South

African Society of Physiotherapy has recently endorsed a best practice guideline for manual chest clearance techniques.

Clinical practice guidelines have been defined by the Institute of Medicine (1990) as 'systematically developed statements to assist practitioner and patient decisions about appropriate healthcare for specific clinical circumstances'. It is important to differentiate a CPG from a 'clinical pathway', which refers to the way in which a CPG can be implemented into daily practice.

2.2.2 The role of clinical practice guidelines

Clinical practice guidelines have been shown to improve clinical practice and outcomes (Grimshaw et al 1993, Grimshaw et al 2004). A CPG is a means of promoting evidence-based practice (Woolf et al 1999), provided the developmental process of the guideline has been rigorous in this regard.

2.2.3 The development of clinical practice guidelines

There are numerous guidelines on the development of clinical practice guidelines. It is not relevant to this thesis to extensively review the development of CPG's. There are groups who have already conducted exhaustive reviews on the topic (van der Wees et al 2007, Schünemann et al 2006, van der Wees & Mead 2004). The aim of the section that follows is to summarise and highlight some important consideration for the process of CPG development.

The development of CPG's can be broadly described by specific phases. Various authors have published ideas on the phases of CPG development and these are summarised in Table 2.1.

Table 2.1 Phases of clinical practice guideline development

Author / Guideline	Phases
Turner et al 2008	• Preparing for CPG development • Systematically reviewing the evidence • Drafting the CPG • Reviewing the CPG
WCPT (based on van der Wees & Mead 2004)	• Organisation and structure • Preparation • Guideline development • Validation • Dissemination and implementation • Evaluation and revision

These phases are broad and it is the specific components within each phase that provide further guidance to the development of a CPG. For the purposes of this review, the components will be discussed within the context of the WCPT framework, since it is already widely used and has been developed with the intent of being used in rehabilitation. In the section that follows, these core aspects of the CPG development process will be elaborated from what is available in the literature.

2.2.3.1 Organisation and structure

This refers to the driving force behind the guidelines, as well as the ***co-ordination of the process*** (van der Wees et al 2007). Guideline development programmes may be co-ordinated by professional bodies or other central organisations, or they may be driven through a bottom up approach by an individual group. If an individual group develops a guideline, it may then be endorsed by a professional body or central organisation. Regardless of who is driving the process, an important consideration is the ***structure of the guideline development group*** (GDG). The constitution of a relevant multidisciplinary group is a factor included in the AGREE appraisal tool. The group may be comprised of clinical experts in the field, stakeholders such as the clinicians who will be implementing the guidelines and even patients (WCPT 2006) and Shekelle et al (1999) highlights the importance of a formal as opposed to informal group structure.

2.2.3.2 Preparation / Initiation

Two main components of this phase are ***prioritising topics*** and ***developing the scope of the guideline*** (van der Wees & Mead 2004). Prioritising is obviously important for large central organisations that may be called upon to develop many guidelines. The framework by van der Wees & Mead (2004) provides a useful list of criteria to consider when prioritising topics. If an individual group is responsible for the guideline development then ***justification*** of the guideline, or ***motivation for the guideline*** (van der Wees et al 2007) may be more important. Another aspect of preparation and initiation is ***how the outcomes will be assessed*** (WCPT 2006).

2.2.3.3 Guideline development

Van der Wees et al (2007) outlines four phases of the development process, namely ***defining the questions***, ***identifying the available evidence***, ***assessing and synthesising the evidence*** and ***translating the evidence into recommendations***.

When the ***questions are defined***, the following points should be considered – the population, the intervention or interventions to be included and the outcome to be expected (van der Wees & Mead 2004). A clinical practice guideline should address a clear clinical question or problem (Turner et al 2008, AGREE collaboration 2003).

The rest of the development process relates to the ***identification, synthesis and translation of the evidence***. Most authors suggest that this is done by systematic review (Turner et al 2008, Oxman et al 2006a, WCPT 2006) and there is evidence that this is usually the case (Turner et al 2008, van der Wees et al 2007. Groups such as the Cochrane Collaboration produce high quality systematic reviews, and where possible, existing systematic reviews can be used to prevent duplication of a labour intensive task (Oxman et al 2006a, WCPT 2006). This is provided that the systematic review is indeed of sufficient quality and that it addresses the specific questions defined in the planning process. It is beyond the scope of this review to delve too deeply into the methodologies of systematic review. The ultimate methodology to be used would be agreed upon by the GDG during the planning phase. The translation of evidence into recommendations is possibly one of the more challenging aspects of drafting the guideline. It is a complex process, as

highlighted by the protocol of Michie et al (2007).Once the evidence has been graded, recommendations may also be graded according to the strength of the available evidence, an example of this being the grading system of the French Agency for Accreditation and Evaluation in Healthcare as presented by Rannou et al (2007). The value of this method is that even though an intervention may not have sufficient strong evidence in its favour, it could be included in a guideline as a weak recommendation. This is important in the field of physiotherapy since many of our interventions do not yet have published evidence of sufficient quality, but it would be impractical and not sensible to exclude them from a guideline. Ultimately, recommendations are usually based on the evidence and the judgement of the GDG (van der Wees et al 2007). There are variable criteria on which these judgements are based (van der Wees et al 2007) and these should also be defined during the planning phase. In practice, it has been shown that most 'guidelines on guidelines' recommend a clear process for drafting the recommendations (Turner et al 2008).

One last aspect to consider in the drafting phase is the ***structure of the guideline*** (van der Wees & Mead 2004). The AGREE collaboration found 'clarity and organisation' to be an important feature of a clinical guideline (The AGREE Collaboration 2003).

2.2.3.4 Validation

Validation essentially involves some form of ***external review of the draft guidelines*** (van der Wees et al 2007). The drafting process must at some point include consultation with relevant persons outside the GDG. This concept is common to most established guidelines on guidelines (Turner et al 2008). The format of the external review can be decided on by the GDG, but it can take the form of, amongst others, a clinical pilot study, a review by an independent committee or appraisal by a tool such as the AGREE instrument (van der Wees & Mead 2004).

2.2.3.5 Dissemination and implementation

If a guideline is to have any impact on clinical practice, it is important that the information be disseminated in a suitable way. While there is poor current evidence for the best methods of dissemination and implementation of guidelines

(Fretheim et al 2006, Grimshaw et al 2006, Haines et al 2004), some authors have provided some useful ideas on the topic (Fretheim et al 2006, van der Wees & Mead 2004). One of the reasons for poor evidence thus far may be that there is wide variation in strategies (Fretheim et al 2006, Haines et al 2004). Also, the guidelines are very variable – some may be single interventions and some may be multifaceted. These factors all need to be taken into account by the GDG during the planning phase so that a clear process for implementation and dissemination can be drawn up. One method of implementing a CPG is via a clinical pathway. A clinical pathway has been defined by the European Pathways Association as 'a complex intervention for the mutual decision making and organisation of care processes for a well defined group of patients during a well-defined period' (www.e-p-a.org).

2.2.3.6 Evaluation and revision

The implementation of a CPG must be followed by an evaluation and review process. Evaluation of a guideline implies ***appraisal of how the guideline was developed*** as well as ***evaluation of the impact of the guideline*** (Oxman et al 2006b). Depending on the guideline and the context, this may range from economic impact to clinical efficacy and patient or clinician satisfaction. The method of evaluation is influenced by the clinical questions or problems which defined the CPG in the first place. The method of impact evaluation should be decided in the planning stage. Appraisal of the quality of the guideline is discussed in the following section.

2.2.4 The appraisal of clinical practice guidelines

While various guidelines for clinical practice have been developed, what may be useful for clinicians is a concise tool for appraisal of available guidelines. Critical appraisal of a CPG enables clinicians to retain some professional autonomy by equipping them to select an appropriate CPG of good quality. One such tool is the AGREE instrument (The AGREE collaboration 2003). The instrument was developed using a multi-staged approach, and after reliability testing and refinement, a 23-item instrument was settled upon. The 23 items are grouped in six domains: Scope and purpose; Stakeholder involvement; Rigour of development; Clarity and presentation; Applicability and Editorial independence.

Shortcomings of this instrument have been highlighted by Vlayen et al (2005), in particular the fact that the evidence base of the guideline is not actually given a score. Nevertheless, it remains a simple method for clinicians in the field to evaluate the practice guidelines with which they are presented and has justifiably been adopted by numerous organisations and networks that are involved in CPG development. It has been shown to be valid and reliable when used by physiotherapists evaluating relevant guidelines (McDermid et al 2005).

2.2.5 Summary

The preceding descriptions of each of the six phases provide an overview of what each phase entails. Table 1.1 showed some questions that apply to the development of a CPG for rehabilitation post TKA in a South African tertiary care public hospital, and which study attempted to answer each question.

2.3 OSTEOARTHRITIS OF THE KNEE

The purpose of this section is to provide a basic profile of a patient with osteoarthritis (OA) of the knee and in doing so, provide a generalised description of the type of patients who may eventually undergo a TKA for OA. Most of the aetiological factors and clinical manifestations are not immediately altered by the surgery and will still contribute to the patients' clinical profile post-surgery. They should therefore be recognised when a clinical CPG is developed as an intervention should take the patients' baseline clinical profile into account. The section on conservative management of OA is less informative for the development of a CPG for rehabilitation post TKA and is thus more concise than the sections on aetiology, pathophysiology and clinical presentation.

Osteoarthritis has been defined by the American College of Rheumatology as 'a heterogeneous group of conditions that leads to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone at the joint margins' (Altman et al 1986). Diagnosis of osteoarthritis of the knee is currently made from a combination of clinical and radiographic findings. It is also possible that serum hyaluronan (Elliott et al 2005) and cartilage oligomeric matrix protein (COMP) (Hunter et al 2007) may be biomarkers for radiographic osteoarthritis. There is generally poor

association between clinical features and pathological changes found on Magnetic Resonance Imaging (MRI) (Kornaat et al 2006).

2.3.1 Epidemiology, aetiology, pathophysiology and clinical presentation

2.3.1.1 Epidemiology

There are limited epidemiological studies published for knee osteoarthritis in Sub-Saharan Africa. One study was conducted by Solomon et al (1975) in a rural Tswana speaking population. No radiographic examination of the knee was conducted, but 20% of the males and 38% of females examined displayed clinical signs of OA of the knee. While the results of this study are dated and the sample size was small, these results are still being used as an indicator of prevalence in Sub-Saharan Africa. Woolf & Pfleger (2003) present the results of a report by a WHO scientific group in 2000 (Symmons et al 2003) in which the results of the Solomon et al (1975) study are used. The collations of these studies (Symmons et al 2003, Woolf & Pfleger 2003) show that in Sub-Saharan Africa, the prevalence of osteoarthritis of the knee ranges from 8% of men aged 60-69, to 25% of women over the age of 80 years. The prevalence of osteoarthritis of the knee is higher in Sub-Saharan Africa than in populations from the Eastern Mediterranean, South East Asia, West Pacific (males and females) and in males is higher than in the developed Americas, Europe, Japan and Australasia. Studies from the United States and Europe show that radiographic prevalence in the elderly (age 63-94 years) ranges from 27 percent to 44 percent (Felson et al 1987) and that prevalence of symptomatic disease ranges from 7 percent (Felson et al 1987) to 17 percent (Maurer et al 1979 cited in Sarzi-Puttini et al 2005). These findings are supported by Woolf & Pfleger (2003) and Peat et al (2001). When looking at prevalence rates of osteoarthritis, specificity of the site must be considered. Disease patterns appear to vary between different parts of the world, for example people of African origin tend to show a higher prevalence of osteoarthritis of the knee than osteoarthritis of the hand (Adebajo 1990) and multiple joint disease appears to be less common than single joint disease (Adebajo 1990, Solomon et al 1976). There is no literature which offers an explanation why, but it may well be related to aetiological factors, particularly genetics, as discussed in section 2.3.1.2.4.

2.3.1.2 Aetiology

'Osteoarthritis is widely believed to result from local mechanical factors acting within the context of systemic susceptibility' (Hunter et al 2007). A more succinct description of osteoarthritis would be difficult to find, hence the quotation. Felson (2009) summarises the systems that are in place to protect a joint during mechanical loading in order to preserve cartilage health. These include muscle co-ordination, sufficient lubrication, cartilage micro- and macro-structure and ligamentous control. It follows then that if one or more of these systems are not functioning, the joint may be at risk for the development of osteoarthritis. The aetiology of osteoarthritis of the knee is multifactorial. Risk factors can be divided into constitutional factors and local mechanical factors. General constitutional factors include age, sex, obesity and genetics (Felson et al 2009). Local mechanical factors include trauma, usage and alignment. The individual factors will now be discussed as they form a clinical profile of the patient population who may eventually undergo a TKA. It should be highlighted that risk factors may vary in their role in incident disease and risk of disease progression. It should also be noted that due to the possible existence of subtypes of the disease (Riyazi et al 2005), the influence of each risk factor may differ between sites. The review that follows refers to osteoarthritis of the knee unless specified otherwise.

2.3.1.2.1 Age

All the large epidemiological studies show that the prevalence of disease increases with age (Felson et al 1987, Symmons et al 2003, Woolf & Pfleger 2003).

2.3.1.2.2 Gender

It would appear that there is a systemic component to the pathophysiology of osteoarthritis in women (Pagura et al 2005). While articular cartilage contains oestrogen receptors and is known to be hormonally sensitive, there is inconclusive evidence as to the relationship between hormone replacement therapy and risk of osteoarthritis in women, but women using postmenopausal oestrogen replacement have been shown to have a higher prevalence of clinical OA than women who are not using hormone replacement therapy (von Mühlen et al 2002).

2.3.1.2.3 Obesity

Obesity is a known risk factor for incident osteoarthritis of the knee (Niu et al 2009, Grotle et al 2008, Cicuttini et al 1996). The effects of obesity on the progression of radiographic disease appear to be mediated by alignment, although there are conflicting findings as to the exact relationship between these two factors. After reviewing a small study by Felson et al (2004) and a larger study by Niu et al (2009), it can be concluded that obesity is not associated with progression of radiographic osteoarthritis in knees with marked varus malalignment. The rationale is that once a knee is in varus alignment, the forces in the medial compartment are so great that the additional body mass cannot significantly increase it. These two studies differ in their findings with regard to neutral knees, the larger and more recent of the two finding that obesity increases the risk of progression of radiographic disease in neutral knees (Niu et al 2009). The smaller study by Felson et al (2004) found the converse in neutral knees, but found that obesity was a risk factor for radiographic progression in moderately malaligned knees. It can probably be concluded that obesity plays a role in the progression of disease in knees with neutral alignment or small deviations thereof, but not in knees with marked malalignment. A recent study has shown that not only body mass index (BMI) but also waist-to-hip ratios are associated with an increased risk of undergoing total knee arthroplasty due to osteoarthritis (Wang et al 2009). These results strongly suggest that obesity may play a mechanical as well as biochemical role in the aetiology of osteoarthritis of the knee, and in doing so they support the thinking of Manek et al (2003). This could be further supported by the fact that obesity may be a risk factor for osteoarthritis of the carpometacarpal joint (Cicuttini et al 1996) and hand (Grotle et al 2008). One school of thought is that visceral adipose tissue may have an endocrine role and that the tissue produces lectin which may stimulate the release of tumour necrosis factor and interleukin-6, thereby increasing any inflammatory response that is taking place (Wang et al 2009).

2.3.1.2.4 Genetics

The role of genetics in the incidence and progression of knee osteoarthritis has really only been investigated in the last 10 years. Studies such as that of Neame et al (2004) have shown that there is a high rate of heritability (0.62) for this condition

(OR 2.9). Their study included men and women, and found higher heritability in men. It is unclear whether their subjects had generalised osteoarthritis or not. In patients with generalised osteoarthritis, there appear to be familial factors at play in the progression of radiographic disease, particularly with regard to joint space narrowing (Botha-Scheepers et al 2007). It would also appear that in patients with known generalised osteoarthritis, osteoarthritis of the knee shows less familial aggregation than osteoarthritis of the hand, hip or spine (Riyazi et al 2005). This finding is contradictory to most other studies, which generally show heritability to be up to 40%. A genetic study by Bergink et al (2003) has shown that there is an association between knee osteoarthritis and polymorphisms in the oestrogen receptor α gene, a protein that is expressed in, among other cells, articular chondrocytes. The fact that patterns of the disease differ between different nationalities as described in section 2.3.1.1 also hints at the role of genetics in the aetiology of OA.

2.3.1.2.5 History of intra-articular fracture and trauma

On long term follow-up (mean 14 years) of patients who had surgically treated intra-articular fractures of the distal femur, 36 percent of subjects had moderate to severe radiological signs of osteoarthritis (Rademakers et al 2004). In keeping with the findings of other studies, this population did not have marked functional impairments or clinical manifestation of osteoarthritis. Therefore, while this study shows that intra-articular fracture plays a role in the development of radiographically evident osteoarthritis, one cannot conclude that intra-articular fracture will lead to symptomatic osteoarthritis. Meniscal tears that are not managed surgically may also be a risk factor for the development of osteoarthritis of the knee as shown in a longitudinal study by Englund et al (2009).

2.3.1.2.6 Usage

Usage and activity levels could refer to occupational or recreational loading of the knee as well as additional loading due to impairment elsewhere in the body (for example contra-lateral limb amputation).

There are conflicting reports on the role of increased physical activity on the development of osteoarthritis of the knee. An epidemiological study by Szoeke et al (2006) conducted in a cohort of peri-menopausal women showed that high

levels of physical activity during the age period 20-29 was a risk factor for the development of knee osteoarthritis, while high levels of activity during other age periods (9-19, 30-39, 40-49) were not. These findings may show that it is a combination of usage and physiological factors that were a risk factor and not usage alone. A detailed systematic review by Vignon et al (2006) concluded that while increased intensity and exposure to a particular sporting activity is associated with the risk of osteoarthritis in high level athletes, trauma is a greater risk factor than the practice of sports. In the last 30 years there has been much debate as to whether long-distance running plays a role in the incidence or progression of lower limb osteoarthritis. A prospective study by Chakravarty et al (2008) has shown that long-distance running is not associated with an increased prevalence or progression of radiographic knee osteoarthritis. While their sample size was small (45 subjects and 53 controls), it is a unique prospective study looking specifically at this issue. Unfortunately they also did not record how long the runners had participated in their sport. More conclusive studies are needed in this area.

Prevalence of knee osteoarthritis has been found to be significantly higher than population norms in the intact leg of a cohort of lower limb amputees (Struyf et al 2009), indicating that increased demands on a limb may predispose the knee to develop osteoarthritis.

Besides intensity of usage, the type of activity may also predispose a person to the development of osteoarthritis of the knee. A study by Zhang et al (2004) has shown that prolonged deep squatting is a risk factor for the development of osteoarthritis of the knee. In a study of physical workload on the risk of osteoarthritis of the knee, Manninen et al (2002) found that high levels of specifically kneeling, squatting and climbing may increase the risk of developing severe osteoarthritis of the knee later in life. This was in comparison with other high load occupational activities such as prolonged standing and lifting. A recent study by Verweij et al (2009) includes a more detailed analysis of physical activity than any previous study and concluded that it is specific components of physical activity rather than intensity that are associated with the development of clinical osteoarthritis. Patients who participated in activities with high mechanical strain or in activities with low strength demands are at higher risk for OA. This has

implications for future research in this area in terms of how physical activity is assessed and quantified.

2.3.1.2.7 Knee malalignment

While knee malalignment is a risk factor for the progression of radiographic knee osteoarthritis, it has not been unequivocally shown that there is a relationship between knee malalignment and incident findings of knee osteoarthritis (Tanamas et al 2009, Hunter et al 2007). The role of malalignment in the progression of disease in obese patients has been discussed in section 2.3.1.2.3.

2.3.1.3 Pathophysiology

While the predominant feature of osteoarthritis remains the progressive destruction of hyaline articular cartilage, a recent review by Felson (2009) has succinctly rationalised why osteoarthritis is now recognised as a disease that affects all of the joint structures as well as the associated neural and soft tissue. Other features of osteoarthritis include fibrocartilage degeneration, chondro-osteophyte formation and synovial inflammation.

Another pathological feature of osteoarthritis of the knee is subchondral bone marrow lesions. These lesions may be local to the medial or lateral compartment or, as recently highlighted by Hernandez-Molina et al (2008) they may be centrally located, surrounding the insertions of the anterior cruciate ligament or posterior cruciate ligament. The lesions localised to a compartment have been ascribed to loading and malalignment, but Hernandez-Molina et al (2008) present evidence which supports the idea that the central lesions may be related to an enthesopathy. Trends from their study show that the central lesions precede ligament pathology which suggests that the enthesopathy may be primarily disease related. It may also simply be due to the change in tensile stress in the knee affected by osteoarthritis, but if enthesopathy is part of the primary disease process, this further illustrates that osteoarthritis affects all joint related structures. This is an important consideration for physiotherapists treating patients post TKA as the procedure replaces the articular surfaces, but it does not directly modify the disease processes occurring in the other intra-articular structures. When designing a post-operative physiotherapy intervention, the fact that the remaining joint

structures may still be subject to the pathological processes of OA should be taken into account.

The pathological changes that are of particular interest to physiotherapists are the effects on the surrounding muscles (discussed under clinical presentation in section 2.3.1.4.4) and peripheral nerves. While pain could arguably be discussed below as part of the clinical presentation of osteoarthritis, it warrants mention as part of the pathological process as it may itself become pathological. Patients with severe osteoarthritis of the knee, in an exploratory study by Imamura et al (2008), showed hyperalgesia that was indicative of central nervous system sensitisation. Chronic nociceptive pain in patients with osteoarthritis of the hip has been shown to disrupt the normal functioning of the descending inhibitory mechanisms of pain modulation (Kosek & Ordeberg 2000).

2.3.1.4 Clinical presentation

2.3.1.4.1 Gait adaptations

It has been shown that patients with osteoarthritis of the knee, particularly if the medial compartment is affected, have a typical adaptive gait pattern (Mundermann et al 2005). Adaptations include a more extended knee at heel strike, a more rapid increase in ground reaction force, an increase in lateral ground reaction force, an increase in hip and knee adduction moments. Patients may also have varus thrust of the affected knee (Chang et al 2004) which is associated with a greater adduction moment at the knee (Mundermann et al 2005, Chang et al 2004).

2.3.1.4.2 Knee buckling / 'giving way'

This is a common clinical feature of osteoarthritis of the knee. In samples of patients with osteoarthritis of the knee, prevalence of knee buckling has been reported at 63% and it has been shown to affect functional ability in 44% of subjects (Fitzgerald et al 2004). Knee buckling may be associated with quadriceps weakness (Felson et al 2007), and in the general population has been shown to be associated with knee pain and not necessarily radiographic knee osteoarthritis (Felson et al 2007).

2.3.1.4.3 Pain

Pain is a predominant feature of osteoarthritis. Severity of pain is a poor clinical indicator of stage of disease and it is well documented that severity of pain is often poorly correlated with radiographic findings, with the exception perhaps of a large joint effusion on MRI (Kornaat et al 2006). A multicentre study (Hawker et al 2008) has established that patients present with two characteristic types of pain. Patients present with a dull ache which eventually becomes constant as the disease progresses, and an intermittent, unpredictable intense pain. It is the latter which causes more distress to the patient. Pain mechanisms have been discussed briefly in section 2.3.1.3.

2.3.1.4.4 Arthrogenic muscle responses

Knee joint pathology, in particular effusion, induces inhibition of the quadriceps muscles and reduces the inhibition of the soleus muscle. It is likely that this response is an attempt by the body to allow more input to be available for the postural muscles to compensate for the decreased activity of the quadriceps (Hopkins et al 2001, Palmieri et al 2004). Patients with OA of the knee have been shown to have inhibition of the quadriceps, even in the absence of effusion (Hurley et al 1997) that is thought to be mediated by an abnormal response of mechanoreceptors to damaged cartilage. The relevance of this to physiotherapy intervention is that conventional methods of muscle strengthening may not apply as the muscle is being physiologically inhibited. This concept will be further discussed within the sections on physiotherapy management post TKA.

2.3.2 Conservative management of osteoarthritis of the knee

This section will be rather more concise than the previous section, as it holds less relevance to the aim of this thesis.

The goals of conservative treatment are to aid in pain relief, improve functional capacity and to slow the rate of disease progression by addressing the modifiable risk factors discussed in the preceding section.

Conservative management of osteoarthritis of the knee may include strategies and modalities as listed in Table 2.2. Where possible, systematic reviews are mentioned, but some interventions have not been subject to systematic reviews, and then individual studies are mentioned.

Table 2.2 Summary of treatment modalities for osteoarthritis of the knee

Intervention	Evidence
Patient education	Ravaud et al (2009) – **Pragmatic randomised controlled trial** evaluating the effects of a goal oriented standardised consultation versus usual care by rheumatologists. Intervention resulted in short term improvement in weight loss and better participation in physical activity. This trial shows the importance of mode of delivery of an education intervention on efficacy.
Exercise therapy	Lin et al (2009) – **Randomised controlled trial** showing evidence for both proprioceptive training or resistance training in a non-weightbearing position to improve function Lange et al (2008) – **Systematic review** of 18 trials in which 50-75% of the cohort showed improvement in muscle strength and self-reported measures of pain and function in the short term Kawasaki et al (2009) – **Randomised trial** comparing exercise and hyaluronate injection, found them to be equally effective (but a long course of injections) Gill et al 2009* – **Randomised controlled trial** comparing multidimensional land-based versus pool-based exercise, found both to be equally beneficial, but the pool group had less pain immediately post exercise session.
Orthotic devices	Reilly et al (2006) – a **systematic review** showing that there is very little literature and none with significant results.
SYSADOA	Vangsness et al (2009) – **review** showing inconsistent efficacy of chondroitin sulphate and glucosamine sulphate (GS). Shows potential to be effective over the longer term which warrants further research. Low toxicity and low incidence of adverse effects. Two publications that have come out of the Glucosamine / Chondroitin Arthritis Intervention trial (GAIT) which compared daily doses of 1500mg glucosamine hydrochloride, 1200mg chondroitin sulphate, a combination of the two and 200 mg celecoxib: Sawitzke AD et al (2008) – **placebo controlled study** with inconclusive results, but leaning towards 1500mg glucosamine. Many limitations to the study. Only used radiographic outcomes. Knees that are less severe radiographically (K/L 2) may have more potential benefit. Clegg et al (2006) – **randomised controlled trial** evaluating the effect on pain, found that a combination of growth hormone and GS may be beneficial in patients with moderate to severe pain.
Intra-articular hyaluronic acid	Kawasaki et al (2009) – **Randomised trial** comparing home exercise and injections, found both interventions to be equally effective, but course of

	injections much longer than what is the norm in South Africa.
Additional modalities	Manual therapy, acupuncture, TENS, ultrasound, laser, intra-articular corticosteroids, topicals, bracing, taping, minerals, vitamins, herbals, nutrients, paracetamol, NSAIDs, opioids, sex hormones, weight loss

There are numerous comprehensive published reports on clinical practice guidelines, in which recommendations for management of patients with osteoarthritis of the knee are suggested. The recommendations in these reports have been found to be fairly consistent (Misso et al 2008, Poitras et al 2007, Pencharz et al 2002), but the quality of some published guidelines has been found wanting when critically appraised with a tool such as the AGREE (Poitras et al 2007, Pencharz et al 2002). Areas of weakness found in both reviews included rigour of development, stakeholder involvement and applicability and implementation. These shortcomings should be avoided when developing future guidelines. These guidelines predominantly relate to the management employed by a team of healthcare professionals and do not focus solely on physiotherapy intervention. A common concern when reviewing the literature on management of osteoarthritis of the knee is that many trials include patients with hip and knee osteoarthritis undergoing the same intervention. If the aetiology and risk factors for progression of disease are properly understood, then certainly from a physiotherapy point of view it does not show good clinical reasoning to expect these patients to respond uniformly to the same intervention. Such studies may only be of value in the context in which they have been conducted. The relevant study is marked with an asterisk (*) in the table.

2.3.3 Summary

The aetiology, pathophysiology and clinical presentation of OA of the knee have been described.

Guideline implication: Patients presenting for TKA for OA of the knee are often overweight females of older age and the intervention should be tailored accordingly. Patients present with pain that is not related to radiological severity, swelling, muscle weakness and functional deficits which must be considered in the intervention.

Topic for further investigation: Post-operatively, the pathological process in peri- and intra-articular structures has not been directly modified by the procedure (for example joint capsule and synovium). These structures may still be subject to the pathological processes associated with OA, which may need to be managed as part of the post-operative intervention.

2.4 TOTAL KNEE REPLACEMENT SURGERY

Verbal consensus from surgeons in Johannesburg, South Africa, is that the surgical approach has no influence on physiotherapy management. Since there are no specific publications which make any link between surgical approach and its effect on physiotherapy management goals, it is not necessary to review the literature on surgical approaches in any depth for the purpose of this thesis. Certain issues may be postulated for further investigation and these will be briefly presented in this section.

There is general consensus amongst surgeons that the type of prosthesis has very little effect on outcome. This consensus is supported by a meta-analysis by Smith et al (2010), which shows that clinical and radiographic outcomes are no different between patients who received fixed- or mobile-bearing prostheses. There is also consensus that patellar resurfacing has little effect on outcome, and this is supported by studies such as that of Lygre et al (2010).

From a physiotherapy perspective, it may be speculated that patients who undergo a minimally invasive procedure (MIP) may have less muscle damage or less inflammation. This may affect the post-operative day (POD) of certain milestones when designing a clinical pathway. Minimally invasive procedures are the recent trend, but a study by Niki et al (2009) has shown that a minimally invasive procedure does not necessarily cause less muscle damage. The type of vastus-splitting approach is of more relevance and the midvastus approach appears to be associated with the most muscle damage, regardless of whether the procedure is minimally invasive or conventional (Niki et al 2009).

Topic for further investigation: When developing a physiotherapy intervention, the type of vastus-splitting approach may have more influence on the prognosis for quadriceps recovery than whether the procedure was minimally invasive or not.

During the period within which this research was conducted, the surgical protocol at the hospital was as follows:

- Arthrotomy via medial parapatellar approach
- Bone cuts are made and prosthesis fitted
- Most common type of prosthesis is a Profix® (Smith&Nephew)
- No patellar re-surfacing
- Closure in layers using absorbable sutures
- Routine antibiotic coverage for 24 hours post surgery
- Post-operative pain control via intra-muscular opiate post-operative day (POD) 1, thereafter oral opiates
- Dressings: Robert-Jones bandage day 1, thereafter local adhesive dressing

Where the surgical protocol of this study sample differs most from what is advocated by the literature, is with regard to pain management. Peripheral nerve blocks and spinal analgesia are not current protocol and are only administered at the discretion of the anaesthetist. Recent guidelines based on an extensive systematic review recommend the use of a femoral nerve block both intra- and post-operatively as first line analgesia (Fischer et al 2008). This is one of many publications advocating comprehensive analgesia protocols post TKA.

Guideline implication: More effective post-operative analgesia may lead to earlier attainment of ROM and strength required to meet discharge criteria. Consultation with the anaesthetics team must be conducted during the guideline development process.

2.5 OUTCOME MEASUREMENT IN REHABILITATION OF PATIENTS UNDERGOING TOTAL KNEE REPLACEMENT

2.5.1 Introduction

Besides the importance of appropriate outcome measures when evaluating individual treatment effects, evaluation of a clinical practice guideline implemented via a clinical pathway is essential. As discussed in section 2.2, outcome measurement can be used in the validation and evaluation phases of CPG development. Outcome measures to be used for these purposes should be selected during the planning phase of CPG development. Since a clinical pathway often involves multiple aspects of patient care (not only rehabilitation), a spectrum

of outcome measures may be needed to evaluate the efficacy of a clinical pathway. For this reason, the review in this section will first consist of a broad overview of outcomes in patients undergoing TKA. It will then focus on the specific outcome measures used in this thesis.

2.5.2 Overview of outcomes in patients undergoing TKA

This section will cover a wide range of outcomes that can be used to monitor outcome from the early post-operative phase to long term follow-up. It provides a list of outcomes from which the CPG development team can select the most appropriate.

Outcome measurement is discussed at this point as an understanding of outcome measurement is needed for the critique of the literature on factors affecting outcome and physiotherapy management post TKA (sections 2.6 and 2.7).

2.5.2.1 Length of hospital stay

Length of hospital stay (LOS) has relevance in itself as an outcome since it has implications for healthcare economics. More often, it is used as an outcome measure, as it is may be indicative of early post-operative recovery.

2.5.2.2 Function

Functional outcome may be divided into early function and late function. This distinction will facilitate the review as some outcome measures are more appropriate in the short term and some are more appropriate at later stages of recovery. For the purpose of this review, early function will refer to functional outcomes attained and measured during the in-patient phase of recovery. Late function will refer to functional outcomes relevant to the post-hospital-discharge phase of recovery and beyond.

The value of measurement of early function is that it can be used to determine readiness for discharge. Using functional outcomes to determine readiness for discharge is of particular value in the current system in South Africa because patients in state hospitals are discharged directly home and not to step-down or in-patient rehabilitation facilities.

2.5.2.2.1 Early function

A well known measure of early function is the Iowa Level of Assistance Scale (ILOA) described by Shields et al (1995). This scale measures the following five activities and scores them on an ordinal scale of zero to six: supine to sitting on the edge of the bed, sitting on the edge of the bed to standing, walking 4,57m, climbing up and down three stairs, walking speed over 13,4m. The ILOA has been shown to be reliable and responsive over the first six post-operative days (Shields et al 1995). It was validated against the Harris Hip Score. The physiotherapists participating in the reliability testing received five hours of training in the use of the scale and all had at least three years experience in the field. This may have contributed to the good inter-rater reliability. If this scale is to be used in research or practice, similar training may be necessary.

2.5.2.2.2 Late function

The Lower Extremity Functional Scale (LEFS) is a measure of self reported function status. It was designed for use in patients with lower limb musculoskeletal conditions (Stratford et al 2000). It is more appropriate for use in an out-patient setting. It has been shown to be valid and reliable in a small sample (n=41) of patients who had undergone TKA (Stratford et al 2000). It is responsive to change over a four week period. In their sample, the number of days since surgery at recruitment ranged from 7 to 119. This is a wide range, and responsiveness and specificity may vary in early or late stages of recovery. A number of the items in the questionnaire are hardly appropriate for a patient who is in the first six weeks post surgery (such as ‘hopping’, ‘walking 2 blocks’, ‘walking a mile’ and a number of items that pertain to running). The content is, at face value, not really appropriate for use in an older population, the typical population undergoing TKA for OA, therefore its value is restricted to a younger or higher functioning group of patients.

2.5.2.2.3 Measures of mobility

Mobility is an aspect of function that has specific outcome measures. Aspects of early mobility are measured using the ILOA, which has already been discussed. Other, more objective measures of mobility, include the six minute walk test (6MWT), the timed up and go test (TUG), the stair test (ST) and the self paced

walk test (SPWT). The 6MWT, ST and SPWT were found to have good reliability in a sample of patients who had recently undergone TKA (Kennedy et al 2005). The scores of all four outcomes showed deterioration at post-operative day (POD) 8 and then improvement by POD 38. This study, by Kennedy et al (2005), supports the use of these outcome measures in the early post-discharge phase of rehabilitation and not necessarily in the in-patient phase. As for which one may be most suitable in the context in which this thesis is being conducted, this will be discussed in Chapter 7 (section 7.2.4.1) as the choice is informed by the findings of study 4.

2.5.2.3 Local impairment

Outcomes pertaining to local impairment include aspects of knee joint integrity, knee range of motion (ROM), strength as well as swelling. Knee joint integrity specifically pertains to joint stability and alignment. Local impairment outcomes are of particular use in explanatory studies where the efficacy of a specific intervention is being investigated. From a rehabilitation point of view, what is of more value is how the impairment relates to the functional limitations or participation.

2.5.2.3.1 Range of motion and stiffness

ROM is typically measured by goniometry. Goniometry has been found to be superior to visual observation (Lavernia et al 2008a). Average standard deviation for measurement of knee ROM with a goniometer has been estimated at six degrees (Boone et al 1978).

The Western Ontario McMaster Osteoarthritis Index (WOMAC™) offers a subjective measure of stiffness subscale (Bellamy et al 1988), but for reasons discussed in section 2.5.2.5., the WOMAC™ may not be the instrument of choice in a South African public hospital setting.

2.5.2.3.2 Pain

Acute post-operative pain can be assessed by the Visual Analogue Scale, which has the sensitivity to detect a relative change in the magnitude of pain sensation of severe acute pain (Myles & Urquhart 2005). This is of course provided the patient understands how to use the linear scale. A South African study by Yazbek et al (2009) showed that a Tswana speaking population in which just over half the

sample (n=100) had a secondary school education, could not reliably use the Visual Analogue Scale (as well as two other linear pain scales). The WOMAC™ has a subscale for pain (Bellamy et al 1988) and the Knee Society Knee Score (KSKS) has a section for self reported pain. These two subscales have been shown to be responsive and to have moderate correlation with one another (Lingard et al 2001). The KSKS section on self reported pain has been used independently from the rest of the scale by Liebensteiner et al (2008), de Beer et al (2005), and König et al (2000). Between the WOMAC™ and the KSKS, the KSKS subscale appears to be the easier of the two to use, but this has not been tested in a South African context.

2.5.2.3.3 Gait parameters

Gait parameters must be considered at impairment level, because alteration in these parameters does not necessarily influence the patients' actual functional status. Gait parameters have been shown to have poor correlation with post-operative clinical knee scores (for example the KSKS) including the function subscales (Liebensteiner et al 2008). The authors use their results to highlight the need for gait analysis as opposed to self reported measures, but the converse is also true. It depends on the outcome of interest. Gait parameters may certainly be of interest in explanatory studies, where interventions are aimed at impairment level, but in terms of functional outcome, it is not sufficient to only perform gait analysis. Functional capacity itself must then be measured as described in section 2.5.2.2. This is a good example of why matching the outcome measure to the outcome of interest is important.

2.5.2.3.4 Strength

Loss of strength as a symptom of OA has been discussed. An aim of rehabilitation post surgery is to improve strength, and therefore it must be measured. Knee strength can be reliably measured by dynamometry after TKA, but patient familiarisation and therapist training are essential to the reliability of this measurement (Gagnon et al 2005). A simpler way of measuring quadriceps strength is measurement of quadriceps 'lag' or knee extension deficit using goniometry. No literature that specifically evaluates the validity and reliability of this measure could be found. In preparation for this thesis, a study to establish

intra- and inter-rater reliability of the KSKS was conducted (Gopal et al 2010) and intra-class correlation co-efficient ranged from 0.65 to 0.87 for intra-rater reliability and from 0.54 to 0.76 for inter-rater reliability, showing moderate to good reliability.

2.5.2.4 Quality of life and patient satisfaction

The value in measuring quality of life in patients post TKA is that it may indicate how the procedure has impacted on the patient's general well-being, and it looks beyond the effect of the procedure on the affected limb. When reporting on quality of life (QOL), it is important to discern between general QOL or health-related quality of life (HRQOL), particularly in an older population where it has been shown that there is often disagreement between self-reported health status and perceived quality of life (Covinsky et al 1999). There is no disease specific measure of quality of life (QOL) for patients specifically undergoing TKA. The Arthritis Impact Measurement Scales (AIMS) is a measure of quality of life for patients with rheumatoid arthritis and has been shown to be a responsive index in patients undergoing TKA (Liang 1990). The AIMS has not been translated into any indigenous African languages (Finch et al 2002).

Perceived health status in patients undergoing TKA has also been assessed using the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) (Davies 2002). Although the SF-36 is a generic measure of the burden of disease (Finch et al 2002), it has been found to be responsive post TKA (Lingard et al 2001). Of concern is that 36 items of self-reported questionnaire require a certain level of literacy and may take time to complete.

Guideline implication: If a CPG is developed for the comprehensive rehabilitation of patients post TKA, with the purpose of improving quality of life post-operatively, it would require a valid measure of quality of life to evaluate the impact of the CPG.

2.5.2.5 Disease specific outcome measures

When assessing functional status post TKA, it is important to use a disease-specific or joint specific measure, so that the results are not confounded by other co-morbid conditions. This has been demonstrated in a study by Kantz et al (1992). Therefore, this section would not be complete without a discussion of the disease specific measures such as the WOMAC™, the Bristol Knee Score, the

Oxford Knee Score (OKS) and the Knee Society Clinical Rating System (KSCRS). These are composite measures designed specifically to assess the knee, and some are additionally specific to osteoarthritis of the knee. The KSCRS and the OKS are discussed in more detail in sections 2.5.3 and 2.5.4.

The WOMAC™ was first described in 1988 (Bellamy et al 1988) and it was designed specifically for use in patients with osteoarthritis of the hip or knee. The current version of the WOMAC™ consists of 24 questions and includes domains of pain, stiffness and physical function. There has been some concern that there is overlap between the pain and physical function domains and Stratford & Kennedy (2004) showed that this may decrease the sensitivity of the function subscale to detect change, particularly when compared to more objective measures of physical function such as the TUG and the ST. The WOMAC™ remains one of the most common measures of patient status post TKA and overall, it has been shown to be valid and responsive to change in patients undergoing TKA. It has not yet been translated into Zulu or Southern Sotho for use in South Africa.

2.5.3 The Knee Society Knee Score

The Knee Society Knee Score is a measure of knee joint integrity. It takes into account aspects of pain, ROM, joint stability, contracture, strength and alignment. It was developed by the Knee Society and first described in 1989 (Insall et al 1989). It is a dual rating system, meaning that it has separate scores for knee integrity and function. Collectively, the scores are known as the Knee Society Clinical Rating System (KSCRS) and the knee score alone is referred to as the Knee Society Knee Score (KSKS). The knee score (KSKS) was modified in 1993, but since no reliability and validity studies are available using the modified system, it will not be discussed further as it was not used in this thesis. Lingard et al (2001) established that while there is poor correlation between the items of the KSCRS, it still demonstrated adequate construct validity. It was validated against the WOMAC and the SF-36. The knee score (KSKS) was found to be responsive over a 12 month period, but the functional score was found to be less responsive. Liow et al (2000) found inter-rater variance to be higher for the functional score than for the knee score, and found that the level of clinical experience and training in the use of the measure influenced the reliability of the score. In preparation for this thesis, a reliability study of the KSKS was conducted in the appropriate clinical

setting by two physiotherapists (Gopal et al 2010). Intra-rater reliability was found to be good (h=0.67) and intra-rater reliability was good to excellent (h=0.95 and h=0.71).

There is insufficient evidence to support the use of the functional aspect of the KSCRS, but the knee score (KSKS) has demonstrated sufficient validity, reliability and responsiveness to justify its use. It is unique in that it is a composite score of various aspects which contribute to knee integrity, as opposed to individual scores of ROM, strength or pain. The components of the KSKS have been found to correlate poorly with one another (Lingard et al 2001), making it difficult to correlate the overall score with a particular clinical presentation. However, the different components of the score ensure that all aspects of knee integrity contribute to the final score. The potential value of using the KSKS for this thesis is that it is quick to conduct and is not reliant on patient literacy.

2.5.4 The Oxford Knee Score

The Oxford Knee Score (OKS) is a measure of functional status that can be used in the post-hospital discharge phase of rehabilitation. The OKS was first described in 1998 by Dawson et al (1998). The development of the questionnaire was clearly described and it was tested in a group of patients undergoing TKA. During development, the questionnaire was validated against the KSCRS, the SF-36 and the Health Assessment Questionnaire (HAQ) (Dawson et al 1998). There has been some concern as to the specificity of the OKS, and as demonstrated by Harcourt et al (2001), the score can be influenced by the presence of hip or lumbar spine pathology. It is important when using the questionnaire to remind the patient that the questions pertain particularly to the knee in question. Also, when the OKS is used for research purposes, patients with severe hip or lumbar spine pathology are often excluded in any case as these conditions may confound any outcome measures. While the WOMAC™ has not been subject to a similar trial as that which Harcourt et al (2001) conducted with the OKS, it would probably yield the same findings due to the nature of the content. The OKS has been successfully translated into Dutch (Haverkamp et al 2005) and Swedish (Dunbar et al 2000). For use in this thesis the OKS was selected over the WOMAC™ due to it having half the number of items to complete, and since pain and knee integrity were to be

measured by the KSKS, using the WOMAC™ would have just duplicated these measures.

2.5.5 The EQ-5D

The EQ-5D is a generic measure of health related quality of life (HRQOL). The EQ-5D index measures the domains of mobility, self-care, usual activities, pain/discomfort and anxiety/depression (Finch et al 2002). The EQ-5D Visual Analogue Scale assesses self-perceived health status.

Reliability of the EQ-5D in a sample of patients with OA has been demonstrated in study by Fransen & Edmonds (1999). This study highlights the valid concern of the 'coarseness' of the three health states within each of the five domains. The first and third options for each domain are extreme options and many patients with osteoarthritis (or undergoing TKA for that matter) will fit into the middle option. The authors did show however, that the EQ-5D can be used as an adjunct to other outcome measures in a clinical study. When the EQ-5D was translated into Xhosa, the test-retest reliability of the descriptors was mediocre (intraclass correlation co-efficient 0.33 to 0.69) (Jelsma et al 2004). The reliability of the VAS was good (ICC 0.66). These authors did not report any difficulties with administration of the questionnaire or difficulties encountered by the patients when completing the questionnaire.

While the EQ-5D may not yet have been used extensively in samples undergoing TKA for OA, it may be worth exploring. It has been translated into African languages and it has been shown to be a useful adjunct measure in clinical studies. Also, it is shorter than other measures of health related quality of life (for example the SF-36).

2.5.6 Summary of outcome measures

One aspect that may serve as an outcome from a management point of view is that of costs. Health economics is a vast and complex field, and it was not within the scope of this review to include such a specialist field. Certainly, cost to the healthcare system as well as the patient should be included in the evaluation of a CPG.

Ultimately, rehabilitation aims to ensure patients' participation in their community. In orthopaedic physiotherapy rehabilitation research, there is no specific tool to

measure the integration and participation of the patient within a community. The ICF can be used, but it is cumbersome and complicated to use in daily clinical practice. Further research in outcomes to assess participation in patients undergoing TKA is required.

An overview of various outcome measures has been discussed according to which outcomes they measure. When planning the validation or evaluation phases of a CPG development process, outcome measures must be selected according to the scope and purpose of the CPG.

2.6 FACTORS AFFECTING OUTCOME POST TOTAL KNEE ARTHROPLASTY

This section deals with the factors affecting the outcome of impairments or function that are dealt with directly by physiotherapists treating patients post TKA. When reviewing the effect of a particular factor on outcome, it is important to clarify exactly what outcome is being affected and how. An attempt will be made to clarify this issue for each factor discussed.

A CPG for the rehabilitation of patients post TKA should address clear clinical questions (as described in section 2.2.3.3) and should be accompanied by a clear implementation strategy, for example a clinical pathway, as discussed in section 2.2.3.5. In order to establish clear clinical questions, knowledge of the clinical problems faced post TKA is important, hence the following discussion of factors affecting outcome. Interventions can then be aimed at those factors which may be modifiable. A clinical pathway can be better described if there is some knowledge of normal progression of recovery and factors affecting the normal progression of recovery.

2.6.1 Obesity (intrinsic factor)

Obesity is defined as a body mass index (BMI) ≥ 30 kg/m^2. Foran et al (2004) showed in a retrospective study that obesity has a negative effect on knee integrity and function post total knee arthroplasty. The obese subjects in their study (n=78) had significantly lower KSKS scores at an average of 80 months (±19.4) follow-up. Obesity has been shown to correlate negatively with post-operative quadriceps strength (Silva et al 2003), but this study was cross-sectional and no cause-effect relationship can be established. An older study by Smith et al (1992) showed that

obesity has a negative impact on post-operative function for up to two years post surgery.

2.6.2 Pre-operative range of motion (intrinsic factor)

A dated, but well known study that deals with this factor is that of Ritter & Stringer (1979). While this study consisted of a sample of adequate size, it was a rather varied sample in terms of age, pathology, prosthesis and procedure. Despite this, the authors have shown the predictive value of pre-operative knee flexion ROM for post-operative ROM. According to their findings, the patients who can expect to gain the most improvement in ROM post TKA are those who have a pre-operative measurement of between 76° and 95° of knee flexion. Patients who have pre-operative knee flexion ROM of greater than 95° are likely to have lost some knee flexion ROM by one year post surgery. Patients who have less than 75° of pre-operative knee flexion ROM are likely to have less improvement of ROM within the first year post surgery. Their findings are confirmed by a more recent retrospective study (Ritter et al 2003), which shows that pre-operative knee flexion ROM is the single most important predictor of post-operative knee flexion ROM. The concept that patients going into surgery with higher flexion ROM are likely to lose ROM post-operatively was confirmed by Parsley et al (1992), although this study is also dated, and Anouchi et al (1996). A retrospective study of a large sample by Gandhi et al (2006) also found pre-operative knee flexion ROM to be predictive of post-operative knee flexion ROM.

2.6.3 Surgical volume (extrinsic factor)

A study by Schroer et al (2008), with a large sample size (n=652) showed that higher surgical volumes were associated with lower complication rates post-operatively. The more procedures the surgeon performed per six month interval, the lower the complication rate.

2.6.4 Workmen's compensation benefits (extrinsic factor)

In a retrospective review, de Beer et al (2005) showed that patients receiving workmen's compensation benefits had inferior short-term (1 year) outcomes when compared with patients receiving no compensation benefits. These outcomes

included worse pain scores and knee flexion ROM and poorer self-perceived function as measured by the OKS. The demographic of their sample differed from the global population undergoing TKA in that they were significantly younger (average age 61, ± 7.5) and predominantly male. There are conflicting results regarding the effect of younger age on outcome as presented below. Thus, younger age may be a confounding variable in the study by de Beer et al (2005) and further studies need to be conducted to show that workmen's compensation benefits may affect outcome.

2.6.5 Age (intrinsic factor)

While the paper by Elson et al (2006) showed that younger patients were more likely to have poorer pain outcomes, it has also been shown that older age is a risk factor for more immediate post-operative complications (Pulido et al 2008). Also, in contrast to the findings of Elson et al (2006), Nilsdotter et al (2009) found that older age was a predictor for more post-operative pain. In terms of outcome of pain, function and health related quality of life, Jones et al (2001) found no effect of age. The lack of influence of age on post-operative physical function as found by Jones et al (2001) was echoed by Nilsdotter et al (2009). In contrast a systematic review by Santaguida et al (2008) concluded that older age is associated with worse function. They also concluded that younger age increased the risk of revision surgery, which could possibly be due to the higher physical demands placed on the prosthesis by younger patients.

Older age may be a predictor for post-operative knee stiffness (Ritter et al 2003), but plays less of a role than pre-operative flexion ROM. Age has also been shown to play a role in predicting short term outcome. As shown by Schneider et al (2009), older patients tend to take longer to achieve their discharge goals. Older age as a predictor for increased length of hospital stay was also shown by Witvrouw et al (2009).

When looking at age as a predictor of outcome, it may be necessary to differentiate between short, mid- and long-term outcomes. It may also be necessary to clarify the type of outcome which is being affected by age.

2.6.6 Pre-operative waiting time (extrinsic factor)

A study of 60 subjects by Vuorenmaa et al (2008) showed that a waiting time of approximately 10 months did not negatively impact pain scores or objective functional measures pre-operatively. Many studies reviewed in this section show that pre-operative scores are a predictor of post operative outcomes, but if pre-operative scores do not decline over a ten-month waiting period then waiting period may be irrelevant from an outcome point of view (although not necessarily an ethical one). Also, this study only evaluated the effect of waiting time on pain scores and functional measures. It did not establish if waiting time had a negative impact on ROM and strength, which have been shown to predict post-operative outcome.

2.6.7 Peri-operative pain management (extrinsic factor)

Numerous studies state that there is a relationship between pain in the pre-operative and / or post-operative period and patient satisfaction after total joint arthroplasty (Lavernia et al 2008b cites Maheshwari et al 2006). It has been said that analgesia has an impact on the perceived success and functional outcome of the procedure (Lavernia et al 2008b cites Dahlen et al 2006). A retrospective study by Lavernia et al (2008b) showed that multimodal pain management peri-operatively resulted in a lower incidence of patients requiring manipulation under anaesthesia for post-operative arthrofibrosis and lack of knee flexion range of motion.

2.6.8 Gender (intrinsic factor)

There has been some debate as to whether gender affects the outcome of total knee arthroplasty. A recent study by MacDonald et al (2008) demonstrated that although females generally score lower on common outcome measures, the benefit that they derive from the surgery is equal to and in some cases superior to that of male patients. It is important to look at the relative gains and not the absolute scores when comparing male and female outcomes. A study by Vincent et al (2006) showed that female patients presented with lower pre-operative functional scores, but had similar percentage gains as males. The female patients however, took longer to achieve these gains, thus increasing length of stay and associated costs. Kennedy et al (2006a) showed that gender was a predictor for

physical performance scores in the first week post surgery, but thereafter was no longer a factor predictive of rate of recovery.

2.6.9 Pre-operative pathological pain (intrinsic factor)

The role of central sensitisation in the pain mechanisms in patients with osteoarthritis of the knee have been discussed in section 2.3.1.3. How centrally mediated maladaptive pain responds to surgery warrants further exploration. If plastic changes occur within the spinal cord as a response to unrelenting pain, it cannot be assumed that pain responses will return to normal post arthroplasty. One study investigated the function of descending inhibitory pain control mechanisms in patients undergoing total hip arthroplasty (Kosek and Ordeberg 2000) and found that their function is restored post operatively. This however is only one aspect of a dysfunctional pain mechanism and whether the plastic changes in the dorsal horn are reversed post surgery remains to be investigated. If dysfunctional pain mechanisms in patients with osteoarthritis can be easily quantified pre- and post-surgery, further investigation should establish if the severity of dysfunction affects the post-operative outcome. Lingard et al (2004) showed that patients with more severe pain scores on the WOMAC scale were more likely to have a worse pain scores up to two years post-operatively. While their measurement of pain did not specifically assess pathological pain, their findings also support the need for further research in this field. Part of a dysfunctional pain response is catastrophic thinking about the pain. While this aspect may overlap with mental status, it is more appropriate to discuss it in this context. Witvrouw et al (2009), in a prospective study, showed that pain catastrophising was a predictor for length of hospital stay. The possible explanation for this being that pain catastrophising may be associated with reluctance to move which may in turn lead to slower achievement of functional goals and therefore discharge.

2.6.10 Multiple co-morbidities (intrinsic factor)

While individual co-morbidities are directly associated with risk for general medical complications of surgery, these issues are not within the scope of this review. While physiotherapists may have a role in the prevention of general post-operative complications, the focus of this thesis is on the rehabilitation post TKA, and the

decision was made to remain within this focus area. What may be of interest for physiotherapists is how the presence of multiple co-morbidities affects the outcomes that are within their scope of rehabilitation.

Forrest et al (1999) have shown that the presence of co-morbidity may predispose patients to discharge to a rehabilitation unit instead of home. They did not present results of specifically how the co-morbidity score influenced impairments and functional levels, and their sample had some confounding variables, but it would appear the co-morbidity had an effect on the patients' recovery. Schneider et al (2009) have shown that the presence and degree of co-morbidities has been associated with a slower achievement of post-operative discharge goals. While the presence of co-morbidities may influence achievement of functional goals, it does not appear to have a direct impact on knee stiffness (Gandhi et al 2006).

There are numerous composites scores of co-morbidity, among them the Cumulative Illness Rating Scale (CIRS) (Miller et al 1992). The CIRS is a measure of co-morbidity particularly in an older population, and has been shown to be reliably used by nurses as well as general practitioners (Hudon et al 2005). The CIRS was used in study 4 as part of the baseline assessment, following clear guidelines on how to score each patient (Salvi et al 2008).

2.6.11 Pre-operative quadriceps strength (intrinsic factor)

Pre-operative quadriceps strength has been shown to be a strong predictor of objective functional measures at one year post surgery (Mizner et al 2005a). This is most likely because quadriceps strength is closely related to functional outcomes (Mizner et al 2005c) and quadriceps strength undergoes a massive decline in the early stages post surgery (Mizner et al 2005b). If the pre-operative strength was poor, and undergoes further decline post-operatively, it follows that the functional recovery will be affected.

2.6.12 Pre-operative functional level (intrinsic factor)

Lingard et al (2004) showed that patients with marked functional limitation pre-operatively (as measured by the WOMAC scale), are predisposed to poor functional outcomes up to two years post-operatively. A possible explanation for this is the relationship between quadriceps strength and function as described in section 2.6.11.

2.6.13 Pre-operative mental status (intrinsic factor)

Poor mental health scores (as measured by the SF-36) have been shown to be associated with poor functional outcome up to two years post-operatively (Lingard et al 2004), although this study could not determine a cause and effect relationship. Further research is needed to clarify the intricate relationship between mental health status and physical function in patients who undergo TKA.

2.6.14 Decreased length of hospital stay (extrinsic factor)

Some medical systems, in order to save time and/or expenses, have attempted to implement accelerated protocols with one of the goals being to decrease length of hospital stay (LOS). The one possible effect of purposely decreasing LOS by modifying the discharge criteria, is the increased need for transfer to a step-down facility (Forrest et al 1999), which in the current South African public health system is not possible. One study that looked at the long term effects of this was that of Teeny et al (2005). Patients who had a mean of 1.3 days less hospital stay were discharged with less flexion ROM, but this had no effect on ROM and function (measured by the Knee Society Score) at three, six and 12 months. Therefore, if the LOS is purposely decreased by modifying the discharge criteria, it must be noted that short term, but not long term outcomes may be affected.

2.6.15 Pre-operative varus / valgus deformity (intrinsic factor)

There are conflicting results with regards to the effect of pre-operative varus / valgus angulation on post-operative flexion ROM. Kawamura & Bourne (2001) showed that it does have an effect, and while their sample was small (n=65) it was uniform in terms of procedure. Ritter et al (2003) in a larger, but more pragmatic sample, showed that the pre-operative varus / valgus deformity has no effect on post-operative flexion ROM, echoing the earlier results of Ritter & Stringer (1979). While this factor is not modifiable post surgery, it is worth noting as it may affect prognosis and therefore physiotherapists' expectations.

2.6.16 Summary of factors affecting outcome

A striking pattern emerging from this section is that the role of various factors in influencing outcome post TKA may vary from outcome to outcome. Also, some factors may have more effect on short term outcomes and others on longer term

outcomes. One of the more consistent relationships reported, is that of pre-operative flexion ROM to post-operative flexion ROM. The effects of age are somewhat more variable and even conflicting. Surgical volume, gender and co-morbidity appear to be of more consequence for shorter term outcomes, particularly LOS. Obesity and pre-operative quadriceps strength may have consequences for post-operative function, but further studies are required. Other factors in need of further research are peri-operative pain management, the role of pathological pain, the role of mental status and worker's compensation.
Part of the value of establishing factors that affect certain outcome post TKA is in using this information to identify patients who may be at risk for poorer outcome post surgery. When developing the CPG, provision must be made to ensure that high risk patients are identified early, to facilitate early intervention, particularly for modifiable factors such as ROM, quadriceps strength, obesity, pain and mental status.

2.7 THE ROLE OF PHYSIOTHERAPY IN PATIENTS UNDERGOING TOTAL KNEE ARTHROPLASTY

2.7.1 Introduction

The earliest publications on the role of physiotherapy in the management of patients undergoing TKA are from the 1970's (Manske & Gleeson 1977), some 20 years after the advent of the TKA. Thus, there is less than 40 years worth of published research.
Since CPG development should be based on the literature, it is essential that it be reviewed as part of this thesis.

2.7.2 Pre-operative physiotherapy

For the purpose of this literature review, pre-operative physiotherapy implies an intervention designed to improve pre-operative condition of the patient.
It has been shown that pre-operative pain and physical function are good predictors of pain and physical function at 6 months post-operatively (Fortin et al 1999). Reason dictates that interventions aimed at improving these parameters in patients who have osteoarthritis and are awaiting surgery, should have an effect on the post operative outcomes. Current evidence, however, does not support this

premise, as concluded by a systematic review (Ackerman & Bennell 2004a).There is potential for further research as the three studies they reviewed had small sample sizes and the interventions themselves may not have been sufficiently justified or controlled. A more recent review by Coudeyre et al (2007) echoes these sentiments, although they do acknowledge the study by Beaupre et al (2004) which shows that a four week pre-operative physiotherapy and education programme may have led to a shortened hospital stay. This is most certainly a field for further research, and should not be ruled out for consideration in the CPG.

2.7.3 Peri-operative physiotherapy

Peri-operative physiotherapy refers to the physiotherapy intervention that patients receive in the acute care setting pre- or post operatively. In South Africa, patients are seldom discharged to rehabilitation hospitals post total knee arthroplasty, and certainly not in the public sector. In this section, physiotherapy management conducted in the acute care setting will be discussed. The aims of the physiotherapist in the immediate post-operative phase are to encourage early ambulation – the first stage in functional recovery – and to ensure early active and passive range of motion of the operated knee. There are various modalities employed to achieve these aims and each will be reviewed according to the available evidence. Besides informing the intervention used in study 3, the review will also provide some information for the guideline.

2.7.3.1 Pre-operative education

Pre-operative education has been used since some of the earliest physiotherapy management programmes were implemented (Manske & Gleeson 1977). The concept has been more extensively researched in patients undergoing total hip replacement than in patients undergoing TKA. A review by McDonald et al (2004) included only two studies which investigated the use of pre-operative education for patients undergoing TKA and both these studies were actually looking at this intervention prior to both hip and knee arthroplasty. There was some evidence that pre-operative education may reduce pre-operative anxiety. Pre-operative anxiety was not assessed in this thesis, and this is an area that warrants further investigation in South Africa.

2.7.3.2 Continuous Passive Motion (CPM)

One of the most extensively researched physiotherapy modalities is CPM. The concept of continuous passive motion post joint surgery was pioneered by Salter, who showed that articular cartilage demonstrated better healing when the joint was moved as opposed to being immobilised (Salter et al 1980). Since a knee that has undergone TKA is devoid of articular cartilage, the clinical reasoning behind using this modality post TKA must be more related to capsular healing, maintenance of soft tissue mobility or the physiological effects of passive movement on pain modulation, although there is no specific literature to this effect. The literature on CPM cannot be discussed without including the comprehensive meta-analysis by Brosseau et al (2004). Their conclusion highlights that while CPM may offer some benefit, further research is needed with regard to modes of application and dosages. Most early trials on CPM use protocols of continuous CPM, such as that of Colwell & Morris (1992) and Maloney et al (1990), and have shown an effect in decreasing length of hospital stay and use of analgesics in the CPM group. However, the control group, in these and other older studies, were immobilised in an extension splint for 2 – 3 days post-operatively. This delayed mobilisation may explain the increased pain and length of hospital stay. In addition, immediate post-operative use of CPM (as was the case in early trials) was associated with increased wound complications in some trials (Maloney et al 1990). These older studies have shown no long term benefit from using CPM. The control groups of more current studies are on protocols and clinical pathways that involve earlier active mobilisation (Leach et al 2006, Bennett et al 2005). The CPM protocols in these current trials are of a lower intensity than earlier trials, so it is difficult to compare them. The more recent trials show no added benefit of using CPM (Leach et al 2006, Bennett et al 2005, Davies et al 2003, Beaupre et al 2001, Chen et al 2000). One recent study that actually compared dosages (no CPM, 25 minutes of CPM and 2 hours of CPM) also showed no difference in outcome between the three groups (Denis et al 2006). The recent trials are not without their limitations, for example in the study by Beaupre et al (2001) the subjects had variable outpatient interventions which may have influenced the long term results. The study by Chen et al (2000) was conducted in a step-down facility and thus the intervention was administered in the post-acute phase. What is of interest is that regardless of how the interventions have evolved, the more recent studies are

showing better outcomes than earlier studies in the experimental and control groups. The two groups in the Leach et al (2006) study achieved 109,8° and 106,5° of knee flexion at six months post surgery, and these results are comparable with and even better than other published research for any intervention. This illustrates that while the literature shows that low intensity CPM has no added benefit over conventional physiotherapy, one must not be tempted to argue that trials with higher intensities should be conducted. If expected outcomes are being achieved without the use of CPM, then researchers cannot hope for marked differences in range of motion outcome when applying any intensity of CPM. A better outcome measure of the value of CPM may be complication rate and the need for manipulation under anaesthesia as opposed to knee flexion range of motion.

Guideline implication: CPM may have a place in patients who are not reaching flexion ROM fast enough, but there is not enough evidence to support its routine use.

2.7.3.3 Alternative methods of achieving knee flexion ROM

The use of CPM does not guarantee the achievement of flexion ROM post operatively. In addition to this it is dependent on expensive equipment which must be purchased and then maintained. Alternative methods of achieving flexion ROM have been investigated.

Hewitt & Shakespeare (2001) conducted a trial on an early flexion regime. In an early flexion regime, patients are splinted with the knee in flexion immediately post operatively, as opposed to the usual extension splint. Physiotherapy management is then conducted in a fairly standard way, within the requirements of the splinting regime. When compared with a standard extension protocol (excluding CPM), it has been shown to decrease hospital stay and improve early knee flexion ROM scores (Hewitt & Shakespeare 2001).This should technically be considered as part of the surgeon's protocol rather than a physiotherapy management strategy, but for obvious reasons it affects the physiotherapy management and therefore warrants mention in this review. Despite the valid concern of skin necrosis following sustained flexion, this study allowed early mobility within the flexion splinting regime, thus averting this complication.

Another method of achieving knee flexion ROM was described and trialled by Kumar et al (1996), known as the drop-and-dangle technique. It is a simple method of using gravity and positioning of the limb to maintain sustained flexion. The patients in both groups (drop-and-dangle versus CPM) received a high volume of physiotherapy treatment throughout their hospital stay, which may have accounted for the overall good knee flexion results, but the drop-and dangle group had a shorter hospital stay (1 day) and better knee extension ROM at six months post surgery. The value of an intervention like this within the South African context is the fact that it is not dependent on any specialised equipment.

2.7.3.4 Cryotherapy

A survey of current practice in the United Kingdom showed little consensus on the application of cryotherapy post total knee arthroplasty (Barry et al 2003). A novel method applying continuous-flow cold therapy for the first six days post surgery showed positive results with regard to ROM, blood loss, pain, analgesic consumption and wound healing (Morsi 2002). This is a modality that is still largely under-investigated.

2.7.3.5 Electrotherapy modalities

Transcutaneous Electrical Nerve Stimulation (TENS) is an electrotherapy modality intended to modulate pain via the ‘gate-control’ theory. It has been trialled in various settings for the management of various types of post-operative pain, with varying results. A study by Breit & van der Wall (2004) showed that it did not reduce the need for patient-controlled analgesia post total knee arthroplasty, although they do not report clearly on what mode of TENS was used.

2.7.3.6 Early hydrotherapy

The benefits of early (from POD 4) hydrotherapy have recently been investigated (Rahmann et al 2009). Their results showed an early improvement in hip abductor strength in the group undergoing specific hydrotherapy when compared to a group receiving standard ward care and a group participating in general hydrotherapy. No adverse events were reported, particularly with regard to wound complications. While this study alone is not sufficient to support the inclusion of early hydrotherapy in the CPG, it does justify further investigation.

2.7.4 Post-operative physiotherapy

This section will cover post-operative physiotherapy management conducted in a rehabilitation hospital, home or out-patient setting. In this section, the common impairments and functional limitations experienced post TKA will be discussed first, followed by the review of physiotherapy interventions. It is important that specific impairments and functional limitations are highlighted as this facilitates clinical reasoning, but interventions are often multifaceted and therefore warrant separate review.

2.7.4.1 Impairments and functional limitations following TKA

Numerous studies have identified various impairments and functional limitations in patients who have undergone TKA. Functional limitations include decreased mobility as measured by the timed up and go (TUG) (Rossi et al 2006) and decreased walking speed (Walsh et al 1998) as well as decreased stair climbing ability (Walsh et al 1998) on objective measurement. Impairments that have been identified include quadriceps weakness (Bhave et al 2005, Mizner et al 2005b, Walsh et al 1998), knee flexion contracture (Bhave et al 2005), loss of knee flexion ROM (Bhave et al 2005, Davies et al 2003) and balance impairments (Gage et al 2008).

Bhave et al (2005) identified five main impairments in a group of patients who developed functional limitations following TKA. These were flexion contracture, quadriceps weakness, knee flexion deficit, peroneal nerve symptoms and malalignment. While this paper does not provide statistical evidence for cause and effect relationships, there are detailed clinical findings of the causes of the impairments and the symptoms thereof. These findings could form the basis of extensive statistically based investigation into cause and effect relationships. This could then extend to the formulation of hypotheses relating to better targeted treatment of patients with functional limitations post TKA. Targeted treatment of specific impairments or functional limitations is a way of streamlining a clinical pathway, as opposed to merely listing a ‘recipe’ of generic treatment to be carried out. Therefore, the CPG should include clear definitions of these impairments to facilitate the presentation of a clear clinical pathway.

2.7.4.1.1 Knee flexion contracture

A knee flexion contracture can be defined as a lack of ten degrees or more of knee extension ROM (Bhave et al 2005) or 15° or more (Kim et al 2004). In the large sample examined by Kim et al (2004) one percent of patients had a knee flexion contracture by their definition. Knee flexion contracture (or knee extension angle) has been shown to be influenced by intra-operative soft tissue tension (Asano et al 2008). There have been no explanatory studies investigating the role of physiotherapy modalities in reducing tissue tension post TKA. The physiotherapy techniques aimed at decreasing tissue tension should be investigated for their role in improving knee flexion contracture, otherwise it will be difficult to justify the inclusion of soft tissue treatment into a CPG.

2.7.4.1.2 Loss of quadriceps strength

Quadriceps weakness has been defined as an extensor lag greater than 15° (early phase), or a deficit of more than 50% of the contralateral limb on isokinetic testing (late phase) (Bhave et al 2005). Weakness can also be expressed as a percentage loss of maximum voluntary contraction. Patients undergoing TKA are subject to a marked loss of quadriceps strength post-operatively, compounding their less than average strength pre-operatively (Mizner et al 2005b, Berth et al 2002). It is apparent that this loss of strength, particularly in the first few months post surgery, is predominantly due to loss of voluntary muscle activation (Mizner et al 2005b, Berth et al 2002) rather than a loss of muscle mass. It has also been shown to be even less influenced by pain (Mizner et al 2005b, Mizner et al 2003). The implications of these findings for CPG development are discussed in section 2.7.4.2.1.

2.7.4.1.3 Knee flexion deficit

A knee flexion deficit can be defined as knee flexion ROM less than 90 degrees at one year post surgery (Gandhi et al 2006). It has also been defined as less than 75° of flexion (Kim et al 2004). Prevalence of knee flexion contracture has been shown to be approximately one percent (Kim et al 2004). Patients who do not gain sufficient knee flexion ROM by the time of discharge from the acute care setting, have been shown to require significantly more out-patient therapy than those who do (Davies et al 2003). An older study has shown that knee flexion ROM does not

change much after one year post-surgery (Parsley et al 1992), suggesting that early intervention is important if physiotherapy is to play a role in improving this. The implications of these findings for CPG development are discussed in section 2.7.4.2.2.

2.7.4.1.4 Balance impairments

Patients who have undergone TKA have demonstrated delayed postural responses in both legs when tested at approximately eight months post surgery (Gage et al 2008). Since the deficit was not limited to the operated leg in this study, it is purported that the reorganisation of the motor response occurs at the level of the central nervous system. This affects the way in which balance is rehabilitated in these patients. A very recent preliminary study has shown that inclusion of balance training into a functional exercise training program may lead to better functional outcomes (Piva et al 2010). This is an area that requires further investigation by physiotherapists in order to justify the inclusion of balance training in a CPG.

2.7.4.1.5 Locomotor deficits

Ouellet and Moffet (2002) studied the gait pattern and functional locomotion of a small (n=18) sample of patients who underwent TKA. Walking speed, cadence and stride length were decreased compared to normal controls both pre-operatively and at two months post surgery. Walking speed was significantly less post-operatively than it had been prior to surgery. The patients showed a decrease in support moments around the hip, knee and ankle and all locomotor deficits were more marked at two months post surgery than pre-surgery. Knee flexion and ankle dorsiflexion were decreased during the swing phase and hip flexion was increased. These impairments measured in the laboratory also had functional implications as reflected by the poor scores on the TUG and 6MWT. While this study is of a small sample, it highlights some useful aspects to consider when re-training gait in patients who have undergone TKA. This level of detail, if incorporated into a CPG, will enhance the concept of gait re-education, again encouraging specific intervention as opposed to generic treatment.

2.7.4.2 Physiotherapy Interventions

2.7.4.2.1 Quadriceps strengthening

The importance of regaining quadriceps strength post TKA cannot be over-emphasised. It has been shown to be a strong predictor of functional outcome (Petterson et al 2009, Mizner et al 2005c). Although studies have shown that a decrease in volitional activation plays a large part in post-operative weakness (Mizner et al 2005c, Berth et al 2002), treatment by neuromuscular stimulation has yet to be shown to be superior to targeted progressive and traditional strengthening exercises (Monaghan et al 2010, Pettersen et al 2009). As is the trend with recent research on this topic, the prescription of the strengthening exercise in the study by Pettersen et al (2009) was patient specific, rather than following a generic protocol, and the above average functional results may well be attributed to this. This research supports the idea that strengthening exercises should be individually prescribed and based on objective assessment. What remains to be investigated is whether other interventions aimed at improving activation (for example, manual facilitation) are superior to conventional strengthening programmes.

Guideline implication: The CPG must include sufficient detail on strength assessment and strengthening treatment, in order to ensure patient specific strengthening is prescribed.

2.7.4.2.2 Treatment to improve range of motion

A successful outcome is dependent on a minimum range of motion. Approximately 65° of knee flexion is required for a normal swing phase of gait, 90° of flexion is required for stair descent and 105° of knee flexion is required to rise from a chair while weight bearing. If full knee extension is lacking, energy requirements of gait and patella-femoral joint reaction forces are increased. Two dated studies (Worland et al 1998, Nadler et al 1993) compared CPM with standard physiotherapy post discharge from acute care, and neither found any significant benefits from CPM. A recent study by Kim et al (2009) investigated the value of physiotherapy passive mobilisation in improving post operative range of motion. The subjects all had bilateral staged procedures and therefore served as their own controls. At six months post surgery, there was no significant difference

between the groups with regards to flexion ROM, KSKS and WOMAC. No single intervention has been shown to significantly improve ROM over any other intervention, therefore a CPG cannot endorse any single form of treatment to improve ROM. However, logic dictates that post-operative management must include some form of mobilisation to ensure knee mobility post-surgery. Explanatory studies are required to inform selection of one method of improving ROM over another. Alternatively, therapy to improve ROM can be incorporated into a multifaceted treatment approach as discussed in section 2.7.4.2.3.

2.7.4.2.3 Exercise

Trials targeting specific impairments have been discussed in the preceding sections. The trend in more recent physiotherapy research, while being impairment-based, is to trial a complete and comprehensive clinical pathway or treatment programme. This pragmatic form of research is in contrast to more explanatory trials which investigate the effect of one modality on one or two impairments and outcome measures. Since three of the main goals post TKA are to regain mobility and strength of the knee, as well as function, it is obvious that some form of multi-faceted exercise therapy should form part of the post-operative intervention. Thus, this section will deal with evidence for various exercise interventions.

Exactly what exercise intervention to include in the CPG should be guided by the literature. There are many parameters to consider when designing an exercise intervention. Besides the usual exercise parameters of intensity and frequency, are the issues of location (home versus clinic based), type (functional versus traditional) and mode of delivery (class versus individual, verbal versus written versus video instruction).

A randomised controlled trial by Frost et al (2002) showed that traditional home exercise and functional home exercise did not yield significantly different outcomes. Their sample size was small, and this warrants further investigation since they did show a trend in favour of functional exercise.

Hydrotherapy as an alternative mode of exercise prescription for patients post TKA was investigated by Harmer et al (2009). This randomised trial showed a water-based exercise programme was not superior to a comparable land-based exercise programme in terms of functional outcome and ROM. The hydrotherapy

intervention in this study commenced two weeks post surgery and the results are in contrast to the study by Rahmann et al (2009) discussed in section 2.7.3.6 in which hydrotherapy was commenced on POD 4.

The intensity and nature of the exercise intervention is important and as demonstrated by Moffet et al (2004), an intense and functional rehabilitation programme can lead to significantly better short and mid-term function when compared with a standard intervention. This particular intervention was conducted in the second to fourth post-operative month, which makes sense from a post-operative healing point of view. What is notable from the rehabilitation programme used is that the majority of the 'functional exercises' were closed chain quadriceps strengthening exercises. It must also be noted that the programme was individually tailored for each patient, as is the current trend in this type of research.

Guideline implication: While multi-faceted exercise therapy may be an effective management strategy post TKA, the CPG should still allow for interventions to be tailored to individual patient needs.

In the private sector in South Africa, many patients are turning to alternate forms of exercise therapy, such as the Pilates system of exercise. While no clinical trials have compared the efficacy of Pilates with any type of conventional rehabilitation, a recent report shows that it is associated with a positive outcomes post total knee arthroplasty (Levine et al 2009). This type of rehabilitation addresses the global strength of the spine and lower quarter and theoretically should be beneficial for patients who have undergone TKA, especially those who desire a higher level of function. Based on the report by Levine et al (2009) it is an area that warrants further investigation, but there is still insufficient evidence to include it in a CPG.

2.7.5 Scheduling and mode of delivery of physiotherapy for patients undergoing TKA

In view of the increasing demand for TKA and therefore the associated rehabilitation, it is important for research to not only focus on content, but also the scheduling and mode of delivery of services.

Scheduling of treatment refers to the timing of the intervention, for example commencement of post-operative care beginning on day of surgery versus the day after surgery, or inclusion of bi-daily therapy or not. Another issue of scheduling is the use of routine weekend physiotherapy or not. Clinical reasoning dictates that

this should depend on the day that the surgery was performed (and to an extent how the patient is progressing), but this is not always taken into account in the literature on post-operative interventions. Patients who have their surgery on Friday are likely to have different needs for weekend physiotherapy than patients who have their surgery on a Tuesday. This concept is demonstrated by the results of a study by Husted et al (2008), in which patients who had surgery on Thursday had physiotherapy only on Friday and not again until Monday, and patients who had surgery on Friday had physiotherapy on Saturday and then again on Monday. Patients who had their surgery on Monday, Tuesday or Wednesday had physiotherapy only during the week and most were discharged by the weekend. Patients who had their surgery on Tuesday had the shortest LOS and patients who had their surgery on Thursdays had the longest hospital stay. These results showed a positive effect of physiotherapy within the first three days post surgery. Weekend physiotherapy (or rather, lack thereof) had an impact on LOS in those patients who had their surgery on Thursday or Friday, but no negative impact on patients who had been operated on earlier in the week. These findings should be taken into account when reviewing trials that evaluate the effect of weekend physiotherapy, particularly on short term outcome measures.

A further issue relating to scheduling is whether post-operative physiotherapy intervention should commence on the day of surgery or the day after surgery. A study such as that of Renkawitz et al (2010) began treatment on the day of surgery in an experimental group in order to optimise an accelerated protocol, but early improvement did not surpass the control group beyond eight days post surgery.

Mode of delivery refers to the format and setting of the intervention, for example home-based versus clinic-based, group versus individual. One such study conducted in Australia by Coulter et al (2009) has shown that a class-based exercise intervention was more efficient than their current home-based one-to-to one intervention, with no loss of efficacy. This study investigated a mixed sample of knee and hip replacements, resulting in a relatively small sample of knees included. The concept however provides a basis for further investigation.

A study by Rajan et al (2004) showed that attending out-patient physiotherapy has no benefit over standard in-patient therapy and a well-structured home program. In this paper, the content of the out-patient therapy is not described and neither is the

home program, limiting the interpretation of the results. Also, their sample was taken from a select group of patients, who pre-operatively had less than 40 degrees of flexion contracture and could walk at least 10m unaided, thus excluding patients with severe impairments and functional limitations. Another study by Kramer et al (2003), in which the out-patient intervention was better described, showed similar results. In this study, as in the study by Rajan et al (2004), all patients were given a structured home exercise program. The sample in the study by Kramer et al (2003) was also not limited to less severe cases.
Thus it can be seen that issues pertaining to scheduling and mode of delivery still require further investigation. Parameters to be investigated include when to commence post-operative intervention, routine referral to out-patient therapy (or not), whether out-patient therapy should be home-based or clinic based and whether it should be class-based or administered one-on-one. There is currently insufficient evidence from the literature with regard to scheduling, with which to make a conclusive recommendation to inform a CPG.

2.7.6 Summary of physiotherapy management of patients post TKA

In terms of pre-operative physiotherapy, various interventions are currently being used in Australia (Ackerman & Bennell 2004b), despite the lack of evidence. A survey of current practice by Naylor et al (2006) highlighted numerous areas of non-uniform practice amongst physiotherapists. These included the use of CPM and cryotherapy in the acute care setting, modes of post-acute rehabilitation, criteria for discharge from rehabilitation and outcome measures. No specific comparisons were drawn with regard to uniformity and the level of evidence for each aspect, but as the authors highlight, the lack of consistency may be a sign of the value (or lack thereof) placed on the specific aspect of management. As shown in the preceding sections, there is indeed inconsistent evidence with regard to the use of CPM and cryotherapy, as well as modes of post-acute rehabilitation and the use of outcome measures.

2.7.7 Conclusion

It is clear from the trials reviewed that there is still relatively little evidence for physiotherapy interventions. The research is clear about what does not work, but

further research is required to establish what does work. This makes it difficult to make recommendations for a CPG.

When looking closely at the results of most clinical trials, it is evident that there is a percentage (usually around 10%) of patients who do not attain an optimum outcome post-operatively, while the rest of the patients attain the desired outcome regardless of what physiotherapy intervention they receive, a finding also highlighted by Ranawat et al (2003). This highlights the need for early identification of patients who may be predisposed to a poor outcome and the implementation of patient-specific, impairment directed treatment plans. A CPG should include a profile of these patients.

More recent studies have used patient-specific clinical pathways as opposed to absolute treatment protocols (for example Lenssen 2006) and this is indicative of the acknowledgement that patients are not a uniform population, and that treatment should be tailored to the individual within well-informed parameters and evidence-based guidelines.

2.8 SUMMARY OF CHAPTER 2

This literature review was conducted to provide some perspective on the rehabilitation of patients undergoing total knee arthroplasty to inform the four studies in this thesis as well as inform the process of CPG development. It provides some insight into the underlying pathophysiological processes occurring in a patient with osteoarthritis of the knee, as well as the clinical presentation. This provides insight into the kind of patients that could be expected to undergo a TKA. Outcome measurement in rehabilitation post TKA was briefly reviewed. The focus was then shifted to the factors that can affect the outcome post TKA, with particular emphasis on the outcomes which are more relevant to physiotherapists. Physiotherapy intervention for patients undergoing TKA was covered from the pre-operative phase to outpatient rehabilitation. The literature review closed with an overview of clinical practice guideline development.

CHAPTER 3

STUDY 1

3.1 INTRODUCTION

During the preparation phase of CPG development, appropriate outcome measures must be selected for the validation and impact evaluation of the CPG. This part of the process will be facilitated by some evidence of what outcome measures have been shown to be valid and reliable for the population in question. Numerous outcome measures that have been used for patients post TKA internationally were reviewed in Chapter 2. The three that were selected for testing in this study were the Oxford Knee Score (OKS), the EQ-5D and the Knee Society Knee Score (KSKS). Rationale for this selection was presented in Chapter 2.

The Oxford Knee Score (OKS) (Appendix 1) is a simple 12-item questionnaire, devised to establish the patient's perception of outcome post TKA using questions related to functional tasks. It has been shown to be valid and reliable (Garratt et al 2004, Davies 2002, Dawson et al 1998). The OKS has up to this point never been used in South Africa and has never been translated into any of the eleven South African languages.

This study did not set out to investigate the validity and reliability of the EQ-5D since there was published evidence of it having been used in a Southern African population (Jelsma et al 2004). Likewise, the KSKS is a validated measure and the reliability when used by the researcher in the proposed research setting has been established (Gopal et al 2010, Appendix 6)
The KSKS were included in *this* study to establish convergent validity of the OKS in this population. The EQ-5D was included in this study to pilot it for use specifically in a South African population undergoing TKA.

3.2 AIMS AND OBJECTIVES

The aim of Study 1 was to establish the face validity and test-retest reliability of the Oxford Knee Score (OKS) within a South African context. A secondary aim was to pilot the EQ-5D for use in a South African population undergoing TKA.

This involved:

- Establishing face validity of the OKS within a South African context.
- Translating and back-translating of the questionnaire into Zulu and Southern Sotho (the two most commonly spoken languages in the area in which the study was conducted).
- Establishing the reliability and the convergent validity of the questionnaire within each language group.

3.3 METHOD

3.3.1 Validity of the OKS

The content of the OKS was assessed for relevance in the South African context. The face validity of the questionnaire was also established for the study population to ensure that the questions were relevant and unambiguous (Seale and Barnard 1998). This was done by discussing the questionnaire with various professionals as described below.

3.3.1.1 Subjects

The participants included an orthopaedic surgeon from Johannesburg Hospital, physiotherapists from the University of the Witwatersrand specialising in the area of Public Health and physiotherapists working clinically in the field of orthopaedics.

3.3.1.2 Ethical considerations

Participants were invited to participate and were free to decline. Ethical clearance was granted by the University of the Witwatersrand Human Research Ethics Committee (Medical) (protocol number M060109) (Appendix 2).

3.3.1.3 Tools

The Oxford Knee Score (Appendix 1).

3.3.1.4 Procedure

- Participants were given copies of the questionnaire, accompanied by aims and objectives of the study
- Participants were requested to comment on the content of the questionnaire, specifically the relevance of the questions within a South African context.
- Comments and responses were recorded in writing by the researcher.

3.3.2 The translation process

An English version of the OKS was sent to professional translators, where it was translated into Zulu and Southern Sotho. These translated versions were given to two first language speakers of each language. One person had a medical background and the other not. Their instructions were to translate the questionnaire back into English. The two back-translations were compared for any discrepancies and assessed for accuracy. Where differences in meaning existed, the question was discussed with a third party who was proficient in both English and the translated language. This followed the procedure described by Beaton et al (2000).

3.3.3 Reliability of the OKS

3.3.3.1 Study Design

Correlational study

3.3.3.2 Subjects and sampling method

Subjects were recruited from an academic tertiary care public hospital in Gauteng, South Africa, according to the following inclusion and exclusion criteria.

Inclusion criteria:

- Diagnosis of osteoarthritis prior to surgery
- Unilateral procedure
- Between three months and one year post-surgery
- First language English, Zulu or Sotho

Exclusion criteria:

- Subjects who were not walking (independently or with a walking aid) prior to surgery
- Revision surgery
- Pre-existing septic arthritis or condition that may compromise TKA outcome eg. Charcot's joints, Paget's disease, severe osteoporosis
- Patients with neurological disorders that may have affected the outcome of TKA
- Patients with infectious diseases
- Metastatic disease

Consecutive sampling was used. According to Beaton et al (2000) a sample of approximately 30 subjects per language should be attained for the preliminary testing. The full sample was not attained in this study for reasons discussed in section 3.4.2.

3.3.3.3 Ethical considerations

Permission for the study was granted by the superintendent of the hospital (Appendix 2). Subjects were invited to participate and were free to decline without being disadvantaged in any way. They were provided with information about the study and questions were addressed. After signing informed consent (Appendix 3), anonymity was maintained by allocating numbers to the questionnaires. Names and contact details were kept on a list for follow up, but did not appear on the questionnaires.

3.3.3.4 Tools

The OKS, the EQ5D and Knee Society Knee Score were used.
The English, Zulu and South Sotho versions of the OKS and the EQ5D were used.

3.3.3.5 Procedure

- Files of patients attending the clinic for a three month to one year follow-up were screened to ascertain which patients met the inclusion criteria.
- A consecutive sample of those patients, were invited to participate in the study and were given an information sheet.

- Subjects were offered the questionnaire in their language of choice for reading and writing. If their first language was not English, but they chose and English questionnaire to complete, they were offered the choice of also completing a questionnaire in their first language.
- The questionnaires (OKS and EQ-5D) were given to the subject to complete independently, before being seen by the surgeon. The KSKS was then carried out by the researcher.
- The subjects were given copies of the questionnaires as well as a stamped and addressed envelope with the instruction to complete the questionnaires within 5 days and post them back to the researcher.
- Subjects who were completing questionnaires in two languages were given the first questionnaire in the alternative language to fill in at home the following day. Their instructions with regard to the two follow-up questionnaires were to then complete them a week later, but with one day between each one. They then returned the three questionnaires in the mail.
- This procedure was repeated over consecutive weeks until 35 subjects had been recruited.

3.3.3.6 Analysis of data

Intra-class correlation co-efficients were calculated to establish agreement between the first and second questionnaire completed by each subject.
The scores of the questionnaires were compared with one another and with the KSKS to ascertain convergent validity, established by calculating the intra-class correlation co-efficient. Internal consistency within each language was calculated using Cronbach's alpha. According to DeVellis (1991), an alpha of less than 0.6 is considered unacceptable, between 0.65 and 0.7 is minimally acceptable and above 0.8 is considered very good.

3.4 RESULTS

3.4.1 Face validity of the OKS within a South African context

The group of professionals that was convened to discuss the face validity of the OKS within a South African context agreed that it did not require any cultural

adaptation. The questionnaire could be translated directly from the available English version.

3.4.2 The sample

Recruitment took far longer than anticipated. Many patients declined to participate in the study. The main reason they gave is that they were afraid that the process would prolong their visit to the clinic, despite clear explanation that it would be conducted while they were in the queue awaiting X-rays. Over a period of nine months only 35 subjects met the inclusion criteria and agreed to participate. The 35 subjects completed the questionnaires as tabulated below.

Table 3.1 Language profile of the sample (n=35)

n=	*First language*	*Language choice for questionnaire*
10	English	English
12	Zulu	Zulu (n=4)
		English (n=1)
		Zulu and English (n=7)
13	S. Sotho	S. Sotho (n=3)
		English (n=3)
		S. Sotho and English (n=7)

There were slightly more Southern Sotho and Zulu speaking subjects than English speaking subjects. As a result of some subjects completing two questionnaires, there were more questionnaires than subjects in the sample. The number of questionnaires completed in each language is shown in Table 3.2.

Table 3.2 Profile of the sample according to completed questionnaires (n=49)

	English	*Zulu*	*S. Sotho*
n=	28	11	10
Returned	18	8	7
Age	61	57	63
Gender (F:M)	25:3	11:0	10:1
First language	10	4	3
Preferred English to first language	15	6	5
No preference	3	1	2

Of the subjects who completed English questionnaires, 18 were not first language English speakers. Fewer Zulu and Southern Sotho questionnaires were completed than the number of first language speakers recruited because three South Sotho speakers and one Zulu speaker chose to only complete an English questionnaire. A total of 49 questionnaires were completed by the 35 subjects.

3.4.3 Reliability of the OKS

Reliability of the OKS was established by calculating a Pearson correlation-coefficient. The reliability could only be calculated using the data sets from subjects who returned the second questionnaire in the mail. Thirty-one questionnaires were returned in the mail. The reliability within each language is presented in Table 3.3.

Table 3.3 Reliability of the OKS in each language (n=31)

Language	*Proportion first language*	*Mean OKS 1*	*Mean OKS 2*	*ICC*
English (n=18)	5	34	34	0.94
Zulu (n=8)	5	34	34	0.97
S. Sotho (n=7)	5	35	34	0.96

There was excellent correlation between the first and second questionnaires within each language. The samples of Zulu and South Sotho questionnaires were too small to make any inferences, but the sample of English questionnaires showed excellent agreement. What is noteworthy is that the majority of the English questionnaires were completed by subjects whose first language was not English, but the reliability was still good.

Since there were 14 subjects who completed questionnaires in English as well as their home language, the correlation between the scores of an English questionnaire and a home language questionnaire could be established. These results are presented in Table 3.4.

Table 3.4 Correlation between English OKS and home language OKS (n=14)

English OKS (n=14)	*Home language OKS (n=14)*	*ICC*
39	38	0.94

There was good correlation between how the subjects scored the English version of the OKS and the translated version of the OKS in their home language.

3.4.4 Internal consistency and convergent validity of the OKS

When it became apparent that most patients preferred to answer English questionnaires, the reliability of the translated questionnaires became less of a priority. Assessing the use of the English version by subjects whose first language was not English seemed a more valuable way of exploring this outcome measure. Internal consistency (IC) provides an indication of how accurately the individual items on an outcome measure (such as the OKS) measure a single underlying construct. The internal consistency of the OKS has been established (Dawson et al 1998). Establishing the IC of the English version when used by Zulu or South Sotho speakers provided some insight into how accurately they completed it and therefore how well they probably understood it. Likewise, establishing convergent validity of the OKS with a more objective measure like the KSKS may also be an indication of whether subjects have understood the OKS and answered appropriately. Cronbach's alpha was calculated for all questionnaires, despite the small sample sizes in the African languages. The results are shown in Table 3.5.

Table 3.5 Cronbach's alpha for all questionnaires (n=49)

Question	*English (n=28)*	*Zulu (n=11)*	*S. Sotho (n=10)*
1	0.94	0.93	0.94
2	0.94	0.93	0.94
3	0.94	0.92	0.94
4	0.95	0.93	0.94
5	0.94	0.93	0.94
6	0.94	0.92	0.94
7	0.95	0.94	0.96
8	0.94	0.92	0.94
9	0.94	0.94	0.94
10	0.94	0.92	0.94
11	0.93	0.92	0.94
12	0.94	0.92	0.96
Average alpha	**0.95**	**0.93**	**0.95**

The Zulu and South Sotho samples were too small to calculate a meaningful Cronbach's alpha.

Convergent validity was established by calculating a correlation co-efficient between the OKS with the KSKS. Since a higher KSKS denotes a better knee and a lower OKS denotes a better knee, the co-efficient is negative.

Table 3.6 Convergent validity of the OKS with the KSKS (n=49)

Language	*Mean KSKS*	*Mean OKS*	*r =*
English (n=28)	65	35	-0.64
Zulu (n=11)	73	36	-0.46
S. Sotho (n=10)	59	36	-0.92

The correlation of the OKS with the KSKS was excellent in the South Sotho questionnaires (-0.92), fair in the English questionnaires (-0.64) and poor in the Zulu questionnaires (-0.46).

3.4.5 The EQ-5D

As mentioned in the introduction to this chapter, the EQ-5D was to be used to establish convergent validity with the OKS. Early on in the study it became

apparent that it was not going to be a suitable outcome measure in this sample. Of the 49 questionnaires that were completed at recruitment, 33 were returned in the post. Of the returned questionnaires, nine did not complete all or part of the EQ-5D. Of the initial 49 questionnaires, eight subjects did not complete the VAS part of the E-5D. For these reasons, no further analysis of the EQ-5D was conducted. Further issues around the EQ-5D will be discussed in section 3.5.

3.5 DISCUSSION

3.5.1 Recruitment and sampling

The prolonged recruitment period, due to the patients' reluctance to participate, can be understood with some insight into the current situation at the follow-up clinic of the hospital where the study took place. Patients arrived early to pay their fee and collect their files. They simultaneously obtained an x-ray request from the doctor. Once they handed in the x-ray request form, they may have had up to a two-hour wait before having their x-ray taken. They then waited again to see the doctor (often up to an hour) and thereafter they usually went to the pharmacy, where they queued once again. The patients knew that if they were delayed at x-ray, their whole visit would run into hours. This is why they did not want to run the risk of being delayed at x-ray (despite explanations that the testing would only take a maximum of 20 minutes) and they therefore declined to participate in the study.

3.5.2 Questionnaire language choices

A high proportion (72%) of subjects whose first language was not English, chose to complete the questionnaires in English. Most stated that they preferred English when reading and writing even though it was not their first language. This suggests that patients felt more proficient in reading English than their first language. This trend cannot be directly attributed to the history of education in South Africa, as most of these subjects would have been educated during the apartheid era, under the Bantu Education Act of 1953. The policies of this act included a primary education in the mother tongue and a secondary education in English or Afrikaans. Around the time these subjects would have been at school, very few African language speakers reached senior secondary level, with only 595 candidates writing matric in 1955, and the number growing to only 9595 by 1976

(Heugh 1999). Therefore, from a historical point of view, it is unclear as to why this generation (of the sample) preferred to answer English questionnaires, unless they learned to read outside of school and were taught in English. Regardless of the reason, the fact remains that most patients preferred to complete English questionnaires, despite their home language.

3.5.3 Reliability, internal consistency and convergent validity of the OKS

Test-retest reliability of the questionnaires that were returned was excellent. In the subjects who answered in two languages, the correlation of scores between the two languages was also excellent. The fact that the reliability of the English questionnaires was so good, despite the majority of the subjects not being first language English speakers, indicates that an English version of the questionnaire may be appropriate to use in this setting. Further support for this is that many subjects preferred to read and write in English. The concern is the minority of subjects who preferred the Zulu or South Sotho version of the questionnaire. While the reliability for both of these versions was excellent, the sample size was very small within each language. For the translated versions to be endorsed by the CPG, further testing with a larger sample would be required. At this stage it did not seem feasible, due to the small number of subjects who actually required it (only 7 out of 35 subjects).

Guideline implication: The English version of the OKS is a valid and reliable measure in this population. Since part of the preparation phase of CPG development includes prioritisation, it must be stated that the findings of study 1 show that translation of outcome measures is not a priority at this stage.

3.5.4 The EQ-5D

One of the problems encountered with the EQ-5D was that the subjects found it difficult to choose between option 1 or 2 on the index, particularly in the first four domains. Although it was explained that they should choose the option that best describes how they feel, they reported that they could not say ‘no problem’, but also did not feel that their symptoms were severe enough to warrant ‘moderate’. This is in line with the findings of Fransen & Edmonds (1999) and indicates that in

this type of sample, the EQ-5D may not be sensitive enough to be used in isolation as a measure of post-operative outcome.

The other problem with using the EQ-5D was the VAS. Subjects did not understand how to express their response to the VAS. Although this issue does not seem to be reported in any previous South African literature on the EQ-5D, the difficulties observed with use of the VAS are not unique to this sample (Yazbek et al 2009).

3.5.5 Further observations

Despite the reliability, convergent validity and internal consistency of the English and translated versions of the OKS, the issue of functional literacy must be mentioned, without which this chapter would be incomplete and inaccurate.

It may appear from the results in this chapter that the subjects had a sufficient level of literacy to complete a questionnaire, as indicated by their reliable use of the OKS. However, it must be noted, anecdotally, that many of the subjects needed an explanation and often a demonstration of how to physically complete the questionnaire. Reading the questions and selecting an answer did not pose any problems, but subjects were unsure of how to express their selected answer. This finding is not unique to this population (Yazbek et al 2009).

Guideline implication: The issue of functional literacy may not prohibit the use of questionnaires in this patient group, but allowances must be made in terms of staff and time for the subjects to be properly orientated as to how to fill in the questionnaire.

3.6 SUMMARY OF THE CHAPTER

Provided patients feel comfortable using English questionnaires and the questionnaires are being used reliably, it is appropriate to use an English version of the OKS in this population. It showed excellent test-retest reliability, good convergent validity with the KSKS and excellent internal consistency. The CPG can endorse the use of the OKS for evaluating the impact of the CPG. The EQ-5D was not an appropriate outcome measure in this sample, and alternative measures for quality of life must be considered for inclusion in the CPG.

CHAPTER 4

STUDY 2

4.1 INTRODUCTION

During the organisation phase of CPG development, it is important to identify relevant stakeholders. Physiotherapists working in the field are an obvious inclusion, but in order to select participants who are representative of these stakeholders, it is necessary to establish their profile. This will also provide some insight into who will be implementing the CPG.

Establishing current practice amongst physiotherapists, and establishing where there is and isn't consensus, justifies the need for a CPG and also prioritises which aspects of physiotherapy management must be included in the CPG. Currently, no practice guidelines for the physiotherapy management of patients post TKA in South Africa exist. Therefore, the only way to establish current practice was by means of a survey.

4.2 AIMS AND OBJECTIVES

The aim of the study was to establish current practice in the management of patients undergoing TKA in South Africa. A secondary aim was to establish a profile of the physiotherapists working in the field.

This involved:

- Establishing a database of physiotherapists with an interest in orthopaedic physiotherapy (ie physiotherapists likely to be involved in the management of patients post TKA).
- Developing a questionnaire in order to survey the current treatment approaches used by physiotherapists with patients undergoing TKA
- Administration of the questionnaire in a manner that ensured an acceptable response rate.
- Descriptive analysis in order to establish trends in referral patterns and treatment modalities.
- Analysis in order to establish any relationship of the clinical situation and level of experience to treatment patterns and modalities.

4.3 METHOD

4.3.1 Study Design

A questionnaire-based survey

4.3.2 Subjects

The sample consisted of physiotherapists practicing in South Africa, currently members of the South African Society of Physiotherapy and listed in the directory of private practitioners as having a special interest in musculoskeletal rehabilitation, as well as physiotherapists working at public tertiary care hospitals where total knee arthroplasties are performed. There were approximately 645 physiotherapists who met these criteria.

4.3.3 Ethical considerations

As described for Study 1. An information letter accompanied the questionnaire. The return address was not directly to the researcher. The questionnaires were then forwarded anonymously to the researcher for data capturing.

4.3.4 Tools

The questionnaire (Appendix 4) was developed by the researcher, based on current literature. An expert group was convened to discuss the content validity of the questionnaire and alterations were made according to their recommendations. The expert group consisted of four physiotherapists. Two of which were clinical physiotherapists working with patients undergoing going TKA, who had 40 and 20 years of experience respectively. The other two members of the group were selected for their academic background. One was a postgraduate student who was working in the field and one was a full time academic. The questionnaire was then piloted on seven physiotherapists to ensure readability and establish time taken to complete it.

4.3.5 Procedure

- Due to database protection, it was necessary to obtain e-mail addresses for each potential subject via a telephone call, which was a time-consuming

and financially costly procedure. Addresses were obtained for 645 physiotherapists.

- The questionnaire was distributed electronically. A reminder was sent monthly for a period of four months, in which participants were asked to only complete the questionnaire if they had not already done so.
- Responses were either returned electronically and printed, or faxed back.

4.3.6 Data analysis

Descriptive statistics were used to describe the main findings. Frequencies of the different treatment approaches are presented. Fisher's-exact tests were used to establish significant differences in distribution of findings between various groups.

4.3.7 Time scale

The survey was conducted over a period of six months. The first two months were spent establishing the database and obtaining e-mail addresses. The questionnaire was then sent out and reminders were sent at monthly intervals. After four months no further reminders were sent and data analysis began. During the data collection phase, questionnaires were also offered manually to physiotherapists attending meetings and courses. All these physiotherapists had been listed in the original data base.

4.4 RESULTS

In this section the results of the e-mailed survey are presented. The survey was conducted to establish current practice of physiotherapists regarding the management of patients post TKA.

4.4.1 Response rate

The response rate is tabulated in Table 4.1.

Table 4.1 Response rate

Type of response	Number (n=645)	Percentage
Blank mail	99	
Other	1	
Completed returns	62	
Total responses	**162**	**25**
Non responders	483	75

The response type blank mail is indicative of a physiotherapist who received the questionnaire, but was not actually involved in the management of patients undergoing total knee arthroplasty, despite fitting the inclusion criteria. In the category 'Other', one response indicated that the physiotherapist was recently deceased.

4.4.2 Clinical situation and experience of responders

4.4.2.1Current clinical situation of responders

The current clinical situation of responders who were treating patients undergoing TKA at the time of the survey is shown in Table 4.2.

Table 4.2 Breakdown of current clinical situation of responders (n=62)

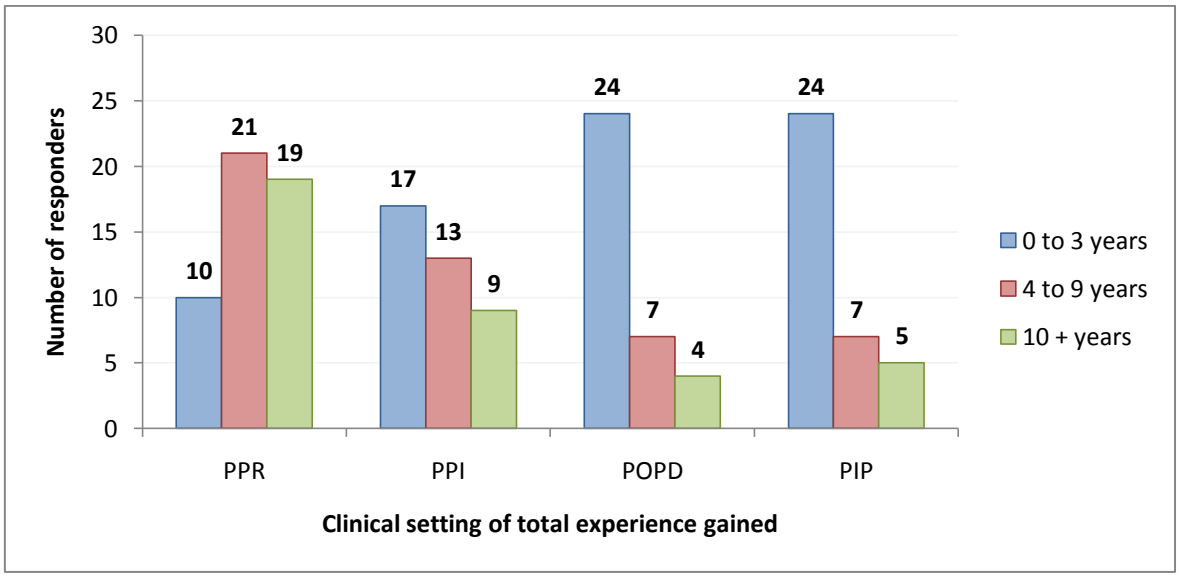
Sector	n= (%)	Situation within Sector	n=
Private Sector	49 (79)	OPD only	27
		OPD and IP	19
		IP only	3
Public Sector	13 (21)	OPD only	2
		OPD and IP	6
		IP only	5

OPD = out-patients; IP = in-patients

Table 4.2 shows the breakdown of the current clinical situation of all responders (n=62). The majority of responders (79 percent) were working in private practice and predominantly in out-patients.

4.4.2.2 Clinical experience of responders

Figure 4.1 shows a profile of the overall clinical experience of responders, regardless of their current clinical situation.



PPR = private practice out-patients; PPI = private practice in-patients; POPD = public sector out-patients; PIP = public sector in-patients

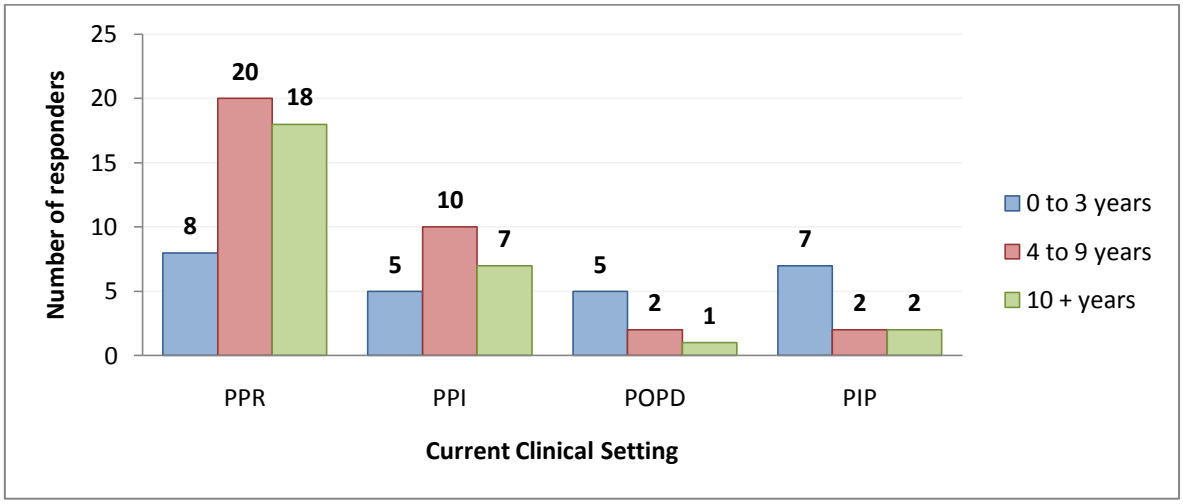
Figure 4.1 Overall clinical experience of responders (n=62)

Figure 4.1 shows that a substantial number of responders had some experience working in a public hospital (despite the fact that they no longer work in that setting as reflected by Table 4.2). This is confirmed by the fact that of the 49 responders who were working exclusively in the private sector, 26 reported that they had some experience working in the public sector. In the private sector, there were a higher proportion of experienced physiotherapists working with out-patients and there were a higher proportion of physiotherapists with less experience working in in-patients. Therefore, physiotherapists working with out-patients tended to have more clinical experience than physiotherapists working with in-patients. In the public sector, the level of experience of physiotherapists did not differ between in-patients and out-patients.

4.4.2.3 Levels of experience in current clinical situation

What is more useful than an overview of clinical experience (as presented in section 4.4.2.2) is an indication of how experienced the physiotherapists working in the different clinical situations were.

Figure 4.2 shows the total clinical experience of responders working within each clinical setting at the time of the survey.



PPR = private practice out-patients; PPI = private practice in-patients; POPD = public sector out-patients; PIP = public sector in-patients

Figure 4.2 Total experience of physiotherapists with each current clinical setting (n=62)

Most responders (38) who were working in out-patients in a private setting had at least four years total experience.

Figure 4.3 depicts what the responders' total level of experience was within each of the current clinical situations.

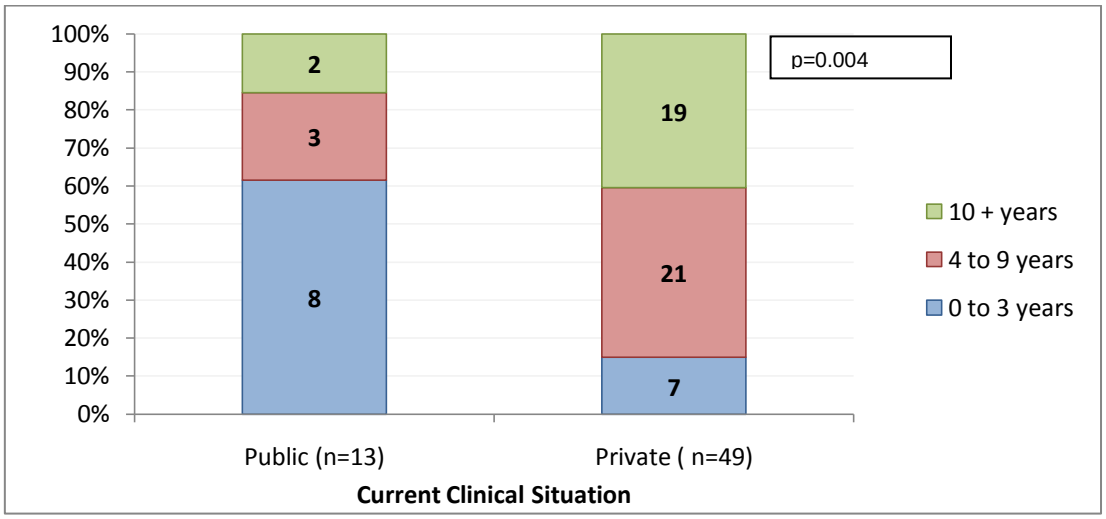


Figure 4.3 Level of experience of physiotherapists currently working in public versus private hospitals

Figure 4.3 confirms that of the responders, the majority of those working in public hospitals had less than three years total clinical experience, whereas of the responders working in the private sector, the majority had between four and nine years of total clinical experience, and a large proportion (39%) had over 10 years clinical experience. There were significantly more experienced physiotherapists working in the private sector (p=0.004).

4.4.3 In-patient physiotherapy practice

Although there were only 33 responders currently working in an in-patient setting, 39 responders completed the section on in-patient practice. It was decided to include the responses of the six not currently working in an in-patient setting as they had sufficient (over 10 years) clinical experience to warrant their inclusion. All 39 responders completed all the relevant questions.

4.4.3.1 Case loads and operating schedules

It can be seen from Table 4.3 that case loads across the board were low, with most physiotherapists only seeing between zero and one new cases per week. This trend is similar in both the public and private sectors, except that in the private sector, a large proportion (twelve out of 28), were seeing up to three new cases per week.

Table 4.3 Case load and day of surgery (n=39)

		Total	Public (n=11)	Private (n=28)	p value
New cases per week (n=39)	0-1	22	8	14	0.385
	2-3	14	2	12	
	4-6	2	1	1	
	7+	1	0	1	
Day of surgery (n=37)	Monday	13	2	11	
	Tuesday	21	4	17	
	Wednesday	11	2	9	
	Thursday	19	9	10	
	Friday	3	0	3	

It was important to establish which days of the week most surgeries were performed as this may have a bearing on whether weekend-physiotherapy is routinely administered. Two responders did not denote which day of the week their patients underwent surgery.

As shown in Table 4.3, surgeries were most frequently performed on Tuesdays and Thursdays. This means that most patients were post-operative day (POD) four and five or POD two and three over the weekend. An analysis of whether this influenced the practice regarding weekend physiotherapy is presented in the following section.

4.4.3.2 Scheduling of in-patient physiotherapy

The section that follows will show what proportion of physiotherapists routinely conducted a pre-operative session. It will show when post operative physiotherapy was commenced as well as whether patients were routinely treated over weekends and how frequently patients were referred to out-patient physiotherapy. Table 4.4 shows the scheduling for in-patient physiotherapy.

Table 4.4 Scheduling of in-patient physiotherapy (n=39)

		Total (n=39)	Public (n=11)	Private (n=28)	p value
Pre-operative physiotherapy	Yes	16	2	14	0.142
	No	19	7	12	
	Other	4	2	2	
Commencement of post-operative physiotherapy	Day of surgery	11	0	11	0.006
	Day after surgery	27	11	16	
	Other	1	0	1	
Number of treatments per day (weekdays)	Once	22	10	12	0.026
	Twice	14	1	13	
	Other	3	0	3	

Table 4.4 shows that overall, a similar proportion of physiotherapists did and did not carry out pre-operative physiotherapy (16 and 19 out of 39 respectively). This trend was also evident within the private sector (14 and 12 out of 28 respectively). The trend in the public sector was not in line with the national trend and there is a larger proportion that did not carry out pre-operative physiotherapy.

Across the board, most physiotherapists started post-operative therapy on the day after surgery. Commencement of post-operative physiotherapy on the day of surgery occurred predominantly in the private sector, and this difference in practice between public and private practice was found to be significant (p=0.006).

The majority of physiotherapists treated their patients once a day on normal weekdays. Bi-daily treatments occurred predominantly in private practice, and more physiotherapists in the private sector conducted bi-daily treatments than once-daily treatment.

Qualifiers for responses 'Other' in Table 4.4 are presented in Table A5.1 in Appendix 5.

Table 4.5 Scheduling of weekend physiotherapy (n=39)

		Total (n=39)	Public (n=11)	Private (n=28)	p value
Routine weekend physiotherapy	No	8	8	0	0.000
	Yes	31	3	28	
Breakdown of 'yes' response	Saturday once	24	3	21	
	Saturday twice	7	0	7	
	Sunday once	23	2	21	
	Sunday twice	5	0	5	

Weekend physiotherapy was infrequently administered in the public sector (three out of 11 responders), while in contrast, every single responder from the private sector treated each patient at least once per weekend (p=0.000).

Table 4.6 Pattern of referral to out-patient therapy (n=39)

		Total (n=39)	Public (n=11)	Private (n=28)	p value
Routine referral to out-patient physiotherapy on discharge	Yes	25	6	19	0.503
	No	4	2	2	
	Only if indicated	10	3	7	

The majority of physiotherapists (25 out of 40) referred patients to out-patient therapy on discharge from hospital. Ten physiotherapists denoted that they only referred to out-patient physiotherapy if it was deemed necessary. The reasons for referral to out-patient therapy are tabulated over the page. There are more reasons than responders because some gave more than one reason.

Table 4.7 Reasons for referral to out-patient physiotherapy (n=10)

Indicating factor	Frequency (/10)
Insufficient flexion range of motion	5
Insufficient range of motion (F&E or did not specify)	4
Inadequate Straight Leg Raise	3
Unable to comply with home exercises	2
General lack of mobility	2
Psychologically vulnerable	1
Poor balance	1

Insufficient knee ROM, flexion in particular, was the main reason for referral to out-patient physiotherapy post discharge.

Of the 35 responders who stated that they referred to out-patient therapy (either routinely or when deemed necessary), only 11 stated that they referred with a protocol. Their responses with regards to scheduling are tabulated below.

Table 4.8 Scheduling protocols on discharge from hospital (n=11)

Time post discharge that OPD commenced		How regularly patients are scheduled for OPD	
Earliest available appointment	1	Depends on availability	1
Within 1 week	4	Every 1 -2 weeks	1
Within 10 days to 2 weeks	5	Once a week	2
Depends on OPD clinician	1	Once or twice a week	4
		Two to three times a week	1
		Depends on the clinician	1
		Depends on progress	1

With a sample of only 11 no detailed analysis could be done on these responses. It appears that physiotherapists working in the hospital setting (public and private sectors) recommended that patients who are going to attend out-patient therapy commence that treatment within two weeks post discharge. Most patients were scheduled to initially attend out-patient therapy once or twice a week.
Although participants were only requested to comment on this scheduling if they stated that they discharged their patients to out-patient therapy with a protocol (n=11), eight participants who stated that they refer to OPD without a protocol still

gave feedback on their scheduling. These responses are presented in Appendix 5 (Table A5.2).

4.4.3.3 Content of in-patient physiotherapy

Pre-operative and post-operative physiotherapy was established separately. For the purposes of these results pre-operative physiotherapy is any intervention occurring in the hospital in the immediate pre-operative period. Post-operative physiotherapy is referred to any treatment in the hospital in the immediate post-operative period. Responses on content of physiotherapy were not separated for the public and private sector physiotherapists.

Table 4.9 Current pre-operative management strategies (n=16)

Management strategy	Number of responses n=16 (%)
Education on contra-indications and precautions	15 (94)
Demonstration and practice of post-operative exercises	15 (94)
General pre-operative care (chest, circulatory drill etc)	14 (88)
Education on reason for surgery	10 (63)
Education on surgical procedure	10 (63)
Education on general care (wound, pressure care etc)	10 (63)
Demonstration and practice of crutch walking	10 (63)
Other	2 (13)

Responses regarding pre-operative treatment were similar amongst all responders. The most standard interventions were education on contra-indications and precautions and demonstration and practice of post-operative exercises. General pre-operative care was also frequently included. The two responses to ‘other’ were information on cryotherapy and psychological assessment.

Table 4.10 Current post-operative in-patient management (n=39)

Management strategy	Number of responses /39 (%)	
Education Strategies		
Education on reason for surgery	22	(56)
Education on surgical procedure	23	(59)
Education on contra-indications and precautions	38	(97)
Education on general care (wound, pressure care etc)	27	(69)
General peri-operative care (chest, circulatory drill etc)	31	(79)
Demonstration and practice of crutch walking	39	(100)
Equipment based modalities		
CPM	11	(28)
Cryotherapy	16	(41)
Pulley system for knee flexion ROM	8	(21)
Dry needling	2	(5)
Manual Therapy techniques		
Soft tissue mobilisation quadriceps	23	(59)
Soft tissue mobilisation hamstrings or other	20	(51)
Patello femoral joint mobilisation	20	(51)
Tibiofemoral passive joint mobilisation	10	(26)
Range of motion exercises		
Active heel slides for knee flexion ROM	35	(90)
Active knee flexion gravity assisted (drop-and-dangle)	34	(87)
Active heel slides in chair for knee flexion ROM	35	(90)
Active or active-assisted knee flexion ROM in prone	21	(54)
Passive knee extension – gravity assisted	21	(54)
Strengthening exercises		
Static quadriceps strength	37	(95)
Terminal knee extension	29	(74)
Open chain quadriceps through range	31	(79)
Closed chain quadriceps	15	(38)
Static hamstrings	12	(31)
Open chain hamstrings	12	(31)
Glut max strengthening	19	(49)
Glut medius strengthening	14	(36)
Straight leg raise	30	(77)

Responses on the education strategies were similar to the pre-operative management, with education on contra-indications and precautions and general peri-operative care included by the majority of physiotherapists. Demonstration and practice of crutch-walking was included by all the responders.

Equipment based strategies are not commonly used. Only four responders commented that they did not have access to a CPM machine. One stated no access to a pulley system and one stated no access to ice.

Manual therapy techniques were used by up to 60% of responders.

Active heel slides, active gravity-assisted knee flexion and active heel slides in a chair for flexion ROM were the most common ROM exercises included in post-operative treatment.

Static quadriceps and open-chain quadriceps through range were the most common strengthening strategies. Less than half the responders included gluteus medius and hamstring strengthening in their post-operative treatments. Closed-chain quadriceps was also used by less than half the responders.

4.4.3.4 Factors influencing scheduling and content of in-patient physiotherapy

Basic relationships between sectors and scheduling of treatment were shown in Table 4.4, Table 4.5 and Table 4.6. Further detail regarding scheduling of weekend treatment is warranted. When conducting further analysis of content of treatment, a personal factor (level of experience) as opposed to institutional factors were analysed.

4.4.3.4.1 Effect of day of surgery on scheduling of weekend treatment

Table 4.9 shows the relationship between the day of surgery and the administration of weekend physiotherapy. Since each responder could choose more than one day, their responses were categorised according to the latest day of surgery indicated. Two responders did not denote the day of surgery, therefore results for 37 responders are reported in this section.

Table 4.11 The relationship between the day of surgery and weekend physiotherapy (n=37)

Day of surgery	n per sector		POD	Weekend Physiotherapy	
	Private	Public		Yes (%)	No (%)
Monday / Tuesday (n=9)	7	2	5 and 6 / 4 and 5	8 (88.9)	1 (11.1)
Wednesday (n=9)	8	1	3 and 4	8 (88.9)	1 (11.1)
Thursday / Friday (n=19)	12	7	2 and 3 / 1 and 2	14 (73.7)	5 (26.3)

The day of surgery did not appear to have any influence on whether or not weekend physiotherapy was administered. In fact in the Thursday / Friday surgery

group, where weekend physiotherapy would be justified considering the POD, there was a higher proportion of responders who did not administer weekend physiotherapy. The size of each group is too small to make any inferences, but it appears that responders did not take POD into account when scheduling weekend treatment.

4.4.3.4.2 Influence of sector on scheduling of weekend treatment

The relationship between sector and scheduling of weekend treatment was shown in Table 4.5.

In the private sector, all physiotherapists included weekend treatment in their management. In contrast, in the public sector most patients did not receive weekend physiotherapy. The fact that a high proportion of public sector surgeries were performed on a Thursday or Friday (as shown in Table 4.11) shows that this trend cannot be explained by POD, and is probably rather explained by institutional factors.

4.4.3.4.3 Level of experience on content of post-operative physiotherapy

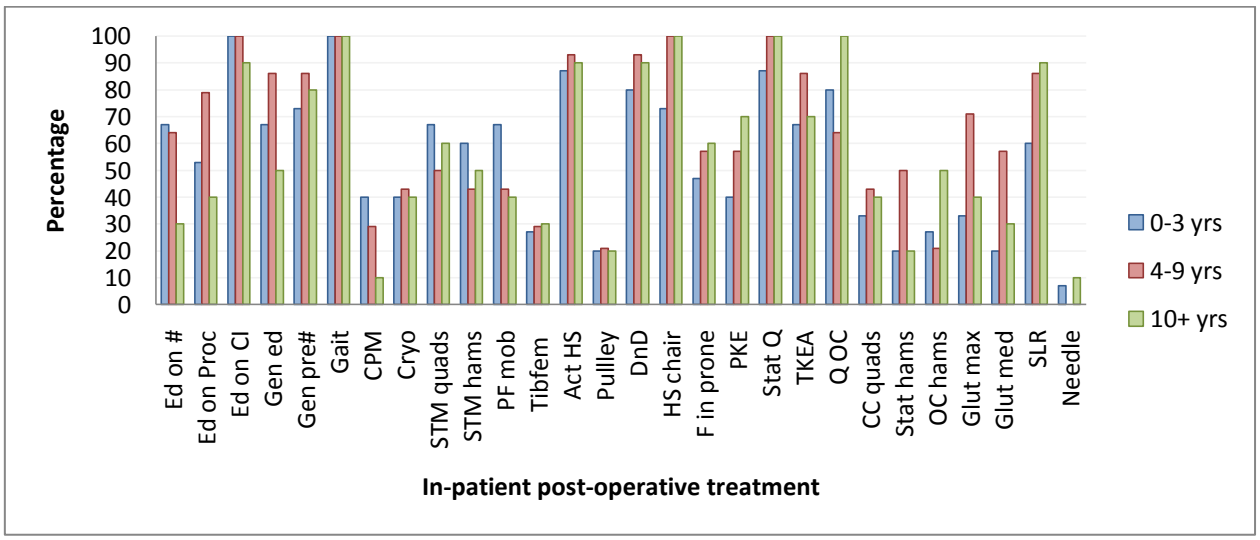


Figure 4.4 In-patient post-operative treatment according to level of experience (n=39)

Figure 4.4 provides a broad overview of how the composition of the physiotherapy management differed according to level of experience. There were no significant differences in what proportion of each group included each modality. Straight leg

raise was used by most of the more experienced responders (90%), and used far less by the inexperienced responders (60%), although this difference was not significant (p=0.06). Gluteus maximus strengthening was also used by very few of the inexperienced responders (33%), but this finding was also not significant (p=0.08).

4.4.4 Out-patient physiotherapy practice

Fifty-four responders were currently working in an out-patient setting and 54 responders completed the section on out-patient physiotherapy. Of these, 46 were in the private sector and eight were in the public sector. One therapist from the public sector did not complete any of the questionnaire beyond the first page. One physiotherapist from the private sector who is not currently working in an out-patient setting completed the section on out-patient practice and the decision was made to include the input based on the level of experience of the participant. Thus a total of 54 questionnaires were completed, but with different proportions of public and private physiotherapists as tabulated in Table 4.2. Two questionnaires were incomplete. One had information missing on referral pattern and scheduling of treatment and the other had no information on which treatment modalities they used.

4.4.4.1 Referral pattern and scheduling of out-patient physiotherapy

Table 4.12 Referral patterns in out-patient physiotherapy (n=54)

		Total (n=54)	Public (n=7)	Private (n=47)	p value
New cases per month	0 to 2	32	5	27	0.571
	3 to 5	16	1	15	
	6 to 7	4	1	3	
	8+	2	0	2	
Number of routine referrals	0 to 2	36	5	31	1.000
	3 to 5	14	2	12	
	6 to 7	2	0	2	
	8+	2	0	2	
Source of referral (n=53)	Surgeon	40	6	34	
	Own from ward	11	2	9	
	Ward physio	10	1	9	
	Other	8	0	8	
Referral to other rehabilitation (n=53)	Biokinetist	21	0	21	
	Pilates	7	0	7	
	Other	3	0	3	

It can be seen from Table 4.12 that case loads were generally low with the majority of physiotherapists only seeing up to two new cases per month. The major source of referral to out-patient physiotherapy was the surgeon. Almost half the responders referred their patients to a biokinetist for additional rehabilitation. Responses to the choice 'other' for referral to other rehabilitation specialists included two who referred to orthotists and one who referred to the gym. The eight responses to 'other' under the heading 'source of referral' are tabulated below.

Table 4.13 Descriptors of 'other' as a source of referral (n=8)

Descriptor	Number of responses
General Practitioner	1
'Word of mouth'	2
Patients come of own accord	1
Responder did not qualify choice	4

The scheduling of out-patient physiotherapy is tabulated below.

Table 4.14 Scheduling of out-patient physiotherapy (n=53)

		Total (n=53)	Public (n=7)	Private (n=46)	p value
Scheduling of treatments in first 6 weeks	< once a week	8	5	3	0.001*
	Once a week	19	1	18	
	2-3 times a week	29	1	28	
	> four times a week	1	0	1	
Scheduling of treatments in second 6 weeks	Once a week	16	2	14	0.004*
	Once in 2 weeks	18	1	17	
	Once in 3 weeks	7	4	3	
	Other	12	0	12	
Length of follow-up of out-patient treatment	6 to 8 weeks	24	3	21	0.167
	8 to 12 weeks	20	1	19	
	3 to 5 months	3	1	2	
	6 or more months	3	1	2	
	Other	3	1	2	

Most physiotherapists (55%) treated their patients two to three times a week in the first six weeks. In the second six weeks, patients were commonly scheduled for

weekly or two-weekly treatment sessions. Responders from the private sector treated their patients more regularly in the first (p=0.001) and second (p=0.004) six weeks post surgery, than responders from the public sector. Forty-five percent of responders discharged their patients from physiotherapy by eight weeks post surgery and a further 38 percent by twelve weeks post surgery. Of the three responses 'other' in the section on length of follow-up, one responder did not qualify their choice and two responders denoted that follow-up was continued 'as long as required'. The descriptors of the choice 'other' in the section on 'scheduling of treatments in the second six weeks' are tabulated below.

Table 4.15 Descriptors to qualify alternative scheduling of treatment in the second six weeks post surgery (n=6)

Descriptor	Number of responses
Usually discharged by then	4
Medical aid funds usually depleted by then	1
No specific protocol	1
Only if patient experiencing difficulties with home programme	1
Depends on the needs of the patient	3
Did not qualify choice	2

4.4.4.2 Content of out-patient physiotherapy treatment

Responses to the content section of the questionnaire with regards to out-patient treatment are shown in Table 4.16 over the page.

Table 4.16 Content of current out-patient treatment (n=53)

Management strategy	Number of responses /53 (%)	
Education Strategies		
Education on surgical procedure	30	(57)
Education on contra-indications and precautions	43	(81)
Education on general care (wound, pressure care etc)	35	(66)
Demonstration and practice of crutch walking	41	(77)
Equipment based modalities		
CPM	7	(13)
Cryotherapy	26	(49)
Dry needling	4	(8)
Stationary cycling	35	(66)
Manual Therapy techniques		
Soft tissue mobilisation quadriceps	49	(92)
Soft tissue mobilisation hamstrings or other	44	(83)
Patello-femoral joint mobilisation	47	(89)
Tibiofemoral passive joint mobilisation	28	(53)
Soft tissue release posterior knee	33	(62)
Range of motion exercises		
Active heel slides for knee flexion ROM	49	(92)
Active knee flexion gravity assisted (drop-and-dangle)	44	(83)
Active heel slides in chair for knee flexion ROM	46	(87)
Active or active-assisted knee flexion ROM in prone	42	(79)
Passive knee extension – gravity assisted	39	(74)
Strengthening exercises		
Static quadriceps strength	49	(92)
Terminal knee extension	40	(75)
Open chain quadriceps through range	48	(91)
Closed chain quadriceps	45	(85)
Static hamstrings	34	(64)
Open chain hamstrings	40	(75)
Glut max strengthening	39	(74)
Glut medius strengthening	31	(58)
Straight leg raise	37	(70)

In contrast with the same analysis of in-patient therapy, most of the physiotherapists included most of the listed modalities in their treatments. The exceptions are CPM and dry-needling, which were very infrequently used.

4.4.4.3 Factors influencing scheduling and content of out-patient physiotherapy treatment

4.4.4.3.1 Influence of sector on scheduling of treatment

As shown in Table 4.14, the sector of practice has a significant influence on the number of treatments scheduled within the first six weeks (p=0.001) and the second six weeks (p=0.004), with more sessions being scheduled in the private sector.

4.4.4.3.2 Influence of level of experience on content of out-patient treatment

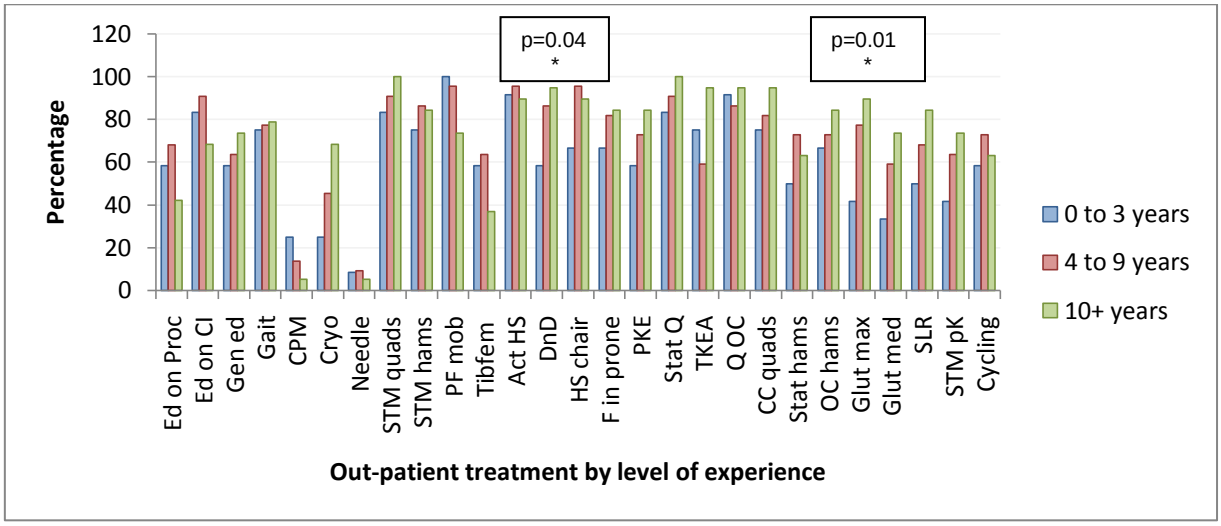


Figure 4.5 Content of out-patient treatment according to level of experience (n=53)

Of the modalities listed above, a few notable differences existed in their frequency of inclusion, between the levels of experience of the responders. Cryotherapy was used more frequently by the experienced responders (p=0.06) and patella-femoral mobilisation was used less frequently by the experienced responders (p=0.06). Two modalities that differed significantly between the levels of experience were drop-and dangle (p=0.04) and gluteus maximus strengthening (p=0.01), which were used less frequently by the less experienced responders

4.5 DISCUSSION

4.5.1 Response rate

A 25 % response rate was achieved in the survey of current practice. This response rate appears to be below what is ordinarily considered acceptable (Sim & Wright 2000) based on the original sample of 645. In hindsight, the sample was probably overestimated, since there was no way of knowing which of the 645 'musculoskeletal' physiotherapists were actually involved in treating patients post TKA. From the 99 blank returns, versus the 62 completed questionnaires, it is fair to assume that there was a higher percentage of the 645 that were not currently treating patients post TKA than who did qualify to complete the questionnaire. If the actual number of physiotherapists currently involved in treating patients post TKA could be estimated, a more accurate response rate could have been calculated. Due to database protection, undeliverable mails, incorrect e-mail addresses and the possibility of inaccurate databases, the response rate may have been further compromised. These difficulties are not unique to this study and were encountered in a similar survey conducted in the United Kingdom (Walsh & Hurley 2009).

4.5.2 Clinical situation and level of experience of responders

It is not surprising that most responders were from the private sector, as there are more centres where TKAs are performed in the private sector than in the public sector.

What is striking is the predominant level of experience in the physiotherapists employed in the public sector versus the private sector physiotherapists. Particularly when looking at the total clinical experience of responders in Figure 4.2, it is evident that while many physiotherapists have had some (0-3 years) experience working in the public sector they do not stay there, indicated by the fact that few physiotherapists have more than four years or more experience working in the public sector. This trend can probably be explained by the community service year, where new graduates are required to work in a public hospital for one year, and based on the findings of this study are evidently not staying for longer than three years.

Guideline implication: There is a high staff turnover, with a constant influx of relatively inexperienced staff. This emphasizes the need for a clinical practice guideline, with very clear parameters for treatment progression and decisions regarding scheduling of treatment.

4.5.3 Case loads

Case loads across the board were quite low. As can be seen in Table 4.3, case loads in the public sector were lower than in the private sector. This in conjunction with the fact that fewer centres in the public sector conduct arthroplasties than in the private sector may be a reason that it has not been a priority for research, development and training as evident from the lack of relevant published literature on this topic in South Africa.

4.5.4 Scheduling of treatment

4.5.4.1 Commencement of post-operative physiotherapy

The majority of physiotherapists who responded to the survey stated that they routinely begin post-operative physiotherapy on the day after the surgery. Thirty percent of responders stated that they start post-operative physiotherapy on the day of surgery. This is a high percentage considering that there is no evidence to support this practice. Renkawitz et al (2010) included this scheduling in an optimised accelerated protocol and found that after eight days there was no significant advantage over a normal accelerated protocol.

Guideline implication: Based on what is predominant current practice and what has been shown in the literature, a possible recommendation for the clinical practice guideline is that post-operative physiotherapy begins on the day following surgery (POD 1).

4.5.4.2 Number of physiotherapy treatments per day

Just over half (58%) of the total sample who responded to the survey reported that they only treat their patients once per day as a matter of routine. However, in the private sector, the number of physiotherapists who responded that they treat their patients twice a day was higher than those who only treat once a day. A well known study by Lenssen et al (2006) has shown no value in routinely treating

patients twice a day. Early post-operative side effects (such as nausea and dizziness) may render a treatment session ineffective. It stands to reason that if a patient has had an unsuccessful treatment session due to such incidents, a second session may be warranted.

Guideline implication: When a clinical pathway is developed in order to implement the CPG, it should include clear daily goals as well as indicators that would warrant additional treatment sessions.

4.5.4.3 Routine weekend physiotherapy.

Weekend physiotherapy was routine practice in the private sector as indicated by the results of this chapter. In contrast, weekend physiotherapy was seldom routinely carried out in the public sector. A dated study by Rapoport & Judd-van Eerd (1989) showed that in an acute care hospital setting, routine weekend physiotherapy services helped to reduce length of hospital stay. Their sample was made up of neurology and orthopaedic patients, so these results cannot necessarily be extrapolated to patients recovering from TKA. In addition, after sub-analysis, it was shown that effect of weekend physiotherapy was less significant in the orthopaedic group when compared to the neurology group, rendering this study even less supportive of the use of routine weekend physiotherapy. As highlighted by the Husted et al (2008) study in Chapter 2, weekend physiotherapy may have more value if surgery was performed on Thursday or Friday, making the patients POD 2 and 3 or 1 and 2 respectively. This was however not the case in this study, so it is not clear what the justification for the routine weekend physiotherapy in the private sector is. Thus far, no recommendation can be made for informing the CPG. This topic will be raised again in Chapter 5 and Chapter 7.

4.5.4.4 Referral to out-patient therapy on discharge

The majority of responders in the survey of current practice reported that they routinely refer to out-patient physiotherapy (OPD) upon discharge.

Whether or not routine OPD is an important part of management of patients post TKA remains questionable. As presented in Chapter 2, the evidence for inclusion of routine out-patient therapy is weak. Rajan et al (2004), while concluding that out-patient therapy had no advantage over a structured home program,

acknowledged that their sample was a select group of patients who were not at high risk for poor outcome.

Where responders did not routinely refer patients to OPD, they could give reasons for any non-routine referral to OPD. The most common reason was related to knee ROM and the second most common reason was related to strength (indicated by inability to SLR). These two impairments are of functional importance. Davies et al (2003) have shown that patients who have insufficient flexion ROM at discharge will require more out-patient therapy than what is standard.

Guideline implication: If routine referral to out-patient therapy is not a viable option, clear guidelines are necessary as to criteria for referral to OPD. This will ensure that the administration time is spent on the patients who will benefit most. In addition, further research is required to establish criteria to better define which patients may benefit from out-patient physiotherapy.

4.5.5 Content of treatment

4.5.5.1 Pre-operative physiotherapy

There were mixed responses to the question on whether or not the responder administered a pre-operative physiotherapy session. Equal numbers reported 'yes' and 'no', and almost a quarter reported 'other'. The literature reviewed in Chapter 2 was not supportive of pre-operative physiotherapy in this context in terms of improving post-surgery outcomes. This may be why practice around pre-operative physiotherapy is not uniform. Whether or not the literature supports pre-operative education, and even it has only shown a small effect on decreasing pre-operative anxiety, it warrants inclusion purely from an ethical standpoint. In a setting where patients may not have high levels of education and do not necessarily have access to information resources such as the internet, health professionals have an important role in informing and educating patients regarding any procedure they are about to undergo.

Guideline implication: Pre-operative physiotherapy, especially from an education point of view, may have some relevance within the clinical practice guideline. Further investigation on this specific intervention is warranted by means of a controlled clinical trial. If such trials are to be

conducted, outcome measure should include measures of pre- and post-operative anxiety as well as traditional measures of recovery.

4.5.5.1.1 Content of pre-operative physiotherapy

From those who responded that they included pre-operative physiotherapy (n=17), the detail regarding content was fairly consistent. This consistency may be indicative of some consensus between those who use this intervention. The only additional content under 'other' was information on cryotherapy. Since this only has relevance when cryotherapy is actually going to be used, it does not have a place in a general pre-surgery guideline.

Guideline implication: If a pre-surgery intervention were to be included in the clinical practice guideline, the content included in the questionnaire on current practice may form an acceptable basis.

4.5.5.2 In-patient post-operative physiotherapy

Components of in-patient physiotherapy which seemed to be the most commonly used and which seemed to show the most agreement were the education strategies and the strategies to improve range of motion. Certainly one of the most researched topics in this field is strategies to improve ROM as much of the in-patient physiotherapy research has focused on CPM. It is evident that most South African physiotherapists are not using CPM, but are rather using various other mobilising exercises to regain early ROM. It may be due to their knowledge of current evidence (which does not support the use of CPM) or it may be that access to the equipment is the limiting factor. The responders were given the opportunity to comment on reasons why a particular modality was or was not used and only four responded that they did not have access to a CPM machine, leading one to think that the infrequent use of CPM is due to familiarity with current literature.

4.5.5.3 Out-patient physiotherapy

Manual therapy techniques such as soft tissue release of the hamstrings and quadriceps as well as patella-femoral joint mobilisation, were used by most physiotherapists, despite there being little published evidence for the efficacy of these modalities. Physiotherapists need to ascertain exactly which structures are

responsible for the limitation of ROM before effectively applying manual therapy techniques and there is little evidence for this evaluation.
Generally there was less consensus of what was included in out-patient therapy than in-patient therapy.

4.6 SUMMARY OF THE CHAPTER

Physiotherapists working in the public sector are stakeholders in the CPG development process and they will be responsible for implementing the CPG. As this study has shown, the majority have less than three years experience. This in itself is justification for the need for a CPG, and also justifies why the CPG will need to be implemented via a clearly defined clinical pathway.
Findings from this study that relate to the development phase of CPG development have been highlighted throughout the chapter and will be highlighted again in Chapter 7.

CHAPTER 5

STUDY 3

5.1 INTRODUCTION

Study 4 specifically evaluated the patients' recovery post-discharge. It was important that all subjects in study 4 received a standardised in-patient physiotherapy intervention. It was also important that the in-patient physiotherapy they received was shown to be at least as effective as current practice. This was the main reason for the inclusion of study 3. In addition, by conducting a trial of an in-patient intervention, formulation of clear clinical questions for the development of the CPG would be informed, as some clinical questions only become apparent once research has been practically conducted in the field. Another question that arises during CPG development is how the CPG will be implemented and with that, how will the implementation be monitored. One way that this could be investigated was by devising a simple protocol, based predominantly on current practice (not the CPG), and monitoring how it was implemented.

5.2 AIMS AND OBJECTIVES

The aim of this study was to compare the effects of an in-patient physiotherapy protocol to the current in-patient physiotherapy management.

This involved comparing the effects of an in-patient physiotherapy protocol with current in-patient physiotherapy practice on the following outcomes:

- Knee flexion ROM at discharge and six weeks post surgery
- Knee extension deficit at discharge and six weeks post surgery
- Knee flexion contracture at discharge and six weeks post surgery
- Knee Society Knee Score at six weeks
- Pain at six weeks
- Length of hospital stay
- Number of days taken to reach 90° knee flexion

A secondary aim was to explore the use of a treatment tracking sheet to monitor the implementation of a physiotherapy protocol. This was achieved by:

- Describing the consistency with which treatment records were kept when using the tracking sheet (second cohort) and when the tracking sheet was not used (first cohort)

5.3 METHOD

5.3.1 Study Design

A prospective cohort study.

A prospective cohort design implies that one group of subjects is investigated at one point in time and then a second group, receiving a different treatment regime, is investigated at another point in time (Seale and Barnard 1998). The value of this design is that contamination is avoided. Another advantage is that it is easier for the clinical staff to implement as they don't have to alternate between protocols during the same period of time.

5.3.2 Subjects

Patients undergoing total knee arthroplasty at a tertiary care public hospital in Gauteng, South Africa

.

Inclusion criteria:

- Diagnosis of osteoarthritis prior to surgery
- Unilateral procedure
- Aged between 45 and 75 years

Exclusion criteria:

- Subjects who were not walking (independently or with a walking aid) prior to surgery
- Revision surgery
- Pre-existing septic arthritis or condition that may have compromised TKA outcome eg. Charcot's joints, Paget's disease, severe osteoporosis
- Patients with neurological disorders that may affect the outcome of TKA

- Patients with infectious diseases
- Metastatic disease

5.3.2.1 Sample Size

The main outcomes were knee flexion ROM, extension deficit, flexion contracture, KSKS and pain. The main outcome that required the largest sample size was knee flexion ROM. The required sample size was 20 subjects in each group. This was calculated to detect a 10° difference in knee flexion ROM, which was deemed to be a significant change when the standard deviation is 10 (Lenssen et al 2006). Power was set at 80% with a confidence interval of 3.57. This sample size accommodated for a 20% drop-out rate.

5.3.3 Ethical considerations

Participants were invited to participate and were free to decline or withdraw at any stage. Ethical clearance was granted by the University of the Witwatersrand Human Research Ethics Committee (Medical) (protocol number M060109) (Appendix 2). Informed consent was obtained (Appendix 3).

5.3.4 Tools and outcome measures

Joint range of motion and quadriceps lag were measured using a universal goniometer. The researcher had performed an intra-rater reliability study for the use of the goniometer (Appendix 6)

Pain was measured using the pain section of the Knee Society Knee Score. The rationale for this is discussed in section 5.5.2.

Demographic data were recorded on a baseline assessment form (Appendix 7).

A data sheet was used to record the daily measurements, number of days taken to achieve 90 degrees of knee flexion and the length of hospital stay (Appendix 8).

The protocol (Appendix 9) was developed based on the literature and current practice. It was formulated with the assistance of an expert group and validated by clinicians work in the field.

5.3.5 Procedure

- Subjects included in the first sample (group 1) received the current treatment regime. The physiotherapists in the ward were requested to continue managing the patients just as they had been up to the commencement of the study.
- The patients were approached by the researcher, prior to surgery and they were invited to participate in the study. After consent was signed (Appendix 3), the researcher measured joint range of motion, knee extension lag and pain.
- The subjects were treated as usual, as per current practice. The researcher did not interfere in the treatment in any way.
- The researcher assessed the outcomes every two days until discharge.
- The subjects were seen by the researcher at the six-week follow-up clinic and pain, knee flexion joint range and quadriceps lag were measured.
- Once the sample size had been achieved, the second part of the study began (group 2).
- The physiotherapists on the ward were orientated to the treatment protocol as described in Appendix 9. Their instructions were to follow the outline as far as was manageable and feasible within their current system, and note when this was not possible.
- Patients admitted for a TKA were approached by the researcher and invited to participate in the study. After signing consent, baseline measures were taken as described for group 1.
- The subjects were then treated as described in Appendix 9. All written information and exercise sheets were translated into Southern Sotho and Zulu. The researcher continued to take measurements post surgery as described above, as well as at six week follow-up.
- The treating physiotherapist recorded the treatment on a tracking sheet (Appendix 9)

5.3.6 Data analysis

The main outcome measures were knee flexion ROM at six weeks, knee extension deficit at six weeks, knee flexion contracture at six weeks, pain at six weeks, KSKS at six weeks and length of hospital stay post surgery. Data were tested for normal distribution. Independent t-tests were performed to ensure

baseline scores between the groups were not significantly different. The change over time in each group was compared using paired t-tests.
Secondary outcomes were LOS and the number of days taken to reach 90° of knee flexion. An independent t-test was conducted on the data for LOS.

5.4 RESULTS

Subjects were recruited as per the inclusion and exclusion criteria described in the methodology (5.3.2). Recruitment took place between June 2006 and October 2009.

5.4.1 Description of sample

A profile of the two groups is presented below.

Table 5.1 Profile of the two cohorts (n=50)

	Group 1 (control) n= 26	Group 2 n= 24
Age (SD)	64 (±8)	63 (±7)
Gender (F:M)	22:4	21:3
Side of surgery (R:L)	13:13	9:15
Day of surgery (MT:W:ThF)	14:6:6	16:0:8
No discharge measurements	1	3
No 6/52 measurements	5	7

Twenty-eight patients signed consent to participate in the first (control) cohort. One patient sustained severe chest complication which led to an ICU admission. Since usual physiotherapy practice was not applied with this patient she was excluded. A second patient in the first (control) cohort developed wound complications which hindered the usual course of rehabilitation and thus led to exclusion. Twenty-five patients signed consent to participate in the second cohort but one developed severe wound sepsis and was excluded on that basis.
Outstanding measurements are accounted for in table 5.2.

Table 5.2 Reasons for loss to follow-up (n=50)

Time	Group	Number missing	Reasons
Discharge	1 (n=25)	1	Early discharge, no contact details
	2 (n=21)	3	Early discharge (1) Missing data sheets (2)
6 weeks post op	1 (n=21)	5	Incorrect or absent contact details (2) Moved away from Johannesburg (2) Died (1)
	2 (n=17)	7	Appointment too late for 6/52 measurement (5) No reply telephonically (2)

The data set with the highest loss to follow-up was the second cohort at six weeks post-op (29%).

Baseline measurements were taken one day pre-operatively. Baseline measures are presented in table 5.3.

Table 5.3 Baseline Measurements (n=50)

Outcome (SD)	Group 1 (n=26)		Group 2 (n=24)		p value
Knee flexion ROM	98	(±22)	92	(±20)	0.296
Quadriceps lag	8	(±9)	7	(±12)	0.657
Knee flexion contracture	7	(±10)	4	(±8)	0.399
KSKS	31	(±18)	42	(±21)	0.047*
Pain (from KSKS)	6	(±10)	20	(±14)	0.000*

Paired t-tests showed that there were no significant differences between the two groups with regard to the main outcome measures, except for the KSKS and the pain score from the KSKS, which were better in group 2.

5.4.2 Current in-patient practice

Current in-patient physiotherapy management was established using a process of record review.

Table 5.4 Interventions included Group 1 and group 2 (n=29)

Management strategy	Group 1 n=12	Group 2 n=17
Pre-operative education, demonstration &practice		
Education on contra-indications and precautions	**0**	**10**
Crutch walking	**0**	**2**
Static gluteus contractions	**0**	**9**
Static quadriceps exercises	**0**	**9**
Active heel slides in bed	**0**	**9**
Active heel slides in a chair	**0**	**7**
Knee flexion in prone	**0**	**9**
One legged bridge	**0**	**9**
Other	**0**	**0**
Questions	**0**	**0**
Day 1		
Static gluteal contractions	**3**	**14**
Static quadriceps exercises	**4**	**14**
Circulatory drill	**4**	**15**
Elevation	**0**	**8**
Soft tissue mobilisation hamstrings or quadriceps	**1**	**7**
Heel slides in bed	**4**	**15**
Mobilise to a chair	**7**	**14**
Other	**3**	**3**
Day 2	**Weekend=2**	**Weekend=3**
Static gluteal contractions	**2**	**12**
Static quadriceps exercises	**4**	**12**
Circulatory drill	**1**	**13**
Elevation	**0**	**10**
Soft tissue mobilisation hamstrings or quadriceps	**1**	**5**
Heel slides in bed	**5**	**11**
Knee flexion over edge of bed	**4**	**12**
Inner range quadriceps strengthening	**2**	**10**
Ice	**1**	**5**
Patello-femoral joint mobilisation	**0**	**6**
Mobilise in the ward	**6**	**13**
Other	**2**	**2**
Day 3	**Weekend=6**	**Weekend=2**
Bed programme	**2**	**13**
Soft tissue mobilisation hamstrings or quadriceps	**0**	**6**
Inner range quadriceps strength / Straight leg raise	**1**	**13**
Ice	**2**	**4**
Patello-femoral joint mobilisation	**0**	**8**
Mobilise out of ward	**5**	**10**
Other	**1**	**0**
	Weekend=10	**Weekend=14**

Day 4		
Bed programme	**1**	**3**
Soft tissue mobilisation hamstrings or quadriceps	**0**	**2**
Inner range quadriceps strength / Straight leg raise	**1**	**3**
Ice	**0**	**2**
Gait re-education	**2**	**3**
Stairs	**0**	**1**
Other	**2**	**0**
Home exercises	**0**	**2**
Day 5 until discharge		**Discharged=1**
Bed programme	**5**	**12**
Soft tissue mobilisation hamstrings or quadriceps	**3**	**11**
Inner range quadriceps strength / Straight leg raise	**4**	**12**
Ice	**1**	**2**
Gait re-education	**10**	**12**
Stairs	**4**	**9**
Other	**3**	**2**
Home exercises given	**0**	**11**

Table 5.4 shows a comparison between current practice (the intervention that Group 1 received) and treatment actually carried out from the protocol (the intervention that Group 2 received).

The number of treatment records for group 1 was only 12 out of 26. This is because the treatment record was obtained from what had been recorded in the patient's file, and was not always available as discussed in section 5.5.5.1. The treatment record for the second group was recorded on the pre-formatted treatment protocol (Appendix 9), and some of these were also not completed and therefore not included. All qualifiers for the option 'other' were CPM. The notation 'weekend' or 'discharged' refers to the number in each group who would not have received treatment on that specific day due to it being a weekend or due to them having been discharged.

Treatments were more consistently recorded when physiotherapists were given a treatment tracking sheet. It also appears that treatments were more standard and comprehensive when the physiotherapists were given a tracking sheet.

5.4.3 Main outcomes

Knee flexion ROM, extension deficit and knee flexion contraction were measured again at discharge and six weeks post surgery. The KSKS was repeated at six weeks post surgery. These results are presented in table 5.5.

Table 5.5 Main outcomes at discharge and six weeks post surgery (n=50)

Outcome(SD)	Group	Pre surgery Group 1 n=26 Group 2 n=24		Discharge Group 1 n=25 Group 2 n=21		p value**	Six weeks Group 1 n=21 Group 2 n=17		p value ***
Flexion ROM	1	98	(±22)	67	(±13)		93	(±19)	0.80
	2	92	(±20)	77	(±20)	0.04*	95	(±16)	0.89
Extension	1	8	(±9)	17	(±11)		5	(±5)	0.15
deficit	2	7	(±12)	17	(±14)	0.66	7	(±7)	0.85
Flexion	1	7	(±10)	4	(±5)		3	(±4)	0.09
contracture	2	4	(±8)	6	(±7)	0.40	8	(±11)	0.94
KSKS	1	31	(±18)				67	(±17)	0.00*
	2	42	(±21)				60	(±23)	0.04*
Pain (KSKS)	1	6	(±10)				32	(±17)	0.00*
	2	20	(±14)				32	(±15)	0.01*

**between groups at discharge

***within group at six weeks

The discharge (p=0.04) and six-week flexion ROM was better in the experimental group, although less so by six weeks. Knee flexion contracture was slightly worse in the experimental group at discharge and six weeks. The relative improvement in the KSKS was better in the control group as was the change in pain score.
There was no imputation of missing data.

5.4.4 Secondary analysis

The number of days taken to reach 90° of knee flexion was used as a secondary outcome since it is often used as a discharge criterion and therefore may influence length of hospital stay. Length of hospital stay was included as an outcome as many patients did not actually reach 90° by the time they were discharged. These results are presented in table 5.6.

Table 5.6 Length of hospital stay and attainment of 90° knee flexion

	Group1	n=	Group 2	n=	p value
LOS (days) (SD)	8 (3)	26	10 (6)	23	0.13
Subjects who reached 90°	1	25	7	21	

LOS=length of stay

As shown in table 5.2, discharge information was not obtained for some subjects. There was no significant difference in LOS between the two groups (p=0.13). Although the LOS was slightly longer in Group 2, more subjects in Group 2 attained 90° by discharge.

An incidental finding was the relationship between the day of surgery and the outcomes. Data from both groups were combined and grouped according to day of surgery. Tables 5.7 and 5.8 show the relationship between the day of surgery and outcome. The outcomes of the six patients who had surgery on a Wednesday were not included in these tables because their baselines scores appeared lower than the other two groups. A full table of these observations is presented in Appendix 10.

Table 5.7 The relationship between day of surgery and discharge outcomes (n=40)

Outcome	Day of surgery	
	Monday / Tuesday (n=28)	Thursday / Friday (n=12)
LOS	10	8
Days to 90°	13	6
F ROM	70	80
ED	17	16
FC	4	8

LOS=length of stay; F ROM=flexion ROM; ED=extensor deficit; FC=flexion contracture

It is of interest that the patients who had their surgery later in the week had a shorter length of hospital stay and reached 90° of knee flexion an average of seven days earlier, although none of the differences in discharge outcomes were significant.

Table 5.8 The relationship between day of surgery and six week outcomes (n=35)

Outcome	Day of surgery	
	Monday / Tuesday (n=25)	Thursday / Friday (n=10)
F ROM	97	100
ED	6	5
FC	5	5
KSKS	62	72
Pain (KSKS)	30	38

LOS=length of stay; F ROM=flexion ROM; ED=extensor deficit; FC=flexion contracture

It is worth noting that the six week KSKS was higher in the group who had their surgery later in the week, but this difference was not significant.

5.5 DISCUSSION

5.5.1 Main outcomes

The only primary outcome that was better in the experimental group was knee flexion ROM at discharge.

The KSKS showed more improvement in the control group, but both groups improved significantly from baseline. The very poor pain scores at baseline in the control group may have contributed to this difference in improvement between the two groups. However, at six-week follow-up, the pain scores and knee flexion ROM were similar, so something else must have contributed to the lower KSKS in the experimental group at six-week follow-up. It was likely a composite of the slightly worse extension deficit and flexion contracture scores which would have resulted in more deductions on the KSKS. The only plausible mechanism behind this was that the more intensive physiotherapy approach described in the outline may have 'irritated' the knee. The treatment outline is very similar to what is being done by physiotherapists in the private sector, as shown in Chapter 4. In the private sector, patients are routinely prescribed non-steroidal anti-inflammatories, which may allow for a more intensive physiotherapy approach. According to Davies (2002) a score of over 85 on the KSKS is considered excellent, a score of between 70 and 84 is considered good and a score of between 60 and 69 is considered fair, so both groups fell within the same level of outcome.

5.5.2 Pain measurement

In the planning of this study, it was proposed that the Visual Analogue Scale (VAS) be used to measure pain. After the first few subjects had been recruited it was evident that they were very unsure of how to use it to express their pain, despite various explanations. This is not a unique finding in a South African population (Yazbek et al 2009) and it matches the findings with regard to the use of the EQ-5D VAS reported in Chapter 3. For this reason, the pain was recorded using only the pain section of the KSKS. The use of this subscale has been described in section 2.5.2.3.2.

5.5.3 Length of hospital stay

While statistical testing did not show a significant difference in length of hospital stay between the two groups, this was not a main outcome measure and the sample size may not have been adequate. Two days difference in the length of hospitalisation may be of significant difference in economic studies where sample size would be calculated specifically for those outcome measures.

5.5.4 Influence of day of surgery on outcome

The incidental observations of the relationship between the day of surgery and the outcomes are of some interest. As this was not part of the primary analysis, the sample size did not allow for statistical analysis, but certain observations raise some interesting questions. Patients who had their surgery on Tuesday would have had physiotherapy treatment on POD 1, 2 and 3, and not on POD 4 and 5.Patients that had their surgery on Thursday, would have had only one physiotherapy treatment before the weekend. This means that they would not have had physiotherapy treatment on POD 2 and POD 3. Their main physiotherapy intervention would have only resumed on POD 4. It is interesting that the patients who had less early intervention ended up gaining flexion ROM faster than those who had early intervention. If one looks at it from the point of view of amount of physiotherapy in the first 72 hours, those who had less intervention in the first 72 hours post surgery may have had better outcomes. These findings are partly in contrast to those of Husted et al (2008), although they looked predominantly at LOS and not achievement of ROM. Further investigation of a sample of suitable size is necessary to validate these observations. If they can

be validated, a possible explanation may be the interaction between the physiotherapy intervention and the phase of healing. Over weekends, mobility and functional independence would be encouraged by the nursing staff, but no specific knee mobility would necessarily be emphasized (besides what the patients may have been given as a bed exercise programme). Functional rehabilitation has been investigated in the subacute setting (Moffett et al 2004, Frost et al 2002) with variable results, but no evidence could be found for functional training in the acute care setting post TKA. The post-surgical approach to knee mobility has progressed from the outdated methods of splinting and immobilisation and benefits of early mobilisation versus immobilisation have been shown (Colwell & Morris 1992, Maloney et al 1990). The effect of various modes of CPM on wound healing has been investigated (Maloney et al 1990), but there appears to be nothing published on the effect of a standard post-operative physiotherapy intervention on wound healing and the early inflammatory phase of healing.

5.5.5 Challenges experienced during data collection

The treatment records of Group 2 were more comprehensive and showed a more consistent treatment approach. Detailed analysis of current practice versus the in-patient treatment outline was not possible due to insufficient complete treatment records. The treatment records of group 1 could only be obtained from the patients' files. Often on the day of discharge when the final measurements were done, the files had already been removed from the ward to complete the discharge process. Gaining access to those files was not always possible and the microfiches ordered did not contain a physiotherapy treatment record, hence the absence of complete treatment records. It was important to interfere as little as possible with the current management of the patients in Group 1. Although the physiotherapy department was fully aware of the study in progress, attempting to keep track of the treatment records in a more obvious way may have influenced the treatments themselves. The lesson from this experience is that when future research calls for a treatment record, data capture should be prospective rather than retrospective.

5.6 SUMMARY OF THE CHAPTER

The findings of this prospective cohort study are similar to other studies investigating the effects of physiotherapy in the immediate post-operative phase. Specific physiotherapy interventions do not appear to have an effect on outcome, particularly in the mid-term (six weeks post surgery). In this study, the only outcomes which may have been impacted by the intervention were knee flexion ROM (positively) and the KSKS (negatively). The use of a physiotherapy treatment outline and tracking sheet, while it may not have improved the outcome, appeared to have lead to more standardised treatment and record keeping, which was necessary for Study 4. This was one aim of the study.

Based on the findings of this study, the protocol as it stands cannot be recommended for use in the current setting. Once a CPG has been developed, this protocol could be refined to form a basis for a clinical pathway to implement the CPG.

CHAPTER 6

STUDY 4

6.1INTRODUCTION

Stakeholder involvement is an important part of CPG development (AGREE collaboration 2003). During the development process, potential stakeholders should be identified during the Structure & Organisation phase. A guideline development group assembled for developing a CPG for rehabilitation post TKA should include representative patients. It would be difficult to select appropriate representatives without some insight into a profile of the relevant population. Detailed demographic description can provide some of this information.
When little is known about a particular patient population, it is difficult to identify clear clinical questions that should be incorporated into a CPG. By exploring the profile of the population as well as exploring factors that are associated with outcome, clearer clinical questions can be formulated for the CPG.

6.2 AIMS AND OBJECTIVES

The aim of this study was to explore and describe the profile of patients undergoing TKA in a tertiary care public hospital in South Africa.
This involved:

- Establishing the scores of the OKS, the KSKS and the EQ5D pre-operatively, at six weeks and six months post total knee arthroplasty
- Conducting a detailed demographic interview with these patients
- Describing the factors that may have affected the outcome in patients in the abovementioned group

6.3 METHOD

6.3.1 Study Design

Prospective, longitudinal study

6.3.2 Subjects

The subjects recruited for the second cohort in the previous study (study 3) were followed up to constitute the sample for study 4.

6.3.3 Ethical considerations

Participants were invited to participate and were free to decline or withdraw at any stage. Ethical clearance was granted by the University of the Witwatersrand Human Research Ethics Committee (Medical) (protocol number M060109) (Appendix 2). Informed consent was obtained (Appendix 3).

6.3.4 Tools and outcome measures

Joint range of motion was measured using a universal goniometer.
Pain was measured using the pain section of the KSKS.
Self-reported function was measured using the Oxford Knee Score (OKS) (Appendix 1).
Health-related quality of life was measured using the EQ-5D (Appendix 1).
The knee joint itself was assessed using the Knee Society Knee Score (KSKS) (Appendix 1).
Demographics were recorded using a form that was developed with the help of an expert group (Appendix 11) as well as support from the literature (Beattie et al 2002, Mahomed et al 2002, Monnin & Perneger 2002, Goldstein et al 2000, Barbarin et al 1995).
Co-morbidity was scored using the Cumulative Illness Rating Scale (CIRS) (Salvi et al 2008, Hudon et al 2007, Hudon et al 2005, Miller et al 1992) (Appendix 11).

6.3.5 Procedure

- Patients admitted for surgery, who met the inclusion criteria, were invited to participate.
- Once consent was signed (Appendix 3), the researcher took all baseline measures (KSKS, OKS, EQ-5D) and a research assistant completed the demographic interview (Appendix 11), including the CIRS. A research assistant conducted the demographic review so that the researcher would remain blinded to demographic factors when measuring outcome.

- The standardised in-patient physiotherapy protocol (as described in Chapter 5) was conducted by the physiotherapists working in the orthopaedic wards. They were familiarised with the protocol prior to the start of the trial.
- At discharge, the subjects were assessed by the researcher and knee joint ROM, quadriceps lag and pain were measured.
- The subjects were offered the option of attending out-patient therapy, and if they chose to do so, arrangements were made to ensure that basic guidelines were followed (Appendix 9). This was to standardise any out-patient intervention due to it being one of the factors being included in the analysis.
- The researcher assessed all subjects at six weeks when they attended the follow-up clinic to see the surgeon. The KSKS was completed.
- The KSKS, as well as the EQ-5D and the OKS, were repeated by the researcher at six-months.

6.3.6 Data Analysis

Due to the exploratory nature of this study, data obtained from the baseline interview was expressed as frequencies and percentages. Data sets were then split into those who had a good outcome and those who did not, and the frequencies of the demographic factors of each group were compared using Fisher's exact.

6.4 RESULTS

6.4.1 Description of sample

6.4.1.1 Recruitment

Subjects from the second cohort of study 3 were followed up for six months post-surgery. As described in Chapter 5, one patient was excluded due to severe wound sepsis, leaving a sample size of 24. The basic demographics, as measured at baseline (pre-surgery), are presented in table 6.1.

Table 6.1 Basic demographics (n=24)

	Mean (SD) or ratio	Range
Age	63 (7)	50-76
Female:Male	21:3	
Right:Left	9:15	
BMI (kg/m$^{2)}$	35 (5)	27-48
CIRS	7 (2)	3-11

BMI=body mass index; CIRS=cumulative illness rating scale

The average BMI of the sample reflected obesity and only two subjects had a BMI of less than 30. The CIRS score reflected in Table 6.1 is the total severity score.

6.4.1.2 Follow-up

Follow-up (FU) was proposed for 6 weeks and at 6 months post surgery. Patients did not always come to the clinic on the appropriate days, and therefore the actual time frames for the two follow up points are presented in Table 6.2.

Table 6.2 Time frames for follow up points

	Mean (SD)	Range
Six-week follow-up (n=17)	9 (2)	5-12
Six-month follow-up (n=21)	6 (1)	5-7

Seven patients did not have early follow-up measurements taken and three patients did not have late follow-up measurements taken. The reasons for loss to follow-up are presented in Table 6.3.

Table 6.3 Reasons for missed follow-up

Time	*n=missing*	*Reasons*
Early follow-up	7 (29%)	Appointment too late for 6/52 measurement (5) No reply telephonically (2)
Late follow-up	3 (12,5%)	Missed appointment and came too late (1) Moved away from Johannesburg (1) Motor vehicle accident between 6/52 and 6/12 (1)

6.4.1.3 Baseline interviews

The baseline interview consisted of a detailed demographic assessment (Appendix 11). The findings for the whole sample are presented in the following tables as averages or frequencies and percentages.

Table 6.4 Marital status and socioeconomic environment (n=24)

	Frequency (%)
Marital status	
Never married, not now living with partner	3(13)
Was married, not now living with partner	9(35)
Widowed	6(25)
Never married, but now living with partner	1(4)
Married and living with partner	5(21)
Yes – is co-habiting with partner	**6(25)**
People currently living in household	
Co-inhabitants >18 years old	21(88)
Co-inhabitants 6-18 years old	6(25)
Co-inhabitants <6 years old	3(13)
Economic status of household	
Monthly household income > national poverty line	15(58)
Current dependents	
Adult physical	1(4)
Adult financial	8(33)
Child physical	6(25)
Child financial	2(8)
None	12(50)
Yes – has dependents	**12(50)**
Current caregivers	
Adult full time	7(29)
Adult part time	9(38)
Old age home	2(8)
None	6(25)
Yes - has a caregiver	**18(75)**

Only 25% of the subjects were currently co-habiting with a partner. Of the 21 subjects who had adult co-habitants, the average number of co-habitants was 2,5 per household. The average number of co-habitants between six and 18 years of age and below the age of six was one. Therefore, 88% of households in this

sample were comprised of at least three adults. Only just over half of households generated enough monthly household income to ensure all members were living above the national poverty line. Half the subjects were either financially or physically responsible for at least one other person. Seventy five percent of the subjects reported they would have a caregiver when discharged. Of the 16 subjects who would have a caregiver, only one caregiver would be sacrificing employment to help the subject.

Level of education, employment history and source of income are presented in Table 6.5.

Table 6.5 Level of education, employment and source of income (n=24)

	Frequency (%)
Level of education	
Less than grade 5	3(13)
Primary school (grade 5-6)	1(4)
Junior secondary (grade 7-9)	6(25)
Senior secondary (grade 10-12)	9(38)
Matric / Vocational training diploma	2(8)
1-2 years college / technician	3(13)
3-4 years university	0
Post graduate	0
Primary / secondary / tertiary	**6(25) / 15(63) / 3(13)**
Current employment status	
Full time	2(8)
Part time	2(8)
Retired	10(42)
Not working due to knee	10(42)
Yes / No	**4 (17) / 20 (83)**
Current source of income	
Salary	3(13)
Pension	14(58)
Grant	3(13)
Donations	1(4)
Partners income	1(4)
Other	2(8)
Salary or pension	**17(75)**

Most subjects had at least a secondary school education. A large proportion (42%) of the subjects were not working due to their knee condition. Most of the subjects were receiving a salary or a pension.
The normal daily activities of the subjects are presented in Table 6.6

Table 6.6 Normal daily activities (n=24)

	Frequency (%)
Household chores	
Laundry	16(67)
Cooking	20(83)
Dishes	17(71)
Floors	12(50)
Other	3(13)
Recreation	
Church	18(75)
Social club	1(4)
Other	5(21)

Subjects could select more than one option for each of these sections. The three responses of ‘other’ to household chores were gardening. The responses of ‘other’ for recreational activities were qualified by swimming (1), flower arranging (1), gym (2) and DIY (1).

The physical home environment is described by the findings presented in Table 6.7.

Table 6.7 Physical home environment (n=24)

	Frequency (%)
Type of house	
None	0
Shack	1(4)
Hostel	0
Room / garage	0
Flat / cottage	6(25)
Home (shared)	2(8)
Own home	15(63)
Toilet	
None	0
Pit / bucket	3(13)
Outside flush	1(4)
Inside flush	20(83)
Distance to running water	
Inside	20(83)
<10 meters	1(4)
10-25 meters	1(4)
> 25 meters	2(8)
Ground around the house	
Smooth sand / lawn	1(4)
Smooth paved	15(63)
Smooth gravel	4(17)
Bumpy gravel	4(17)
Rocky	0
Hilly	0
Other	0

The majority of subjects lived in their own home (63%), had running water (83%) and a flush toilet (83%) inside the house. Most subjects did not have rugged terrain outside their house.

The baseline interview also assessed how patients travel to the hospital. The findings are presented in Table 6.8.

Table 6.8 Transport and access to the hospital (n=24)

	Frequency (%)
Transport to hospital	
Own car	3(13)
Family member's car	11(46)
Employer's car	1(4)
Taxi (car)	2(8)
Taxi (Minibus / venture)	8(33)
Bus	2(8)
Train	0
Other	0
Time to walk to transport	
Not at all	12(50)
Less than 15 minutes	8(33)
15 to 30 minutes	2(8)
More than 30 minutes	2(8)
Time of the journey to the hospital	
Less than 30 minutes	1(4)
30 minutes to 1 hour	17(71)
1 to 2 hours	4(17)
More than 2 hours	2(8)
Accompanied by	
Nobody	11(46)
Family member (employed)	7(29)
Family member (unemployed)	6(25)
Employer	0
Other	0
Yes – accompanied to hospital	**13(54)**
Cost of the transport to hospital	
Less than R15	9(38)
R15 – R30	13(54)
R30 – R50	1(4)
More than R50	1(4)

Subjects could choose more than one response to the question on form of transport. The most common forms of transport were a family member's car (46 %) or a minibus taxi (33%). Reaching their transport took less than 15 minutes for the majority (83%) of subjects. For the majority of subjects the journey to the hospital took an hour. The journey to the hospital cost less than R30 for most

subjects (92%). Just over half (54%) of subjects were accompanied on their trips to the hospital. Subjects were given the opportunity to comment on why they were accompanied to the hospital. The open-ended responses are tabulated below.

Table 6.9 Reasons for being accompanied to hospital

Patient factors	Difficult to walk alone Brings husband for 'moral support' Likes to bring someone because of pain Help with reading and carrying bags
Transport factors	Initially not allowed to drive Don't like to travel alone Easier to use private car than public transport Need son to use his car
Hospital factors	Son came with as doesn't know way around hospital Son comes to help look after her Moral support and get things done more quickly Husband can queue at pharmacy while still at clinic to speed things up Scared of falling Difficult to walk with crutch and carry bag

Two subjects also commented that they would like to be accompanied to the hospital, but the cost is too much.

Assessing how the patients access their local clinics could potentially inform the CPG, particularly with regard to implementation. The findings are presented in Table 6.10.

Table 6.10 Transport and access to local clinic (n=24)

	Frequency (%)
Number of local clinics the subject could name	
0	4(17)
1	11(46)
2	7(29)
3	2(8)
Transport to clinic	
Own car	4(17)
Family member's car	6(25)
Employers car	1(4)
Taxi (car)	1(4)
Taxi (Minibus / Venture)	7(29)
Bus	1(4)
Train	0
Other	5(21)
Time to walk to transport	
Not at all	16(67)
Less than 15 minutes	5(21)
15 to 30 minutes	3(13)
More than 30 minutes	0
Time of the journey to the clinic	
Less than 15 minutes	11(46)
15 to 30 minutes	10(42)
30 minutes to 1 hour	2(8)
More than 1 hour	1(4)
Accompanied by	
Nobody	19(79)
Family member (employed)	1(4)
Family member (unemployed)	4(17)
Employer	0
Other	0
Yes – accompanied to clinic	**5(21)**
Cost of the transport to clinic	
No cost	11(46)
Less than R15	13(54)
R15 – R30	0
R30 - R50	0

Seventy-five percent of subjects could name at least one nearby clinic. As for hospital travel, the most common forms of transport to the clinic were a family member's car or a taxi. Subjects could give more than one response to mode of transport. The five subjects that responded 'other' to form of transport qualified their response with 'walk'. The majority of subjects (89%) did not have to walk more than 15 minutes to get to their transport (if at all). Only 21 percent of subjects were accompanied to the clinic. Four subject gave reasons for being accompanied to the clinic and these were 'moral support' (two subjects) and 'scared of falling' (two subjects). No subjects paid more than R15 to get to their local clinic.

Subjects were questioned about previous experience of physiotherapy services and also about their expectations of the surgery. The responses are reported in Table 6.11.

Table 6.11 Previous exposure to physiotherapy and post-operative expectations (n=24)

	Frequency (%)
Previous physiotherapy treatment	14(58)
Location of treatment	
Public hospital	9(64)
Public clinic	3(21)
Private sector	4(29)
Would like to make use of physiotherapy services again	14(100)
Amount of pain expected after surgery	
None at all	7(29)
Slight	8(33)
Moderate	6(25)
Severe	3(13)
Pain expected	**17(71)**
Amount of limitation expected after surgery	
None at all	12(50)
Slight	9(38)
Moderate	3(13)
Severe	0
Limitation expected	**12(50)**

Only 58% of the subjects had been exposed to physiotherapy services prior to this assessment. Of the 14 subjects who had encountered physiotherapy services before, most of them had been in a public hospital setting (64%). All 14 responded that they would like to make use of the services again. Most subjects (71%) expected some degree of pain post surgery but only 50% expected some degree of functional limitation.

6.4.2 Main outcomes

The main outcomes were knee integrity (as measured by the KSKS), self-reported function (OKS) and health-related quality of life (EQ-5D). The results of the KSKS, the OKS and the EQ-5D(VAS) are presented in Table 6.12. The results of the EQ-5D(index) are presented in Table 6.13.

Table 6.12 KSKS, OKS and EQ-5D(VAS) at baseline, 6 weeks and 6 months post surgery (n=24)

Outcome (SD)	*Pre-surgery (n=24)*	*Early FU(n=17)*	*p value*	*Late FU (n=21)*	*p value*
KSKS	42 (21)	60 (23)	0.04*	72 (19)	0.00*
OKS	43 (7)	-	-	25 (11)	0.00*
EQ-5D(VAS)	72 (20)	-	-	75 (24)	0.39

All measures improved post surgery. At early follow-up, the KSKS had improved significantly (p=0.04) and at late follow-up the KSKS (p=0.00) and OKS (p=0.00) had improved from baseline. There was a small improvement in the EQ-5D(VAS), but it was not significant (p=0.39).

Table 6.13 Baseline and six week EQ-5D indices (n=24)

Domain	*Answer option*	*Pre surgery (n=24)*	*Late FU(n=21)*
Mobility	1	1	15
	2	23	6
	3	0	0
Self-care	1	11	15
	2	11	5
	3	2	1
Usual Activities	1	2	8
	2	19	11
	3	3	2
Pain / Discomfort	1	1	11
	2	16	8
	3	7	2
Anxiety / Depression	1	14	14
	2	10	5
	3	0	2

In all domains of the EQ-5D index measurement, the responses were more favourable post surgery, except for the domain of Anxiety / Depression, which did not improve.

6.4.3 Additional outcomes

Knee flexion ROM and knee extension deficit were not primary outcomes in this study, but they warrant some reporting as they are frequently used outcomes and are used in most literature. The results are presented in Table 6.14.

Table 6.14 Knee flexion ROM and knee extension deficit at baseline, six weeks and six months post surgery (n=24)

Outcome (SD)	*Baseline (n=24)*	*Six-week follow-up (n=17)*	*p value*	*Six-month follow-up (n=21)*	*p value*
Knee flexion ROM	92 (20)	95 (16)	0.08	100 (13)	0.06
Knee extension deficit	7 (12)	6 (5)	0.71	2 (3)	0.05*

Both outcomes improved over a six month period post surgery, but only the knee extension deficit had a significant improvement (p=0.05). At early follow-up, while both outcomes had improved, there was not a significant change in either outcome.

6.4.4 Factors affecting outcome

Subjects were considered to have a 'better' outcome if they improved from baseline and scored above average in at least three outcomes and were considered to have a 'poorer' outcome if they did not meet these criteria. Demographic factors are presented as percentages, and trends regarding demographic factors relationship to outcome are noted. Comprehensive tabulation of the factors in the good and poor outcome groups is included in Appendix 11.

6.4.4.1 Intrinsic factors

Intrinsic factors that may have affected outcome include baseline measurements of knee integrity, function and perceived health related quality of life. Age and co-morbidity are also considered intrinsic factors. These findings are tabulated below.

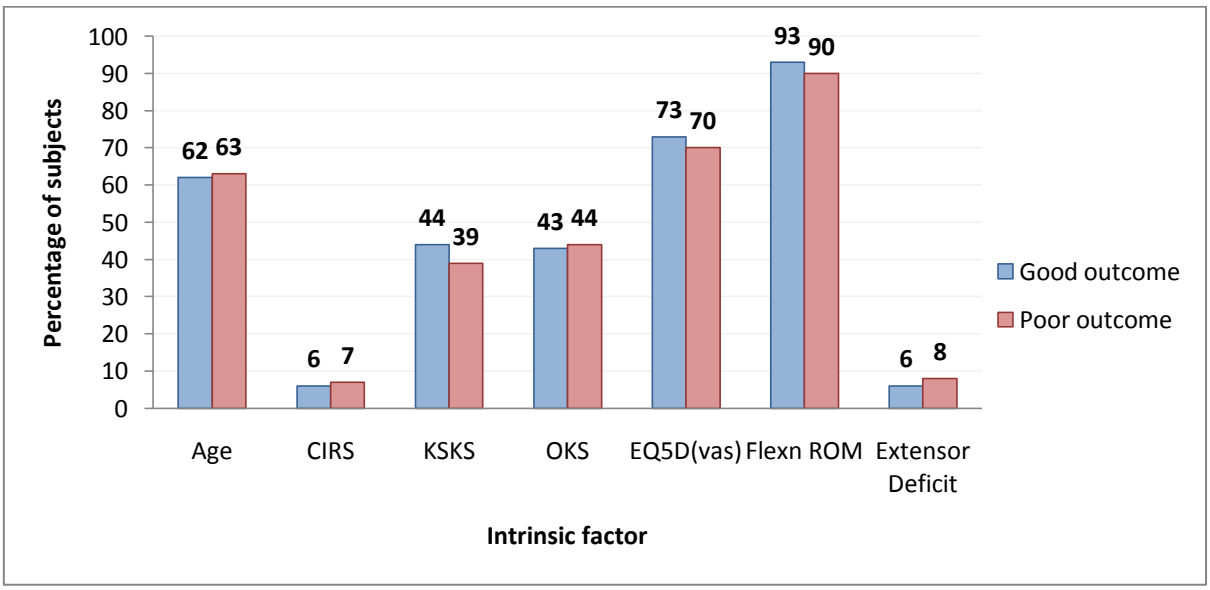


Figure 6.1 Intrinsic factors and outcome (n=24)

Body mass index and co-morbidity scores were slightly higher in the group with poorer outcome. This group had slightly worse pre-operative knee integrity (KSKS) and slightly lower perceived health related quality of life. Knee extension deficit

was slightly more in the group who had poorer outcome. None of these differences were significant.

6.4.4.2 Sociodemographic factors

Sociodemographic differences between the subjects with a better outcome and the subjects with a poorer outcome are presented in the figures that follow.

6.4.4.2.1 Social environment at home

Marital status and the presence of dependents or caregivers in the home are presented in figure 6.2.

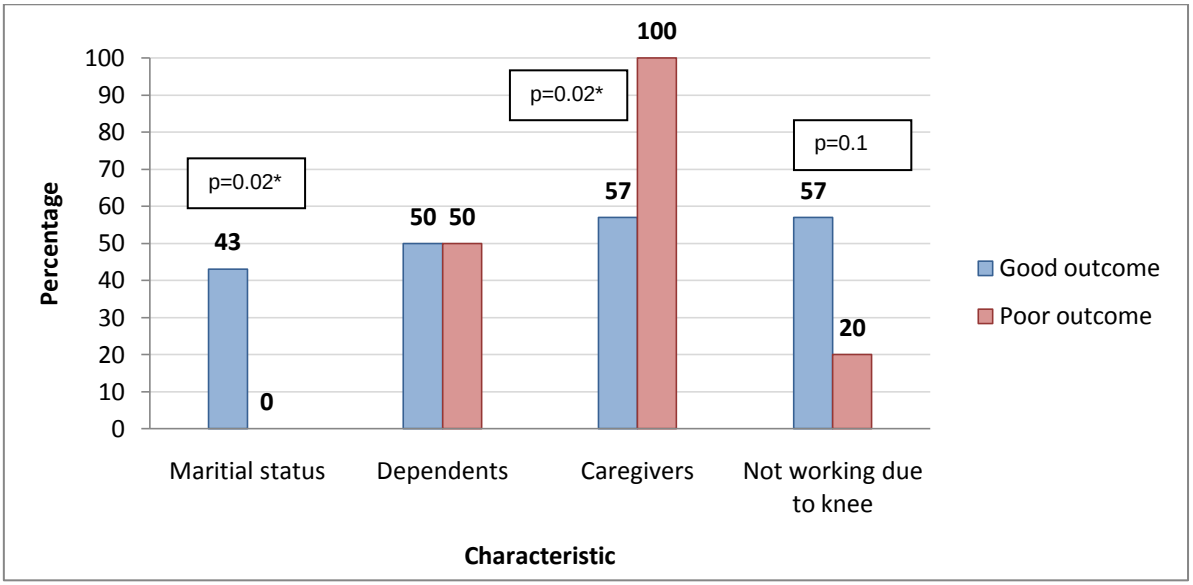


Figure 6.2 Marital status, dependents and caregivers in subjects with good and poor outcome (n=24)

None of the subjects in the group with the poorer outcome were co-habiting with a partner, which was significantly different from the group with a better outcome (p=0.02). A significantly smaller proportion (p=0.02) of the subjects in the better outcome group had caregivers (only 57%) whereas all the subjects in the poorer outcome group had caregivers. The economic status was similar in both groups. A higher proportion (p=0.1) of subjects in the group with better outcome reported that it was their knee that was stopping them from working, although this was not significant.

6.4.4.2.2 Level of education

Figure 6.3 shows the differences in level of education between the subjects with good outcome and those with poor outcome.

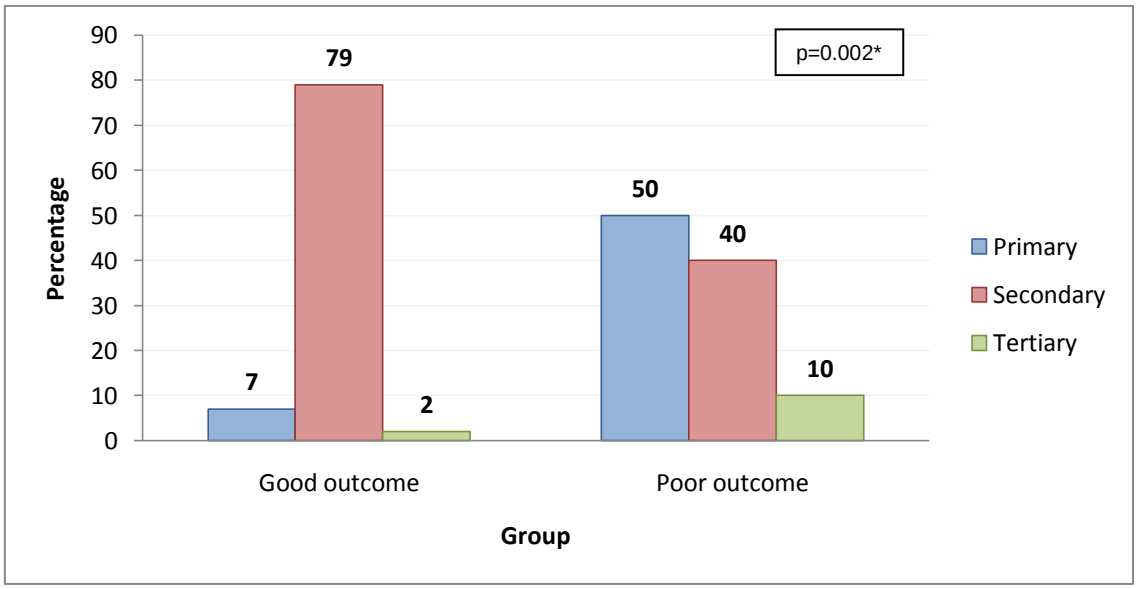


Figure 6.3 Level of education and outcome (n=24)

In the group that had a better outcome, the majority of subjects had at least a senior secondary level of education, whereas in the group with poorer outcomes, less than half of the subjects had reached this level of education. The level of education was significantly higher in the group that had a better outcome (p=0.002).

6.4.4.2.3 Previous exposure to physiotherapy and patient expectation

The percentage of patients in each group who had previously been exposed to physiotherapy services, as well as what the subjects' expectations were in terms of post-operative pain and functional limitation, are presented in figure 6.4.

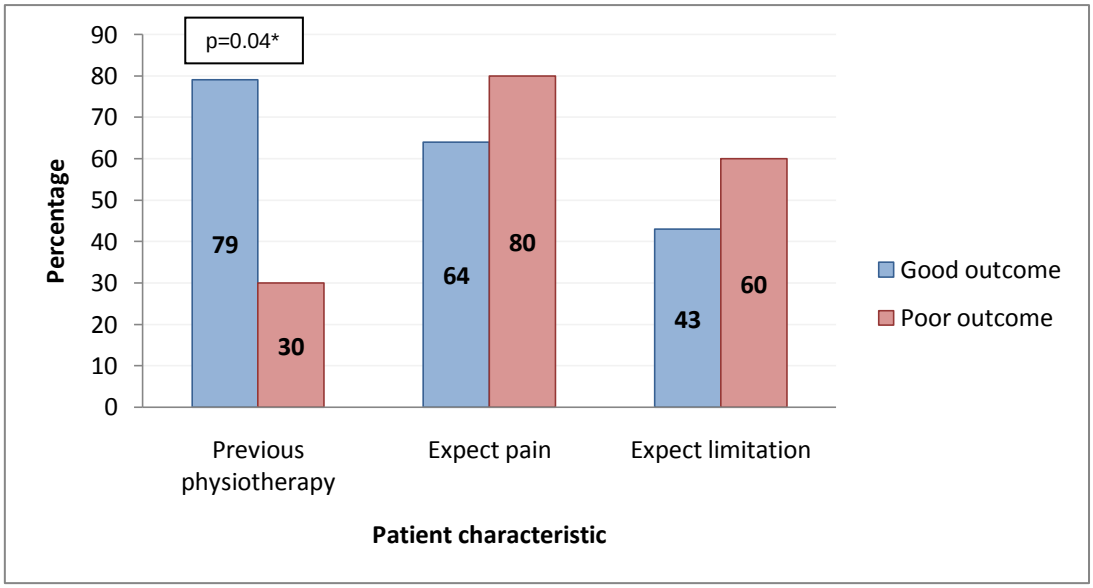


Figure 6.4 Previous experience of physiotherapy and patient expectations (n=24)

A larger proportion (79%) of the subjects who had better outcomes had previous experience of physiotherapy (p=0.04). Subjects in the group with a better outcome generally had higher expectations with regard to pain relief and functional limitation post surgery, although their expectations were not significantly different from the group with poorer outcome.

6.5 DISCUSSION

The discussion that follows is structured around the baseline assessment, from baseline knee scores to detailed sociodemographics and patient expectations. Each aspect or group of aspects will first be compared to norms from other publications (where such norms are available). Then, each aspect will be discussed in terms of whether it may have a relationship with outcome. By the end of this discussion, a general profile of the subjects in this study should be formed, with the intention that this should provide some insight into the profile of potential stakeholders in the CPG development process. In addition, from the factors described in subjects with good and poor outcome, a profile of an 'at risk' patient should be formed. This can then inform clinical questions to be addressed by the CPG.

6.5.1 Age, gender, BMI and co-morbidity

6.5.1.1 Age

The sample in this exploratory study was slightly younger than most other recent studies on patients post TKA. The group with poorer outcome was slightly older (63±9 years) than the group with better outcome (62±7 years), though this was not a significant difference.

6.5.1.2 BMI

This sample had a higher BMI than most studies of patients who have undergone TKA, which range from 29 (Elson et al 2006) to 35 (Gandhi et al 2006). The average BMI was 35 and all but two subjects had a BMI over 31.
The pattern of more women than men in the sample is totally in line with previous studies, but this sample has a substantially lower proportion of male subjects than historical controls.

6.5.1.3 Co-morbidity

There are not many references for age-related norms for the CIRS, particularly not in a population undergoing TKA. Miller et al (1992) and Hudon et al (2005) present total severity scores of groups of similar age, although the sample in the study by Miller et al (1992) was a sample with known medical illness. The average of 7 recorded in this study is well below what was observed by both of these authors. The main contributors to the CIRS total scores were obviously the OA of the knee, as well as obesity and hypertension. In this study, CIRS was scored by interview and not record review, which in the study by Hudon et al (2005) was found to slightly overestimate total severity scores. Further study of this measure for use by rehabilitation professionals is warranted. The group with poorer outcome scored slightly higher on the total severity score of the CIRS.

6.5.1.4 Summary

Therefore, this sample is slightly younger and more obese than most samples and they may have a lower than average for age co-morbidity.

6.5.2 Outcome measures

6.5.2.1 KSKS

The baseline score of the KSKS falls in between the range of baseline scores in published studies. Historical controls range from 33 (Gandhi et al 2006) to 49 (Lenssen et al 2006). This sample had a similar average (42) to the sample in the study by Kumar et al (1996), which had an average KSKS of 41. The baseline KSKS was slightly higher in the group that had better outcome.

The six-week KSKS (60) in this sample was lower than historical controls, which range from 69 to 77 (Gandhi et al 2006; Lenssen et al 2006), as was the six-month score (72) when compared with those of Gandhi et al (2006), which averaged 82 points.

6.5.2.2 OKS

The mean baseline OKS of 43 in the study sample is similar to that of Gandhi et al (2006) in which the average OKS of the entire sample was 42 and the study by Dawson et al (1998) in which the sample mean was 44. The baseline OKS score was not significantly different between the group that had a better outcome and the group that had a poorer outcome.

The six-month OKS of 25 in the study sample was slightly better than the scores in the study by Gandhi et al (2006), which averaged 29 points.

6.5.2.3 EQ-5D

The EQ-5D was included in study 4, despite the challenges encountered in study 1 (as described in Chapter 3) as these challenges had not been reported in previous publications regarding its use in Southern African populations. During study 4, the same challenges were encountered. The relationship of the EQ-5D(VAS) to outcome and follow-up is reported on for completeness sake, but the validity in this population requires further testing. The EQ-5D(VAS) was only slightly higher at baseline, in the group that had better baseline.

There are no studies with which to compare the six-week EQ-5D scores.

6.5.2.4 Knee flexion ROM

The knee flexion ROM baseline score of 92° was slightly lower than most studies, which ranged from 90° (Johnson et al 1990) to 116° (Asano et al 2008). The baseline knee flexion ROM was slightly better in the group that had better outcome, but not significantly. Previous studies have shown that pre-operative knee flexion is the single most important predictor of post-operative knee flexion ROM (Gandhi et al 2006, Ritter et al 2003), so this may have influenced the outcome, although in this study the association was not significant.

The six-week (95°) and six-month (100°) flexion ROM in the study sample was slightly lower than what has been reported in most previous studies. The six-week flexion ROM in studies that were reviewed ranged from 79° (Gandhi et al 2006) to 105° (Kumar et al 1996), and the six-month flexion ROM ranged from 89° (Gandhi et al 2006) to 115° (Kumar et al 1996).

6.5.2.5 Knee extension deficit

Knee extension deficit at baseline was slightly higher in this study sample when compared with previous studies. The group that had better outcome had slightly less knee extension deficit at baseline than the group with poorer outcome. Pre-operative quadriceps strength has been shown to be a strong predictor of post-operative functional outcome (Mizner et al 2005a).

The six-week (6°) and six-month (2°) knee extension deficit in the study sample did not differ from historical controls.

6.5.2.6 Summary

In this sample, none of the baseline measures were dissimilar from previous studies. They were also not significantly different between the groups with good and poor outcomes. Outcomes for which this sample scored less than historical controls were the KSKS, and knee flexion ROM. The OKS was slightly better in this sample than those in the studies reviewed, and the knee extensor deficit did not differ.

6.5.3 Marital status, socioeconomic environment, dependants and care-givers

6.5.3.1 Marital status

In the group that had a better outcome a higher proportion (43%) (p=0.02) were currently co-habiting with a partner, in contrast with group with a poorer outcome in which no subjects were currently co-habiting with a partner. While this finding has not yet been shown in a sample of patients who have undergone TKA, it is not unique to this study (Murphy et al 2008).

6.5.3.2 Composition of the household and household income

A large proportion of all subjects had a number of adults living in the household, with an average of 2,5 adults per household co-habiting with the subject .
Forty-two percent of subjects were part of a household in which the monthly household income is less than the national poverty line. Economic status did not differ between the groups with better and poorer outcome.

6.5.3.3 Dependents and caregivers

Half of the subjects had dependants of some form or another, the most common type being a financially dependent adult (33%). The better and poorer outcome groups did not differ at all in terms of whether or not the subjects had dependants.
Seventy-five percent of all subjects had a caregiver at home after discharge. In terms of outcome, a significantly lower proportion (p=0.02) of the group with better outcome had caregivers (57%) as opposed to the group with poorer outcome in which all the subjects had caregivers. A possible explanation for this is that patients without caregivers are forced to become more self-sufficient, encouraging mobility and functional independence.

6.5.3.4 Summary

The group that had poorer outcomes was not currently co-habiting (p=0.02), but a high proportion of them had caregivers (p=0.02).

6.5.4 Level of education, current employment and source of income

6.5.4.1 Level of education

Sixty-three percent of the total sample had a senior secondary education. The group with a better outcome had a higher level of education (p=0.002). A possible explanation is that a better educated sample would possibly have better health awareness and take more responsibility for their recovery.

6.5.4.2 Employment status

Only seventeen percent of the total sample was currently employed. This is hardly surprising considering the mean age of the sample. An unexpected finding was the high (though not significant) proportion (p=0.1) of subjects in the group with a better outcome who stated that they were not working due to their knee. While these patients were not receiving workman's' compensation benefits, they still have this connection between their knee problem and work situation. Patients who are receiving workmen's compensation have been shown to have a poorer outcome (de Beer et al 2005).

6.5.4.3 Form of income

Seventy-five percent of the total sample received their income in the form of a salary or pension. These can both be considered a form of income that implies that the patient has some degree of financial independence. A slightly lower proportion of subjects in the group with better outcome had this independent form of income. It is unclear why this would be the case.

6.5.4.4 Summary

Patients with lower levels of education may be at risk for poorer outcome.

6.5.5 Normal daily activities

A large proportion of the sample was involved in chores around the house. The lowest proportion (but still 50%) responded that they cleaned the floors. This makes sense as floor-washing may involve kneeling, and this is one of the most difficult activities for patients with knee pathology. There were no obvious differences between the group with better outcome and the group with poorer

outcome in terms of their involvement with household chores. The group that had better outcomes had a higher proportion of subjects that attended church or participated in other recreational activities.

6.5.6 Physical home environment

Almost all subjects in the total sample had an acceptable standard of accommodation, with only one subject living in a shack. What was interesting was that in the group with better outcome, a lower proportion lived in their own 'stand alone' house.

Access to running water and toilet facilities was for the most part, of a high standard in all groups. There were three subjects who did not have access to a flush toilet and these three all had poorer outcomes. These were probably the same three subjects who had to walk more than 10m to reach running water.

The observation that the group with poorer outcome may have rougher terrain outside their homes may be explained by the idea that the rough terrain might have discouraged them from mobilising outside their house. This could have hampered their functional independence and therefore outcome. Perhaps of more value is the finding that overall, the majority of subjects have smooth terrain outside their houses. During the preparation of this study, it was suspected that this was not the case. It was important to investigate this as rougher terrain would have meant higher functional demand on the patient post discharge. This would have implications for discharge criteria and in-patient intervention.

6.5.7 Transport and access to hospital and clinic

6.5.7.1 Hospital

The most common form (46%) of transport to travel to the hospital was a family member's car. The second most common form of transport was a minibus taxi (33%).

In terms of transport to the hospital, the trend was similar in both the better and poorer outcome groups. The group with better outcome had a lower proportion of subjects who were accompanied to the hospital, echoing the concept of independence and responsibility being associated with better outcome as discussed in sections 6.5.3 and 6.5.4.

The majority of the total sample did not have far to walk to access their transport to the hospital and this trend was similar in both groups in terms of outcome. Most subjects had between 30 minutes and one hour journey time to the hospital and the cost of transport was less than thirty rand. This trend was similar for both groups.

6.5.7.2 Clinic

Mode of transport to a local clinic followed a similar pattern to that of the hospital, but a higher proportion of the sample used their own car or walked to the clinic. Most subjects were not accompanied on clinic visits.
Journey time to a local clinic was less than 30 minutes for the majority of subjects and the cost of transport for most subjects was less than fifteen rand.

6.5.7.3 Summary

Journey times of between 30 minutes and one hour may be acceptable for occasional follow-up with the surgeon, but are not acceptable if the patients need to have regular visits to physiotherapy. The journey time of less than 30 minutes, lower transport cost of less than fifteen rand and the fact that they are not accompanied, suggests that local clinics are a feasible option if out-patient therapy is to be administered. The concern is that patients seem to have poor knowledge of their local clinics, as most patients could only name one local clinic and 17% could not even name one local clinic. These findings confirm the concerns that were raised in the introduction to this thesis.

6.5.8 Previous exposure to physiotherapy and post-operative expectations

6.5.8.1 Previous exposure to physiotherapy

Only 58% of subjects had had any kind of prior exposure to physiotherapy services. This is surprising in an elderly population who has a chronic musculoskeletal condition such as osteoarthritis. The reasons for this should be explored further, since there may be a place for physiotherapy and exercise in the conservative management of osteoarthritis of the knee (Lange et al 2008, Lin et al 2009). The other observation that supports this concern was that only five of all the subjects knew whether or not their local clinic had physiotherapy services or not.

Over half of the subjects who had previous experience of physiotherapy services had done so at a public hospital, with only 21% of that sample having attended physiotherapy at their local clinic. All subjects who had previous experience of physiotherapy services responded that they would like to make use of them again. This may indicate that the lack of utilisation of physiotherapy services is not due to a poor service as such, but may have more to do with lack of awareness of such services or obstacles in accessing such services.

The proportion of subjects who had previous experience of physiotherapy was lower in the group with poorer outcome ($p=0.04$). This reinforces the notion that in this sample there may have been subjects with poor health awareness which was associated with poorer outcome.

6.5.8.2 Patient expectations

While 71% of subjects expected pain after surgery only 50% expected some functional limitation. The group that had a better outcome had a lower proportion of subjects that expected pain and functional limitation post surgery. A simple explanation may be that the subjects with higher expectation were more positive and this may have influenced outcome. This finding is in agreement with those of Mahomed et al (2002) who showed that pre-operative expectation of complete pain relief was a predictor of successful outcome.

6.6 SUMMARY OF THE CHAPTER

A basic demographic profile of the subjects has been described in this chapter. This will be used in Chapter 7 (section 7.2.1.2) to inform the process of stakeholder selection. The findings of this study can be used to identify which factors could possibly affect outcome. Factors that may be associated with poorer outcome may, if assessed early, help to detect patients at risk for poorer outcome. These factors are presented in Chapter 7 in table 7.2. This raises clinical questions for the CPG as discussed in Chapter 7 (section 7.2.3.1.2).

CHAPTER 7

REPORT TO INFORM THE DEVELOPMENT OF A CLINICAL PRACTICE GUIDELINE

7.1 INTRODUCTION

The results of the four individual studies have been discussed within their respective chapters. The six phases of CPG development will now be discussed within the context of what has been investigated or reviewed during the course of this thesis. Questions outlined in table 1.1 will be answered based on findings of the literature review, relevant findings from the four studies or any anecdotal or incidental findings that may inform the CPG development process. The report is structured as illustrated by Figure 7.1.

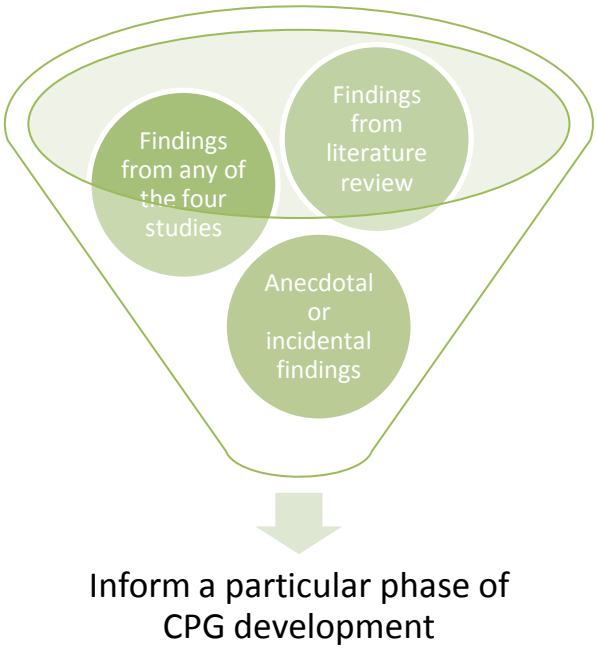


Figure 7.1 Informing each question in each phase of the development of the CPG

7.2 INFORMING EACH PHASE OF CPG DEVELOPMENT

7.2.1 Organisation and structure

7.2.1.1 Co-ordination of the process

Shekelle et al (1999) mention a 'central organisation' co-ordinating the process of guideline development. In South Africa, the obvious central organisation to drive the process of clinical practice guideline development for physiotherapists would be the South African Society of Physiotherapy (SASP). While the Society has endorsed certain guidelines (www.physiosa.org.za), none of these have been developed according to a universal guideline development procedure such as the WCPT guideline. The value in having a central organisation such as a professional body co-ordinating the process is that it provides a level of neutrality and credibility.

7.2.1.2 Defining the potential stakeholders

The potential stakeholders investigated during the course of this thesis were the physiotherapists working in the public sector and the patients themselves. It is important that if stakeholders are to be included in the CPG development process, they must be representative of the relevant population.

From the results of study 2, it is evident that a physiotherapist treating patients in the public sector post TKA is likely to have less than three years clinical experience. It is also likely that they work in both in-patient and out-patient situations.

A typical patient profile can be described from the findings of study 4. A typical patient is likely to:

- Be female
- Be obese
- Not be co-habiting with a life partner
- Be co-habiting with other adults
- Have a caregiver

- Have a secondary school education
- Have some form of income (either salary or pension)
- Live in their own home
- Have running water and a toilet inside their house

7.2.1.3 Anecdotal or incidental findings

The peri- and post-operative analgesia protocol is not in line with international guidelines (Fischer et al 2008), therefore consultation with the anaesthetics team is required to ensure an evidence-based CPG.

7.2.1.4 Summary

Even though this thesis is informing the development of a physiotherapy guideline post TKA, the physiotherapy management of patients post TKA does not take place in isolation of the rest of the medical team. Thus, the structure of a multidisciplinary group to develop the guideline should include the various members of the healthcare team as well as patient representatives for the reasons shown in Table 7.1.

Table 7.1 The constitution of the multidisciplinary team

Member of team	Reason for inclusion on team
Clinical physiotherapist/s	For obvious reasons – particularly physiotherapists familiar with the clinical situation in public hospitals. A physiotherapist familiar with the public health system would be of value in addition to a physiotherapist with clinical experience in the management of patients post TKA. A physiotherapist who is in their first year of clinical work may provide some insight into the level at which the guideline should be pitched.
Orthopaedic surgeon/s	The patients are primarily under the care of the orthopaedic surgeon and thus any post-operative intervention should be developed in conjunction with their department.
Anaesthetist	Post-operative pain control may be important in influencing early recovery (refer to studies and Chapter 2), therefore an anaesthetist should be included if the guideline is to include the immediate post-operative phase, particularly since current pain management post-surgery is not in line with international guidelines.
Nursing sister/s	If the guideline is to include the in-patient phase of management, the nursing sister will provide insight into ward procedure which has obvious impact on implementation. Examples of this include streamlining the admission procedure to allow for pre-operative education, ensuring pain medication is administered for maximum efficacy to coincide with the daily physiotherapy session and ensuring dressing changes are appropriately timed in consultation with the physiotherapists. The input of a nursing sister can facilitate lines of communication between physiotherapy staff and nursing staff.
SASP representative/s	The process must be co-ordinated by a central organising body.
Patient representative	Particularly due to the specific characteristics highlighted in section 7.2.1.2.

It is proposed that the SASP co-ordinate the CPG development process, provided the appropriate phases of CPG development are followed. A CPG should at least be endorsed, if not driven, by a central body. Currently there is no committee or structure within the SASP that oversees this process. If more CPGs are to be developed, as is the worldwide trend, a committee should be convened to ensure a certain standard of CPG development.

7.2.2 Preparation

7.2.2.1 Justifying the need for a CPG

Shekelle et al (1999) and van der Wees et al (2007) mention the importance of *prioritising* which guidelines are to be developed as part of the preparation process. If the process is being driven by a 'top-down' approach (being initiated by the 'central organisation'), and there are many requests for guidelines to be developed, then this is a feasible stand to take. However, if the initiative is coming from 'grass roots' level and there is not yet a great demand on the central organisations that should be co-ordinating the process, then prioritising *which* guidelines are developed is less of an issue. What is more relevant in this situation, is the *justification* of the need for a clinical practice guideline. As shown by the results of Study 2 (Chapter 4), the majority of physiotherapists working in the public sector are relatively inexperienced. This in itself may be justification for a CPG for physiotherapists working with patients post TKA. The fact that these patients are being managed by relatively inexperienced physiotherapists, who are rotating through the ward for only four months, could lead to inconsistencies in the treatment they receive. Inexperienced physiotherapists may not be equipped to identify the 'at risk patient' (as will be discussed in more detail in section 7.2.3.1.2) and a guideline can provide them with a basis for their clinical decision-making regarding these patients. In addition, the proportion of subjects in Study 4 who had a good outcome was lower than what is commonly reported (Ranawat et al 2003). Since one of the roles of a CPG is the improvement of clinical outcomes (Grimshaw et al 1993), this finding is also justification for a CPG.

7.2.2.2 Anecdotal or incidental findings

The findings of study 2 showed that there was variable practice with regard to scheduling of treatment and in some cases, content of treatment. The scheduling of weekend treatment as well as the scheduling of out-patient treatments was significantly different between the public and private sectors, with public therapists not routinely treating patients over the weekend ($p=0.00$) and treating patients less regularly in the out-patient setting ($p=0.00$). The real reasons behind this discrepancy were not investigated, and neither mode of scheduling can be

supported by any literature. Further investigation is warranted before applying either mode of scheduling to a CPG.

7.2.2.3 Summary

Due to the recommendation of a 'bottom-up' approach, the need for the CPG should be justified. Findings from this thesis that justify the need for a CPG include:

- The relative inexperience of physiotherapists working in the public sector
- The variances in practice between private and public sector physiotherapists may also justify the need for standardising practice.

7.2.3 Guideline development

7.2.3.1 Identifying important clinical questions for this population

It is important that a practice guideline provides a solution to clearly defined clinical problems. The following are the proposed clinical problems to be covered by the guideline, as they are the problems encountered during the completion of this thesis.

7.2.3.1.1 Out-patient referral

The majority of responders in the survey of current practice (Chapter 4) reported that they routinely refer to out-patient physiotherapy (OPD) upon discharge, even the responders from the public sector. This is in contrast to what was observed in the longitudinal study (Chapter 6) in which patients were given the option of attending out-patient therapy and none attended. This may have been because most of the responders were from the private sector and the patients in the longitudinal study were all using public health services, but even in the small sample of responders from the public sector (n=11), the majority referred their patients to out-patient physiotherapy.

The literature reviewed in Chapter 2 showed that there is little evidence to support routine referral to out-patient therapy (Kramer et al 2003, Rajan et al 2006). Therefore, the current situation is that physiotherapists are referring patients for out-patient therapy, contrary to what the evidence supports, but patients are not always following-up on the referral (as observed in study 4). This raises the

question of whether or not the incorporation of out-patient therapy should even be considered a priority for a CPG in this context.

The clinical problem is less about whether or not to include out-patient therapy in the CPG, and more about who should be referred to OPD (discussed in section 7.2.3.1.2) and about how to facilitate the process so that the patients who are referred to OPD are actually able to have the therapy for which they have been referred.

The reasons for patients not following-up on their referral to out-patient therapy were not specifically explored, but observations in study 4 may provide some insight into this problem. As presented in Chapter 6, 42% of subjects are part of a household in which the monthly household income is insufficient to maintain each member above the national poverty line. For these patients, the R15 to R30 that it costs them to travel to the tertiary hospital may be prohibitive to regular therapy visits. As highlighted in the discussion of Chapter 6, the 30 minutes to one hour journey time is also not practical if it is to be done regularly as would be required for therapy purposes. The obvious solution for delivering out-patient therapy services is to make use of the local clinic services, but since 17% of the subjects could not even name one local clinic, this avenue could not be recommended for the CPG without further investigation, particularly to establish which clinics actually offer physiotherapy services.

Another possible solution is to establish, as early as the pre-operative assessment, which clinics are closest to the patient and whether or not they offer physiotherapy services. If not, and particularly if the patient is identified as ‘at risk’ (see section 7.2.3.1.2), it may be necessary to motivate for a longer hospital stay to ensure basic post-operative goals are reached prior to discharge. Although it cannot be applied directly to the South African context, Forrest et al (1999) showed that early discharge led to a higher rate of referral to a rehabilitation facility. If the converse is true, patients who are kept longer may require less post-operative rehabilitation. While this obviously has economic implications, healthcare practitioners have an obligation to advocate for the best possible outcome for their patients.

The study by Rajan et al (2004) showed specifically that a home-program was equally as effective as attendance at out-patient therapy. This shows that an

alternative form of service delivery may be effective, particularly for patients who have difficulty accessing out-patient therapy services.

7.2.3.1.2 Identification of 'at risk' patients

Previous studies have shown that most patients have a favourable outcome, regardless of the specific intervention received, but there are a group of patients (approximately 15%) who will not have a favourable outcome (Ranawat et al 2003). It is therefore important to conduct further research to aid early identification of these 'at risk' patients. This is particularly important within the context of this study population since more than 15% of subjects (10 out of 24) in study 4 had a poorer outcome, a higher proportion than reflected by international studies (Ranawat et al 2003). Factors that may be associated with outcome have been explored in study 4 (Chapter 6). The literature concerning factors affecting outcome has been reviewed in Chapter 2. These factors are tabulated below.

Table 7.2 Factors that may identify an 'at risk' patient

Factors based on study 4	Factors based on literature review
Not co-habiting with a life partner	Poor pre-operative quadriceps strength
Care-giver at home after discharge	Poor pre-operative ROM
Less than secondary school education	Obesity
No previous exposure to physiotherapy	Workmen's compensation benefits
	Markedly poor pre-operative function

Some factors are not directly modifiable. These factors include: not co-habiting with a life partner; presence of a care-giver at home; workmen's compensation benefits; less than secondary school education and no previous exposure to physiotherapy. While these factors are not directly modifiable, it may be worth exploring interventions targeted at overcoming their influence on outcome. For example, patients who have a low level of education or no previous experience of physiotherapy may benefit from pre-operative education even though the literature shows that it does not necessarily benefit a general sample of patients undergoing TKA (Beaupre et al 2004). No study has looked specifically at the benefits of pre-operative education in patients with low levels of education or no previous experience of physiotherapy services. While pre-operative education cannot

currently be endorsed by a CPG due to insufficient evidence, it should be considered as a topic for further investigation.

Some of the factors in table7.2 are modifiable, either by targeting an intervention at the patient or within the healthcare system. Poor pre-operative quadriceps strength, ROM and function are factors intrinsic to the patient that can be specifically addressed in the patient's pre- or post-operative management. Previous studies have shown no benefit of pre-operative physiotherapy in a general sample of patients undergoing TKA (Ackerman & Bennell 2004a). The studies they reviewed were not targeted specifically at a sample with particularly poor knee flexion ROM, quadriceps strength and knee function, so the effect of a pre-operative exercise programme in an 'at risk' sample has yet to be established. Obesity is a factor that is modifiable, and the expertise of a dietician could be employed for this intervention. The fact that obesity has been shown to be a risk factor for poor outcome post TKA (Foran et al 2004, Silva et al 2003), and that all but two of the subjects in study 4 were obese, is of some concern. No specific studies have examined the effects of a weight loss programme as an intervention to improve outcome post TKA, but there is enough evidence on the effect of obesity on outcome to support this intervention. In addition, it has been shown that patients tend to gain weight within two years post TKA (Zeni & Snyder-Mackler 2010), and this effect on an already obese population may further affect the outcome post TKA. Strategies to combat obesity should be included in the CPG, and should be considered for implementation as early as the pre-operative phase.

7.2.3.1.3 Weekend physiotherapy for in-patients

As highlighted in study 2, many physiotherapists are treating patients over weekends. Weekend treatment did not seem to relate to any particular day of surgery. The results of study 3 showed that subjects who were POD 2 and 3 over a weekend and did not receive physiotherapy over that time (less physiotherapy within the first 72 hours post surgery), actually gained range of knee flexion faster than subjects who received earlier physiotherapy (more physiotherapy within the first 72 hours post surgery). This was in contrast to the findings of Husted et al (2008), who found that patients who had their surgery later in the week, and less physiotherapy in the first three days post surgery, had a longer LOS. A reason for their findings may be that patients who had their surgery earlier in the week were

discharged over the weekend because it was the weekend and not necessarily because they had reached their discharge goals. The authors themselves note that staff tended to discharge on a Friday, suggesting that the LOS was not related purely to attainment of discharge goals. When the results of study 3 were discussed in Chapter 5, it was proposed that a possible explanation for the findings of study 3 was the relationship between the physiotherapy intervention and the phase of healing. No studies have specifically examined the interaction between physiotherapy intervention and the phases of healing in patients who have undergone TKA, and therefore no recommendation can be made to inform the CPG in this regard.

One way of addressing the prescription of weekend physiotherapy in the CPG is to describe specific criteria which clinicians could use to decide which patients should have weekend physiotherapy and which should not. This can be achieved by a summary of post-operative milestones, which if the patient has not achieved by the appropriate time period, could be used to motivate for them to have weekend physiotherapy. These milestones can be informed by studies which show normal rates of progression post surgery. This has been done successfully by Kennedy et al (2006b), with regard to post-discharge milestones, through hierarchical linear modelling. A similar design applied to the in-patient phase of recovery would be an optimal way of defining milestones which could be used as criteria for prescribing weekend physiotherapy for patients.

Due to conflicting findings on the value of weekend physiotherapy, what may be a more relevant question is on which POD is physiotherapy intervention more crucial (therefore justifying weekend physiotherapy). This is a topic for further investigation and is discussed further in section 7.3. Whether weekend physiotherapy should be routine for in-patients or not is an area for further investigation.

7.2.3.2 Summary

Specific clinical problems that the CPG should address include:

- Strategies to ensure that the patients who require out-patient therapy actually receive the treatment they require
- A clear profile of ‘at risk’ patients to assist physiotherapists in identifying these patients timeously

- A strategy for the management of obesity
- Clear criteria on which to base prescription of weekend physiotherapy

Important topics that warrant further investigation to support their inclusion into the CPG include:

- Whether or not this population will benefit from out-patient therapy
- Methods of delivering out-patient therapy services that will benefit this specific population
- The effect of an education intervention in specifically those patients with a low level of education or no previous experience of physiotherapy
- The effect of a pre-operative exercise programme specifically in those patients who have lower than average pre-operative knee flexion ROM, quadriceps strength and functional scores.
- The interaction between physiotherapy intervention and the phases of healing

7.2.4 Validation

7.2.4.1 Outcome measures that can be used to validate the CPG

The outcome measures used for this report were the Oxford Knee Score (OKS), the Knee Society Knee Score (KSKS) and the EQ-5D.

The OKS has been shown to be reliable in the context for which the CPG is to be developed. It showed convergent validity with the KSKS and appears to be sensitive to change (based on the results of study 4). The fact that the English version of the OKS was used reliably (and willingly) by subjects whose first language was not English may lessen the urgency for the need for further testing of the Zulu and South Sotho versions of the OKS. As mentioned in Chapter 3, functional literacy difficulties require sufficient staff and time allowed for patients to complete the OKS.

The EQ-5D index may not be a suitable clinical outcome for patients undergoing TKA due to the coarseness of the options. This was a finding of study 1 of this thesis and it echoes the findings of Fransen & Edmonds (1999) who used the measure in a sample of patients with OA of the knee. Visual analogue scales were

not well understood, and should be avoided, as shown by the findings of study 1 and study 3. These findings were also supported in the literature by the study of Yazbek et al (2009). This, in conjunction with the difficulty experienced by some patients when answering long questionnaires, suggests that more objective measures be employed, particularly where measurement of functional ability is required. Questionnaires and interviews should be restricted to the domains of 'patient perceived outcome' and 'quality of life'.

The ILOA scale may be useful in defining discharge criteria and monitoring effects of the in-patient physiotherapy. In terms of its use for research purposes, it must be noted that reliability has been established only for physiotherapists who have received a significant amount of training in the use of the scale (Shields et al 1995). Reliability amongst physiotherapists who have not been trained in the use of the tool has not been established. In a unit where there is high turnover of staff, a scale which requires such training to be used effectively may not be appropriate. If it could be shown that it can be used reliably by physiotherapists with minimal training, then it may be a suitable measure to use within the context for which the CPG will be developed. Due to the simplicity of the scale, it could well be reliably used by untrained physiotherapists, but this would require further investigation. The rationale for not completely discarding the ILOA as an option for use in the context of the proposed CPG is that despite the issue of it only being shown to be reliable when used by experienced therapists, is that it is an objective measure, and the preceding paragraph highlighted the need for objective measures. Objective measures of mobility may be valuable in this population, particularly because they do not require any level of literacy from the patients. As discussed in section 2.5.2.2.3 of the literature review, the 6MWT, ST and SPWT have been shown to be valid, reliable and responsive measures. Of these, the 6MWT and the SPWT may be the most relevant due to the distances that these patients usually walk. As shown by study 4 (Chapter 6) 21% of patients walked to their local clinic (Table 6.10) and half the patients had to walk to reach their transport to the hospital (Table 6.8).

7.2.4.2 Summary

The validation phase of CPG development can include a clinical pilot study to establish if the guideline is in fact effective (van der Wees & Mead 2004). For this

to be achieved, relevant outcome measures are necessary. The OKS and KSKS have been shown to be valid and reliable in this population and based on the findings of this thesis should be the outcome measures of choice for the CPG. Objective outcome measures such as the 6MWT and SPWT should be considered for further investigation. Even the ILOA scale should be considered for further investigation to establish if it can be used reliably by inexperienced therapists.

7.2.5 Dissemination and implementation

7.2.5.1 Stakeholders responsible for implementing the CPG

Based on the findings of study 2, it is likely that the physiotherapists who will be implementing the CPG will have less than three years of clinical experience. The rotation system amongst junior physiotherapists in the public hospitals means that they will only have four months on the orthopaedic ward. The guideline must be presented in such a way that they can follow it from the beginning of the rotation and not require too much time to familiarise themselves with it. This emphasises the necessity for the CPG to be clear and easy to follow. One method of achieving this is via a clear clinical pathway.

7.2.5.2 Monitoring the implementation of the CPG

Study 3 showed that monitoring physiotherapy interventions in the current system is not reliable, particularly if done retrospectively. The use of treatment tracking sheets may improve record-keeping, thereby facilitating the monitoring of CPG implementation. There is much work to be done in the field of implementation of guidelines and monitoring the uptake of guidelines (Fretheim et al 2006) and it is the recommendation of this thesis that specialists in the field are consulted to properly inform this aspect of the CPG development process.

7.2.5.3 Summary

The guideline should be easy to follow and should preferably be accompanied by a simple clinical pathway to facilitate implementation. The use of a treatment tracking sheet appears to result in more consistent recording of treatment and may be a simple, initial method to monitor implementation.

7.2.6 Evaluation and revision

7.2.6.1 Evaluating the impact of the CPG

See response in section 7.2.4.1

7.2.6.2 Appraisal of the CPG development process

Appraisal of a clinical practice guideline is traditionally considered part of the evaluation and revision process. This should however not limit it to only being conducted after the process of guideline development is complete. If an appraisal tool, such as the AGREE instrument, is used parallel to the guideline development process, the quality of the guideline can only be enhanced.

Using the AGREE tool, it can be seen in table 7.3 how this thesis has contributed to the CPG development process thus far.

Table 7.3 Contribution of this thesis to the CPG development process as appraised by the AGREE tool

Domain and criteria	Contribution of thesis
Domain 1: Scope and purpose	
1.The overall objective(s) of the guideline is (are) specifically described	Yes – by the aim of the report
2.The clinical question(s) covered by the guideline is (are) specifically described	Identified in chapter 7, to be refined by GDG
3.The patients to whom the guideline is meant to apply are specifically described	Chapter 6 and 7
Domain 2: Stakeholder involvement	
4.The guideline development group includes individuals from all the relevant professional groups	Chapter 7
5.The patients' views and preferences have been sought	Patients to be selected as defined in chapter 7
6.The target users of the guideline are clearly defined	Chapter 4
7.The guideline has been piloted among end users	Still to be done
Domain 3: Rigour of development	
8.The systematic methods were used to search for evidence	To be done by GDG
9.The criteria for selecting the evidence are clearly described	To be done by GDG
10.The methods used for formulating the recommendations are clearly described	To be done by GDG
11.The health benefits, side effects and risks have been	To be done by GDG

considered in formulating the recommendations	
12.There is an explicit link between the recommendations and the supporting evidence	To be done by GDG
13.The guideline has been externally reviewed by experts prior to its publication	To be ensured by GDG
14.A procedure for updating the guideline is provided	To be done by GDG
Domain 4: Clarity and presentation	
15.The recommendations are specific and unambiguous	To be done by GDG
16.The different options for management of the condition are clearly presented	Literature review provides a basis
17.Key recommendations are easily identifiable	To be done by GDG
18.The guideline is supported with tools for application	Chapter 5
Domain 5: Applicability	
19.The potential organisational barriers in applying the recommendations have been discussed	Some already identified the thesis
20.The potential cost implications of applying the recommendations have been considered	To be done by GDG
21.The guideline presents key review criteria for monitoring and/or audit purposes	Chapter 3 and literature on AGREE tool
Domain 6: Editorial independence	
22.The guideline is editorially independent from the funding body	To be ensured by GDG
23.Conflicts of interest of guideline development members have been recorded	To be ensured by GDG

This thesis has contributed, at least in part, to 10 of the 23 criteria of the AGREE tool. Most of the criteria to which it has not yet contributed are dependent on how rigorously the GDG follows the phases of the process that have been described in the literature review.

7.2.6.3 Summary

Once the guideline has been implemented, ongoing evaluation and revision is essential. Evaluation includes assessing the efficacy of the guideline (via outcome measurement) as well as appraising the development process of the guideline. Part of responsible use of a clinical practice guideline is ensuring that the clinicians involved have the necessary skills to retain their professional autonomy by being able to critically appraise any CPG that they are encouraged to implement. The

CPG must therefore include the necessary information for clinicians to do this, for example by including a description of the AGREE tool.
Thus far, this thesis has provided a substantial contribution to the CPG development process as shown by the AGREE appraisal.

7.3 TOPICS FOR FURTHER INVESTIGATION

Numerous topics for further investigation have been mentioned within the body of this thesis. Two of these topics have been prioritised for specific mention as from an orthopaedic physiotherapy point of view they cover the largest gaps in the current literature.
One of the most disturbing findings of the current evidence is that the content of physiotherapy intervention (or any physiotherapy intervention at all in some cases) has not yet been shown to make any difference to outcome. To date, the research has failed to relate any benefits of physiotherapy intervention to any component of that intervention. This section will highlight two topics for further investigation that may overcome this concern.

7.3.1 The effect of residual OA pathology on post-operative recovery

Post-operatively, intra-articular structures have not been directly modified by the procedure (for example joint capsule and synovium) may still be subject to the pathological processes associated with OA, which may need to be managed as part of the post-operative intervention. The extent of this and the extent to which these factors influence post-operative recovery have not been well researched.

7.3.2 The interaction between physiotherapy intervention and the phases of healing

The interaction between physiotherapy intervention and the phases of healing and control of pain and inflammation in the acute post-operative phase has also not been well researched. The only studies that have come close are those of Mizner et al (2005) with regards to quadriceps strengthening. More explanatory studies, which take into account the effect of physiotherapy modalities on the healing tissue, may inform better design of physiotherapy intervention strategies.

7.4 SUMMARY OF THE CHAPTER

One of the issues raised in the literature pertaining to CPG development is that they lack practical detail and clarity of how decisions are made (Turner et al 2008, van der Wees 1999). The information that is presented in section 7.2 is an attempt to combat these issues when a CPG for physiotherapy post TKA is developed.

CHAPTER 8

CONCLUSION

The aim of this thesis was to answer certain questions that arose when the CPG development process was applied to the management of patients undergoing a TKA in a tertiary care public hospital in South Africa.
The conclusion to this thesis is best presented by table 8.1, which shows how each question was answered.

Table 8.1 How the thesis informed each phase of CPG development

Phase of CPG development	Questions arising	Summary of findings	Relevant chapters
Organisation and structure	Who will co-ordinate and drive the process?	The process should be co-ordinated by the SASP	Chapter 7
	Who are the potential stakeholders?	Physiotherapists and patients to represent their respective stakeholder groups should be selected according to the criteria highlighted in Chapter 4 and Chapter 6.	Chapters 4 and 6
Preparation and initiation	Is there a need for a CPG?	By establishing that the current level of experience of physiotherapists working in the public sector is less than three years it was possible to help justify the need for a CPG	Chapter 4
CPG development	What clinical questions are important for this population?	Important clinical questions are more centred around scheduling, for example weekend physiotherapy and out-patient therapy. The literature and the results of study 3 show that content of treatment has little effect on outcome. The other important clinical question for this population is identification of patients 'at risk' for poor outcome.	Chapters 5 and 6

Validation	If validated by a clinical pilot study, what outcome measures can be used?	The Oxford Knee Score is a reliable outcome measure in this population. The KSKS is a reliable measure in this population.	Chapter 3 Chapter 2
Implementation	Who will be implementing it?	Staff working in the public setting is relatively inexperienced in the field, so the CPG must be pitched at the appropriate level.	Chapter 4
	How will implementation be monitored?	The use of a treatment tracking sheet may facilitate adherence to the CPG.	Chapter 5
Review and evaluation	How will the impact be evaluated?	The OKS and the KSKS are suitable outcome measures in this population to evaluate the impact of the CPG.	Chapters 2 and 3
	How will the CPG be appraised?	The AGREE criteria can be used	Chapter 2

In addition to answering the questions as tabulated above, and thereby achieving the aim of the thesis, the thesis has also facilitated the process by contributing to 10 out of the 23 criteria on the AGREE tool. Therefore, this thesis constitutes a substantial knowledge base, which a GDG can now use to continue with the development of a CPG for patients undergoing TKA in a tertiary care public hospital in South Africa.

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APPENDIX 1

OXFORD KNEE SCORE

EQ-5D

KNEE SOCIETY KNEE SCORE

PROBLEMS WITH YOUR KNEE

During the past 4 weeks..

✓tick one box for every question

1 *During the past 4 weeks.....*

How would you describe the pain you usually have from your knee?

None	Very mild	Mild	Moderate	Severe
☐	☐	☐	☐	☐

2 *During the past 4 weeks.....*

Have you had any trouble with washing and drying yourself (all over) because of your knee?

No trouble at all	Very little trouble	Moderate trouble	Extreme difficulty	Impossible to do
☐	☐	☐	☐	☐

3 *During the past 4 weeks.....*

Have you had any trouble getting in and out of a car or using public transport because of your knee? (whichever you would tend to use)

No trouble at all	Very little trouble	Moderate trouble	Extreme difficulty	Impossible to do
☐	☐	☐	☐	☐

4 *During the past 4 weeks.....*

For how long have you been able to walk before pain from your knee becomes **severe**? (*with or without a stick*)

No pain/ More than 30 minutes	16 to 30 minutes	5 to 15 minutes	Around the house only	Not at all - pain severe when walking
☐	☐	☐	☐	☐

5 *During the past 4 weeks.....*

After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your knee?

Not at all painful	Slightly painful	Moderately painful	Very painful	Unbearable
☐	☐	☐	☐	☐

6 *During the past 4 weeks.....*

Have you been limping when walking, because of your knee?

Rarely/ never	Sometimes, or just at first	Often, not just at first	Most of the time	All of the time
☐	☐	☐	☐	☐

During the past 4 weeks...

✓tick one box for every question

7 *During the past 4 weeks.....*

Could you kneel down and get up again afterwards?

Yes, Easily	With little difficulty	With moderate difficulty	With extreme difficulty	No, Impossible
☐	☐	☐	☐	☐

8 *During the past 4 weeks.....*

Have you been troubled by pain from your knee in bed at night?

No nights	Only 1 or 2 nights	Some nights	Most nights	Every night
☐	☐	☐	☐	☐

9 *During the past 4 weeks.....*

How much has pain from your knee interfered with your usual work *(including housework)*?

Not at all	A little bit	Moderately	Greatly	Totally
☐	☐	☐	☐	☐

10 *During the past 4 weeks.....*

Have you felt that your knee might suddenly 'give way' or let you down?

Rarely/ never	Sometimes, or just at first	Often, not just at first	Most of the time	All of the time
☐	☐	☐	☐	☐

11 *During the past 4 weeks.....*

Could you do the household shopping on your own?

Yes, Easily	With little difficulty	With moderate difficulty	With extreme difficulty	No, Impossible
☐	☐	☐	☐	☐

12 *During the past 4 weeks.....*

Could you walk down one flight of stairs?

Yes, Easily	With little difficulty	With moderate difficulty	With extreme difficulty	No, Impossible
☐	☐	☐	☐	☐

By placing a tick in one box in each group below, please indicate which statements best describe your own state of health TODAY.

Mobility

I have no problems in walking about	❑
I have some problems in walking about	❑
I am confined to bed	❑

Self-Care

I have no problems with self-care	❑
I have some problems washing or dressing myself	❑
I am unable to wash or dress myself	❑

Usual Activities (*e.g. work, study, housework, family or leisure activities)*

I have no problems with performing my usual activities	❑
I have some problems with performing my usual activities	❑
I am unable to perform my usual activities	❑

Pain/Discomfort

I have no pain or discomfort	❑
I have moderate pain or discomfort	❑
I have extreme pain or discomfort	❑

Anxiety/Depression

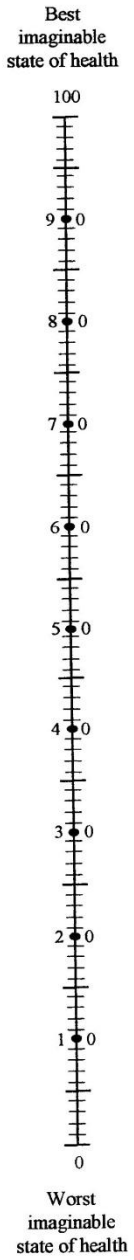
I am not anxious or depressed	❑
I am moderately anxious or depressed	❑
I am extremely anxious or depressed	❑

© EuroQoL Group 1990

To help people say how good or bad their state of health is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale, in your opinion, how good or bad your own health is today. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your state of health is today.

Your own state of health today



© EuroQoL Group 1990

Knee Society Knee Score

Pain			**Points**
None			50
Mild or Occasional			45
Stairs only			40
Walking and stairs			30
Moderate			
Occasional			20
Continual			10
Severe			0

Range of Motion	**Points**
(5° = 1 point)	25

Stability			**Points**
Anteroposterior	<5mm		10
	5-10mm		5
	>10mm		0
Mediolateral		<5°	15
		6° - 9°	10
		10°- 14°	5
		>15°	0
Subtotal			----------

Deductions (minus)		**Points**
Flexion contracture		
	5°-10°	-2
	10°- 15°	-5
	16°- 20°	-10
	>20°	-15
Extension Lag		
	<10°	5
	10° – 20°	10
	>20°	15
Alignment		
	5° – 10°	0
	0° – 4°	3 points each degree
	11°- 15°	3 points each degree
	Other >15	20
Subtotal		**----------**
Total		_____

APPENDIX 2

ETHICAL CLEARANCE CERTIFICATE

HOSPITAL PERMISSION

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Wood

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M060109**
PROJECT	Rehabilitation Post Total Knee Arthroplasty in South Africa
INVESTIGATORS	Mrs WA Wood
DEPARTMENT	Physiotherapy
DATE CONSIDERED	06.01.27
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 06.02.16 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof A Stewart

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

082 921 4619
717- 3702/3725

Private bag X39, Johannesburg 2000, South Africa
Tel: +27 (0) 11 488 4911, Fax: +27 (0) 11 643 1612
www.johannesburghospital.org

Gauteng Department of Health

PERMISSION FOR RESEARCH

NAME OF RESEARCHER WENDY-ANN WOOD

TITLE OF RESEARCH PROJECT REHABILITATION POST TOTAL KNEE ARTHROPLASTY IN SOUTH AFRICA

METHODOLOGY (briefly or include a protocol) SEE ATTACHED

CONFIDENTIALITY OF PATIENTS MAINTAINED YES

COST TO THE HOSPITAL NONE

APPROVAL OF HEAD OF DEPARTMENT YES Prof M. Lutchman 22/11/2005

APPROVAL OF CRHS OF WITS UNIVERSITY IN APPLICATION PROCESS

CLINICAL EXECUTIVE PERMISSIONS

Signature Dr. D. Wojciechowska Clinical Executive Date 22/11/2005

Subject to any restrictions

APPENDIX 3

LETTER OF INFORMATION AND CONSENT FOR PROFESSIONALS INVITED TO EXPERT GROUP

LETTER OF INFORMATION AND CONSENT FOR PATIENTS INVITED TO PARTICIPATE IN RELIABILITY STUDY

LETTER OF INFORMATION FOR PHYSIOTHERAPISTS PARTICIPATING IN THE SURVEY OF CURRENT PRACTICE

LETTER OF INFORMATION AND CONSENT FOR GROUP 1 OF STUDY 3

LETTER OF INFORMATION AND CONSENT FOR GROUP 2 OF STUDY 3

LETTER OF INFORMATION AND CONSENT FOR STUDY 4

Letter of information and consent for professionals invited to expert group

Dear ,

I am embarking on a research project entitled **'Rehabilitation post total knee arthroplasty in urban South Africa'**. It will be written up as a PhD.

I am at the stage of selecting my outcome measures and I would like to invite you at attend a focus group to discuss the outcome measures I have in mind.

We will be looking specifically at the Oxford Knee Score, the EQ-5D and the Knee Society Knee Score. Please see the attached abstract and references for more information on these measures.

I look forward to your participation.

Regards
Wendy-Ann Wood
(011) 717-3702
woodwa@therapy.wits.ac.za

Letter of information and consent for patients invited to participate in reliability study

Dear Patient,
My name is Wendy-Ann Wood and I am a physiotherapist. You were probably seen by a physiotherapist after your knee operation.
I am starting to do some research to find out how physiotherapists can offer a useful service to our patients in future. I am interested in how we can best help patients after they have had knee surgery like you had.
Before I can start my research, I need to find out if we are measuring your recovery in the right way. I also need to know if the tools we use to measure recovery are accurate. The way we do this is to take all the measurements on a group of patients and then take the measurements again at a later stage.
The measurements I am using are how much your knee can bend and straighten, how strong your knee is and how much pain you have. These tests are usually done by your doctor anyway. The other measurement I am using is a questionnaire with 12 questions.
If you agree to be in the study, I will ask you to fill in the questionnaire. It will take about 10 minutes. I will then do the measurements of your knee. None of the measurements I take will hurt you and they are all measurements that physiotherapists and doctors do regularly on patients who have had

knee operations. When I have finished examining your knee I will give you a blank questionnaire and an envelope with a stamp to take home. After 5 days I would like you to fill in the questionnaire and post it back to me.
The information that I find out from this study will be shared with other physiotherapists and doctors. Your name will not be mentioned anywhere, so nobody will know that it is your information.
If you don't want to be in the study it will not affect the usual treatment you receive from the doctor. Even if you agree to join the study and then decide you don't want to do it anymore, you can do so and it will not affect any other treatment that you would normally receive from the hospital.
If you have any questions regarding the study I will gladly answer them. If you would like to contact me you can phone me at the Physiotherapy Department, University of the Witwatersrand, on (011) 717-3702.
Please sign below if you agree to participate.

I _____, have read the information above. I agree to participate in the study.

_____ _____

Participant Witness

Please sign below if you agree to participate.

I _____, have read the information above. I agree to participate in the study.

_____ _____

Participant Witness

Letter of information for physiotherapists participating in the survey of current practice

Dear Colleague,
I am in the process of completing my PhD at the University of the Witwatersrand My research project is entitled **'Rehabilitation post total knee arthroplasty in urban South Africa'**. The project is being supervised by Prof Aimee Stewart and Prof Anton Schepers.

The primary aim of this study is to identify factors that affect the outcome post total knee arthroplasty.
A secondary aim is to establish the factors affecting patients participation in the use of health care facilities post TKA, as well as the patients expectations post-operatively.

A tertiary aim is to make recommendations for an appropriate rehabilitation programme for patients post total knee arthroplasty in a South African tertiary care hospital.

The physiotherapy management of the patients participating in the trial will be based on the current literature. Since almost all the published studies have been conducted outside of South Africa, I would like to establish what current practice is in South Africa. This will ensure that he interventions used in my study, while evidence based, are also realistic within the South African context.

If you choose to participate, you would be required to complete the attached questionnaire according to the instructions provided. On e-mailing the questionnaire back to the return address, the mal will be received by an independent administrator and forwarded to me once your address has been erased. This will ensure confidentiality. The findings of the questionnaire will be submitted for publication in a local journal.

You are not obligated to participate and there will be no record of who has not responded.

Questionnaires can be e-mailed back to bhr@icon.co.za
If you prefer you can fax your response to (011) 794-
If you would like any more information on the study please contact me at bradwend@hotmail.com

I look forward to your responses.
Regards
Wendy-Ann Wood

Letter of information and consent for group 1 of study 3

Dear Patient,
My name is Wendy-Ann Wood and I am a physiotherapist. Physiotherapists help patients to recover after knee operations like you are going to have.
I am starting to do some research to find out what is the best way to help patients like you after their knee replacement operation. I need to find out how useful the physiotherapy that you receive after your operation is.
If you agree to be part of the study, I will need to take some measurements of your knee and I will need to measure your height and weight. I will also need to ask you some questions about yourself so that I can see if you have any problems that will affect your recovery form the operation. None of the measurements I take will hurt you and they are measurements that the physiotherapists take regularly in all patients who have had knee operations. I will then come to take measurements of your day everyday until you go home. I will also see you when you come to see your doctor after six weeks and I will take the last measurements then.

The treatment you receive in hospital will not be any different to what you would receive if you choose not to be part of the study. The only difference is all the measurements I will be taking. It will probably take about half an hour to take these measurements.
The information that I find out from this study will be shared with other physiotherapists and doctors. Your name will not be mentioned anywhere, so nobody will know that it is your information.
If you don't want to be in the study it will not affect the usual treatment you receive from the doctor or physiotherapist. Even if you agree to join the study and then decide you don't want to do it anymore, you can do so and it will not affect any other treatment that you would normally receive from the hospital.
If you have any questions regarding the study I will gladly answer them. If you would like to contact me you can phone me at the Physiotherapy Department, University of the Witwatersrand, on (011) 717-3702.
Please sign below if you agree to participate.

I _____, have read the information above. I agree to participate in the study.

_____ _____

Participant Witness

_____

Letter of information and consent for group 2 of study 3

Dear Patient,
My name is Wendy-Ann Wood and I am a physiotherapist. Physiotherapists help patients to recover after knee operations like you are going to have.
I am starting to do some research to find out what is the best way to help patients like you after their knee replacement operation.
I would like to test a treatment programme that has been developed for patients who have had total knee replacements. This treatment programme has been developed from research that has been done before, as well as in consultation with other physiotherapists and your doctor. It includes the usual kind of treatment that is given after total knee replacement.
If you agree to be part of the study, I will need to take some measurements of your knee and I will need to measure your height and weight. I will also need to ask you some questions about yourself so that I can see if you have any problems that will affect your recovery from the operation. None of the measurements I take will hurt you and they are measurements that the physiotherapists take regularly in all patients who have had knee operations. I will then come to take measurements of your day everyday until you go home. I will also see you when you come to see your doctor after six weeks and I will take the last measurements then. It will probably take about one and a half hours to take all these measurements.
The treatment you receive in hospital will be given by a qualified physiotherapist.

The information that I find out from this study will be shared with other physiotherapists and doctors. Your name will not be mentioned anywhere, so nobody will know that it is your information.
If you don't want to be in the study it will not affect the usual treatment you receive from the doctor or physiotherapist. Even if you agree to join the study and then decide you don't want to do it anymore, you can do so and it will not affect any other treatment that you would normally receive from the hospital.
If you have any questions regarding the study I will gladly answer them. If you would like to contact me you can phone me at the Physiotherapy Department, University of the Witwatersrand, on (011) 717-3702.
Please sign below if you agree to participate.

I _____, have read the information above. I agree to participate in the study.

_____ _____

Participant Witness

Letter of consent for Study 4

Dear Patient,
My name is Wendy-Ann Wood and I am a physiotherapist. Physiotherapists help patients to recover after knee operations like you are going to have.
I am doing some research to find out what is the best way to help patients after their knee replacement operation.
If you agree to be part of the study, I will need to take some measurements of your knee and I will need to measure your height and weight. I will also need to ask you some questions about yourself so that I can see if you have any problems that will affect your recovery from the operation. None of the measurements I take will hurt you and they are measurements that the physiotherapists take regularly in all patients who have had knee operations. I will also see you when you come to see your doctor after six weeks and again at 3 months and 6 months.
The treatment you receive in hospital will not be any different to what you would receive if you choose not to be part of the study. The only difference is all the measurements I will be taking. It will probably take about half an hour to take these measurements.
The information that I find out from this study will be shared with other physiotherapists and doctors. Your name will not be mentioned anywhere, so nobody will know that it is your information.
If you don't want to be in the study it will not affect the usual treatment you receive from the doctor or physiotherapist. Even if you agree to join the study and then decide you don't want to do it anymore, you can do so and it will not affect any other treatment that you would normally receive from the hospital.
If you have any questions regarding the study I will gladly answer them. If you would like to contact me you can phone me at the Physiotherapy Department, University of the Witwatersrand, on (011) 717-3702.

Please sign below if you agree to participate.

I _____, have read the information above. I agree to participate in the study.

_____ _____

Participant Witness

_____

APPENDIX 4

QUESTIONNAIRE ON CURRENT PRACTICE

CURRENT PHYSIOTHERAPY MANAGEMENT OF PATIENTS UNDERGOING TOTAL KNEE ARTHROPLASTY IN SOUTH AFRICA

Consent

I have read the information letter and agree to participate in this study	Yes

Instructions
Please complete one questionnaire per surgeon.
All participants are to complete section A.
Section B is only to be completed by participants working in a hospital setting.
Section C is only to be completed by participants who work in an out-patient setting.
If completing the questionnaire please use an asterisk (*) to mark your responses.

SECTION A - BASIC INFORMATION

You may asterisk more than one response to each question

1.	**What is your current clinical situation?**			
Private practice rooms	Private practice in-patients	Government hospital OPD	Government hospital in-patients	Other: (state which)

2.	**How many years experience do you have in each clinical situation?**											
Private practice rooms (orthopaedics)			Private practice in-patients (orthopaedics)			Government hospital OPD (orthopaedics)			Government hospital in-patients (orthopaedics)		
0-3	4-9	10+	0-3	4-9	10+	0-3	4-9	10+	0-3	4-9	10+

3.	**For how many years have you been seeing total knee arthroplasties in each clinical situation?**											
Private practice rooms (orthopaedics)			Private practice in-patients (orthopaedics)			Government hospital OPD (orthopaedics)			Government hospital in-patients (orthopaedics)		
0-3	4-9	10+	0-3	4-9	10+	0-3	4-9	10+	0-3	4-9	10+

SECTION B - IN-PATIENT PHYSIOTHERAPY

General

1.	**How many new cases do you see per week?**		
0-1	2-3	4-6	7+

2.	**How many of each type of prosthesis do you see per week?**			
Posterior stabilised	0-1	2-3	4-6	7+
Cruciate retaining	0-1	2-3	4-6	7+
Rotating platform	0-1	2-3	4-6	7+
Other: (state which)				
Don't know	Comments:			

3.	**What day of the week are the surgeries performed?**			
Monday	Tuesday	Wednesday	Thursday	Friday

Pre-operatively

1.	**Routinely, do you see the patients pre-operatively in hospital?**	
No	Day of surgery	Other
Comments:		

2.	**Tick all of the components of your pre-operative session**	
Component	**√**	**Comments (please note if given verbally or in writing or both)**
Education on reason for surgery		
Education on surgical procedure		
Education on contra-indications and precautions		
Education on general care (wound, pressure care etc)		
General pre-operative care (chest, circulatory drill etc)		
Demonstration and practice of crutch walking		
Demonstration and practice of post-operative exercises		
Other		

Post-operatively

1.	**At what stage does the post-operative physiotherapy begin?**	
Day of surgery	Day after surgery	Other:

2.	**Routinely, how often per day are the patients treated? (weekdays)**	
Once	Twice	Other
Comments:		

3.	**Routinely, are the patients treated on the weekend?**		
Saturday		Sunday	
Once	Twice	Once	Twice
Comments:			

4.	**Tick all of the components of your post-operative sessions**	
Component	**√**	**Comments** • **Note if given verbally or in writing or both** • **Note which day post surgery commenced** • **Note if lack of equipment is the reason for not including a modality**
Education on reason for surgery		
Education on surgical procedure		
Education on contra-indications and precautions		
Education on general care (wound, pressure care etc)		
General pre-operative care (chest, circulatory drill etc)		
Demonstration and practice of crutch walking		
CPM		Dosages:
Cryotherapy		Method:

Soft tissue mobilisation quadriceps		
Soft tissue mobilisation hamstrings or other		
Patello femoral joint mobilisation (state direction)		
Tibiofemoral passive joint mobilisation (state which techniques)		
Active heel slides for knee flexion ROM		
Pulley system for knee flexion ROM		
Active knee flexion gravity assisted (drop-and-dangle)		
Active heel slides in chair for knee flexion ROM		
Active or active-assisted knee flexion ROM in prone		
Passive knee extension – gravity assisted		
Static quadriceps strength		
Terminal knee extension		
Open chain quadriceps through range		
Closed chain quadriceps		
Static hamstrings		
Open chain hamstrings		
Glut max strengthening		
Glut medius strengthening		
Straight leg raise		
Dry needling		

5.	**Are your in-patients routinely referred for out-patient physiotherapy?**	
No	Yes	Only if deemed necessary (explain in comments below)
Comments:		
If yes to q5:		
5a. Are they referred with a specific protocol?	Yes	No
If yes to q5a:		
How soon do they begin out-patient physiotherapy?		
How often are they required to attend out-patient physiotherapy?		
Comments:		

SECTION C - OUT-PATIENT PHYSIOTHERAPY

1.	**How many new cases do you see per month?**		
0-2	3-5	6-7	8+

2.	**How many of these cases are routine referrals?**		
0-2	3-5	6-7	8+

3.	How many of each type of prosthesis do you see per month?			
Posterior stabilised	0-2	3-5	6-7	8+
Cruciate retaining	0-2	3-5	6-7	8+
Rotating platform	0-2	3-5	6-7	8+
Other: (state which)				
Don't know	Comments:			

4.	How are most of your patients referred?		
Surgeon	Your own referral from hospital	Other physiotherapist from hospital	Other:

5.	How many times a week do you see the patients in the first 6 weeks?		
< 1 per week	Once a week	2-3 times per week	>4 times per week
Comments:			

6.	How many times a week do you see the patients in the second 6 weeks?		
Once a week	Once in 2 weeks	Once in 3 weeks	Other:
Comments:			

7.	Routinely, how long do you follow your patients up for post operatively?			
6-8 weeks	8-12 weeks	3-5 months	>6 months	Other:
Comments:				

8.	Tick all of the components you use for the treatment and rehabilitation of these patients		
Comments • **Note if given verbally or in writing or both** • **Note the time post surgery commenced** • **Note if lack equipment is the reason for not including a modality**			
Education on reason for surgery			
Never	<50% of the time	>50% of the time	Always
Comments:			
Education on surgical procedure			
Education on contra-indications and precautions			
Education on general care (wound, pressure care etc)			
Demonstration and practice of crutch walking			
CPM		Dosages:	
Cryotherapy		Method:	
Dry needling			
Soft tissue mobilisation quadriceps			
Soft tissue mobilisation hamstrings			
Patello femoral joint mobilisation (state direction)			
Tibiofemoral passive joint mobilisation (state which techniques)			
Active heel slides for knee flexion ROM			
Active knee flexion gravity assisted (drop-and-dangle)			
Active heel slides in chair for knee flexion ROM			

Active or active-assisted knee flexion ROM in prone		
Passive knee extension – gravity assisted		
Static quadriceps strength		
Terminal knee extension		
Open chain quadriceps through range		
Closed chain quadriceps		
Static hamstrings		
Open chain hamstrings		
Glut max strengthening		
Glut medius strengthening		
Straight leg raise		
Soft tissue mobilisation posterior knee		
Stationary cycling for ROM		

9.	**Tick all of the other allied health practitioners that you refer to**	
Practitioner	**√**	**Comments**
Biokineticist		
Pilates instructor		

APPENDIX 5

ADDITIONAL TABLES FROM CHAPTER 4

Table A5.1 Qualifiers for 'Other' responses to in-patient physiotherapy scheduling

Inclusion of pre-operative physiotherapy	Frequency (n=4)
Done when admission procedure and time allows	**2**
May be done as an out-patient	**2**
Only if requested by surgeon	**1**
Day of commencement of post-surgery physiotherapy	**Frequency (n=1)**
One week post surgery	**1**
Number of treatments per day	**Frequency (n=3)**
Three times a day (depending on progress)	**3**

Table A5.2 Scheduling on discharge from hospital

Time post discharge that OPD commenced		How regularly patients are scheduled for OPD	
Within 1 week	3	Depends on availability	1
Within 10 days to 2 weeks	2	Once or twice a week	3
Two weeks	2	Two to three times a week	3
When referred by doctor	1	Depends on transport	1

APPENDIX 6

ABSTRACT OF PUBLICATION SHOWING THE INTRA-RATER RELIABILITY OF THE KSKS

Intra- and inter-rater reliability of the Knee Society Knee Score when used by two physiotherapists in patients post total knee arthroplasty

Research A r t i c l e

It has yet to be shown whether routine physiotherapy plays a role in the rehabilitation of patients post total knee arthroplasty (Rajan et al 2004). Physiotherapists should be using valid outcome measures to provide evidence of the benefit of their intervention.

The aim of this study was to establish the intra and inter-rater reliability of the Knee Society Knee Score, a scoring system developed by Insall et al (1989). The Knee Society Knee Score can be used to assess the integrity of the knee joint of patients undergoing total knee arthroplasty. Since the score involves clinical testing, the intra-rater reliability of the clinician should be established prior to using the scores as data in clinical research. Where multiple clinicians are involved, inter-rater reliability should also be established.

This was a correlation study.

A sample of thirty patients post total knee arthroplasty attending the arthroplasty clinic at Johannesburg Hospital between six weeks and twelve months postoperatively. Recruited patients were evaluated twice with a time interval of one hour between each assessment. The intra- and inter-rater reliability were estimated using Intraclass Correlation Coefficient (ICC).The intra-rater reliability showed excellent reliability (h= 0.95) for Examiner A and good reliability (h= 0.71) for Examiner B. The inter-rater reliability showed moderate reliability (h= 0.67 during test one and h= 0.66 during test two).

The KSKS has good intra-rater reliability when tested within a period of one hour. The KSKS demonstrated moderate agreement for inter rater reliability.

KEYWORDS: TOTAL KNEE ARTHROPLASTY, KNEE SOCIETY KNEE SCORE, REHABILITATION OUTCOME MEASURES.

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APPENDIX 7

BASELINE ASSESSMENT FORM STUDY 3

Patient Code:_____ **Date:**_____

Age:_____ **M / F** **Knee:** **R / L**

Height:_____ **Date of Surgery:**_____

Weight:_____

BMI:_____

Occupation (or previous occupation):_____

Years at occupation:_____

Recreational activities, including years spent on each one:_____

_____

_____

Current source of income:_____

Dependants (living with patient and away:_____

_____

Caregivers:_____

General Health and Medication:_____

_____

_____

Previous injuries:_____

_____

_____

APPENDIX 8

DATA TRACKING SHEET

Daily progress sheet for in-patients

Patient Code:_____

Date of surgery:_____ **Date of discharge:**_____

Date	Pain	ROM	Quads lag	Swelling
Admission				
Post-op				
Day 1				
Day 2				
Day 3				
Day 4				
Day 5				
Day 6				
Day 7				
Day 8				
Day 9				
Day 10				
Day 11				
Day 12				
Day 13				
Day 14				
Day 15				

Length of stay post surgery:_____

APPENDIX 9

IN-PATIENT TREATMENT PROTOCOL

PATIENT INFORMATION AND HOME EXERCISE PACK

IN-PATIENT TREATMENT TRACKING SHEET

OUT-PATIENT TREATMENT PROTOCOL

In-patient protocol guidelines

Each session is about 30 minutes per day

Pre-op

- Patient to have one session with physiotherapist. Q & A session, teaching of contra-indications and precautions post-op, teaching of crutch-walking including transfers and stairs, teaching of post-op exercises:

  Static quads and gluts, circulatory and pressure care, active ROM heel slides on bed and floor

Post-op

Day1: Mobilise to chair if stable

- Static quads and gluts
- Circulatory drills
- Gentle active heel slides for ROM

(Done hourly)

Day 2: Mobilise with crutches

- Bed programme as above
- Knee flexion over edge of bed
- Pulley system for flexion if necessary
- Inner range quads over fulcrum

Day 3: Increase mobility training and gait re-education

- As above
- Knee flexion sustained over edge of bed 20 mins
- Inner range quads progressing to SLR
- Hip abd and add with theraband

Day 4: Ensure sound gait pattern

- As above
- Soft tissue treatment for ROM if necessary
- Ensure patient is able to perform home exercise programme

TOTAL KNEE REPLACEMENT
PATIENT INFORMATION AND HOME EXERCISE PROGRAMME

This handout contains valuable information. Please make sure you take it home with you.

Your operation
The doctor has replaced your painful knee with an artificial joint. This is a big operation and after the operation you will have some pain and stiffness for a while. You will need to work hard to regain your movement and strength. It should take about 3 months to recover from this operation. After you have recovered from the operation you should no longer have pain in the knee and you should be able to do most daily activities.

The physiotherapist
In order for your operation to be a success, it is important that you work hard to exercise your knee. There are specific exercises to be done at specific times. The physiotherapist will teach you all the exercises you need to do and will explain when each exercise should be done. The physiotherapist will also explain how you should look after your new knee.

Caring for your new knee
Positioning you leg
- For the first week, try to keep your leg lifted up and supported on a chair if you are out of bed (unless you are exercising)
- Never, put a pillow underneath your knee
- Your toes should always point up towards the ceiling and not out to the side
- You may put a pillow underneath your foot to help the back of your knee to stretch

The wound
- Keep the wound dry until the stitches are out
- Make you sure you have the stitches out by the date given to you on discharge
- If the wound starts to bleed or ooze a lot once you are discharged, come back to the hospital as soon as you can

Walking
- The physiotherapist will help you to get out of bed on the first day after your operation
- You will start walking with crutches or a walking frame
- The doctor or physiotherapist will tell you how much weight you can put through your leg.
- The physiotherapist will teach you to go up and down stairs

Basic procedure for walking with crutches	
1	Stand up straight with your weight evenly balanced between your unoperated leg and the crutches
2	Move your crutches together to a little way in front of you

3	Step forward with your operated leg and try to straighten your knee so that your heel touches the ground first
4	Move your body forward, so that your foot is flat on the floor and your weight is spread between your crutches and your operated leg
5	Step forward with your unoperated leg and then start to lift the operated leg from heel to toe

Basic procedure for going up and down stairs	
Up	Leave your crutches on the level you are starting on and step up with your unoperated leg. Then bring your crutches and your operated leg up.
Down	Stand on your unoperated leg. Slowly lower the crutches and your operated leg to the step below. Then lean on your crutches and step down with your unoperated leg.

Driving and traveling by car

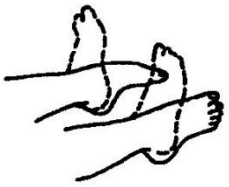
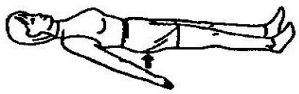
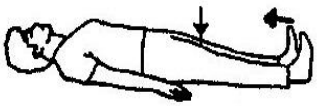
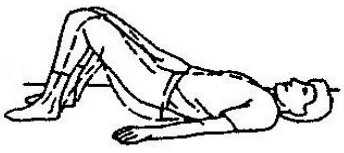
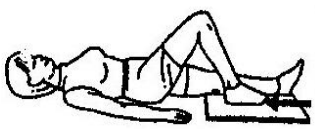
- You should only start driving yourself 6 weeks after your operation.
- If you are a passenger in a car, get in by having the car directly behind you and sitting straight backwards. Once you are sitting you can swivel your legs into the car one at a time.

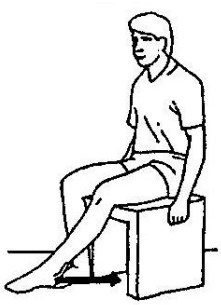
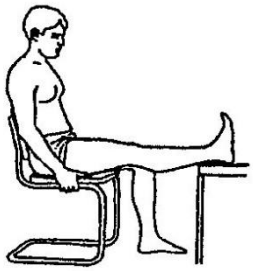
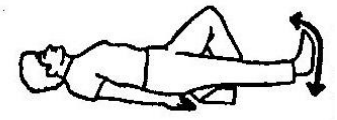
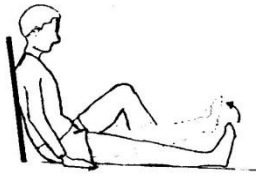
Exercises

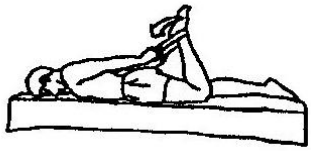
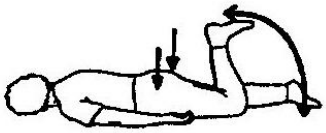
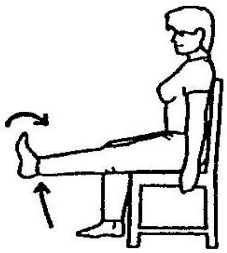
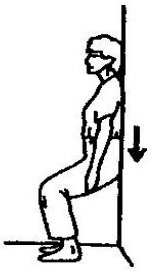
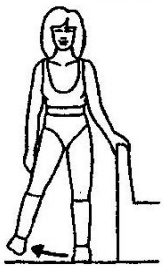
You will be given a list of exercises to do. Some will start in the hospital and some will start when you go home. The physiotherapist will explain each exercise to you and make sure you are able to do it.

TOTAL KNEE REPLACEMENT

Hospital and home exercises

	In your bed or sitting in the chair Move your feet up and down at the ankles Move as far as you can each time Keep your knees straight while you do this Do the movement as fast as you can Do this exercise with both feet, 10 times every hour
	Lie in your bed Squeeze your buttocks firmly together Hold for about 7 seconds Relax Do this exercise 10 times every hour
	In your bed with your knees straight Pull your toes up and contract your thigh muscle Try to pull your kneecap toward you Try to straighten your knee further Do this exercise 10 times every hour
	Lie on your back with your ____ knee bent Push through your ____ leg and lift your hips up off the bed Hold for 5 seconds Slowly lower your hips Do this exercise 5 times every hour
	Lie on your back Slide your ____ foot along the bed and try to bend your ____ leg as far as you can You can use a piece of paper under your foot to help it slide Do this exercise for 5 minutes, 6 times a day

	Sit with your legs over the side of the bed Relax your thigh muscle and let your foot hang over the edge of the bed Do this exercise for 5 minutes, 6 times a day
	Sit in a chair Rest your feet on the floor Slide your ____ foot backward along the floor and try to bend your ____ knee as much as possible Use a piece of paper under your foot to help it slide Do this exercise for 5 minutes, 6 times a day
	Sit in a chair, with your ____ leg up on a stool Rest your ____ heel on the stool and let your knee straighten as much as possible Try to relax your leg as much as possible Do this exercise for ____ minutes, ____ times a day
	Sit in your bed with a pillow under your ____ knee **THIS IS THE ONLY TIME YOU MAY HAVE A PILLOW UNDER YOUR KNEE** Pull up your foot and toes Contract your ____ thigh and straighten your ____ knee to lift your heel off the bed Keep your thigh resting on the pillow Do this exercise ____ times, ____ times a day
	Sit in your bed, leaning backwards on your arms Pull up your toes and straighten your ____ knee Once your knee is fully straight, lift your foot about 10cm off the bed Lower your leg slowly Do this exercise ____ times, ____ times a day

	Lie on your tummy (or standing) Hold a towel around your ____ foot Bend your knee and use the towel to help you bend it further Hold this position for 15 seconds Do this exercise 3 times, 3 times a day
	Lie on your tummy Contract your tummy muscles and buttocks Bend your ____ knee as far as you can Slowly straighten your knee Do this exercise ____ times, ____ times a day
	Sit in a chair or over the edge of the bed Slowly straighten your ____ knee as much as you can Hold for 5 seconds Allow your knee to bend slowly again Do this exercise ____ times, ____ times a day
	Stand leaning with your back against a wall and your feet about 40 cm from the wall Put _____ weight through your ____ leg Slowly slide down the wall Stop when you feel pain or too weak Slowly slide up the wall again Do this exercise ____ times, ____ times a day
	Stand holding onto a table in front of you Keep your back straight and lift your ____ leg out to the side Keep your knee straight Slowly bring the leg back to the middle Do this exercise ____ times, ____ time a day

	Stand holding onto a table in front of you Keep your back straight and lift your ____ leg out behind you Keep your knee straight Slowly bring the leg back Do this exercise ____ times, ____ time a day

TRACKING SHEET FOR IN-PATIENT TREATMENT

Patient code:_____ **Date of surgery:_____**

Pre-op
Date:_____

Intervention	Done Y/N	Comments
Education on contra-indications and precautions		
Teach mobility with appropriate walking aid (including transfers and stairs)		
Teach static gluteal contractions		
Teach static quadriceps contractions		
Teach active heel slides in bed		
Teach active heel slides in sitting		
Teach ankle dorsi and plantar flexion for circulatory drill		
Teach pressure care with one legged bridging		
Other		
Patients questions		

Day 1
Date:_____

Intervention	Done Y/N	Comments
Static gluteal contractions		
Static quadriceps contractions		
Circulatory drill (ankle dorsi and plantarflexion)		
Elevate		
Soft tissue management of hamstrings and quadriceps		
Heel slides in bed (heel on paper)		

Mobilise to chair if medically stable		
Other		

Day 2
Date:_____

Intervention	**Done Y/N**	**Comments**
Static gluteal contractions		
Static quadriceps contractions		
Circulatory drill (ankle dorsi and plantarflexion)		
Elevate		
Soft tissue management of hamstrings and quadriceps		
Heel slides in bed		
Knee flexion over edge of bed		
Inner range quads over small fulcrum		
Ice		
Patellofemoral joint mobilisation		
Mobilise in ward		
Other		

Day 3
Date:_____

Intervention	**Done Y/N**	**Comments**
Check bed programme: Static gluteal contractions Static quadriceps contractions Circulatory drill (ankle dorsi and plantarflexion) Elevate Heel slides in bed Knee flexion over edge of bed / chair (20 minutes tds)		
Soft tissue management of hamstrings and quadriceps		
Inner range quads over small fulcrum / progressing to SLR		

Ice		
Patellofemoral joint mobilisation		
Increase mobility training		
Other		
Patients questions		

Day 4
Date:_____

Intervention	**Done Y/N**	**Comments**
Check bed programme: Static gluteal contractions Static quadriceps contractions Circulatory drill (ankle dorsi and plantarflexion) Elevate Heel slides in bed Knee flexion over edge of bed / chair (20 minutes tds)		
Soft tissue management of hamstrings and quadriceps and patellofemoral joint mobilisation if necessary		
Inner range quads over small fulcrum / progressing to SLR		
Ice if necessary		
Ensure sound gait pattern		
Stairs if flexion > 65		
Other		
Teach home exercise programme		

Day 5 until discharge
Date:_____

Intervention	Done Y/N					Comments
Check bed programme: Static gluteal contractions Static quadriceps contractions Circulatory drill (ankle dorsi and plantarflexion) Elevate Heel slides in bed Knee flexion over edge of bed / chair (20 minutes tds)						
Soft tissue management of hamstrings and quadriceps and patellofemoral joint mobilisation if necessary						
Inner range quads over small fulcrum / progressing to SLR						
Ice if necessary						
Ensure sound gait pattern						
Stairs if flexion > 65						
Other						
Teach home exercise programme						

Guidelines for out patient therapy

VISIT 1 – 2/52 POST DISCHARGE

- Ensure 90º knee flexion – if not:
    - Check quadriceps fascial mobility
    - Check of quadriceps trigger points
    - Check patellofemoral mobility NB caudad
    - Address swelling if excessive
- Ensure zero quadriceps lag – if there is still a lag:
    - Address swelling if excessive
    - Check hamstring myofacial mobility
    - Check for hamstring trigger points
    - Check for quadriceps trigger points
    - Check patellofemoral mobility
    - Inner range quads drill with facilitation and patellofemoral quick stretch
- Ensure full knee extension – if not:
    - Address swelling if excessive
    - Check hamstring myofacial mobility
    - Check for hamstring trigger points
    - Address popliteal fascia and gastrocs
    - Address neural mobility
    - Address glide of the tibiofemoral joint
- Ensure correct crutch gait pattern
- Ensure correct and safe use of stairs
- Ensure all home exercises are correctly demonstrated by the patient

VISIT 2 – FRIDAY CLINIC 6/52 POST SURGERY

- Ensure 100º knee flexion, zero quadriceps lag and full knee extension, if not follow guidelines above. (can also introduce glides for tibiofemoral flexion)
- Ensure adequate ankle dorsiflexion. If not treat accordingly.
- Assess balance and weight-bearing ability. Give particular attention to hip control.
- Begin weaning within patient limits – ensure hip control and full knee extension. Teach correct gait pattern.
- Teach patient new home exercises according to sheet. Emphasise appropriate exercises for balance and control.

VISIT 3 – 2 WEEKS POST VISIT 2

- Ensure 110º knee flexion, zero quadriceps lag and full knee extension, if not follow guidelines above.
- Ensure adequate ankle dorsiflexion. If not treat accordingly.
- Assess balance and weight-bearing ability. Give particular attention to hip control.
- Continue weaning as appropriate. Ensure correct gait pattern. Emphasise knee control.
- Ensure all home exercises are correctly demonstrated by the patient

APPENDIX 10

ADDITIONAL OBSERVATIONS FROM CHAPTER 5

Table A9.1 Relationship between day of surgery and outcomes

Outcome	Monday / Tuesday (n=30)	Wednesday (n=6)	Thursday / Friday (n=14)
LOS	10	10	8
Days to 90°	13	dnr	6
Flexion ROM (pre)	95	92	95
Flexion ROM (dc)	70	61	80
Flexion ROM (6/52)	97	75	100
ED (pre)	7	9	9
ED (dc)	17	18	16
ED (6/52)	6	4	5
Flexion Con (pre)	5	8	7
Flexion Con (dc)	4	1	8
Flexion Con (6/52)	5	4	5
KSKS (pre)	41	25	32
KSKS (6/52)	62	66	72
Pain (KSKS)(pre)	15	7	17
Pain (KSKS)(6/52)	30	38	38

APPENDIX 11

DEMOGRAPHIC ASSESSMENT FORM

ADDITIONAL TABLES FROM CHAPTER 6

BASELINE INTERVIEW STUDY 4

Patient Code:_____ **Date:**_____

Age:_____ **M / F** **Knee: R / L**

Height:_____ **Date of Surgery:**_____

Weight:_____ **Date on waiting list:**_____

BMI:_____

Are you using an assistive walking device?					**Appropriate ?**	
Walking stick	1 crutch	2 crutches	Walking frame	Wheelchair	Yes	No

Co-morbidity score

CIRS	

Medication

Previous injuries

---

1. Are you married? (Barbarin & Khomo 1997)

1.	Never married, not now living with a partner		
2.	Married, but not now living with partner (divorced, separated etc)		
3.	Widowed		
4.	Never married, but not now living with partner		
5.	Married and currently living with partner		
Co-habiting		1. Yes	0. No

2. How many people currently live in your household? (Barbarin & Khomo 1997)

1.	Number 18 and older	
2.	Number 6 – 18 years old	
3.	Number under 6 years old	

*2.1 What is the monthly household income?*_____

Less than R593 pppm	More than R593 pppm

(R 593 pppm is a proposed upper threshold of a poverty indicator proposed by the national treasury in February 2007)

3. What is your level of education? (Barbarin & Khomo 1997)

1.	Less than standard 3
2.	Primary school (standard 3-4)
3.	Junior secondary (standard 5-7)
4.	Senior secondary (standard 8-10)
5.	Matric / High School Graduate / Vocational training diploma
6.	1-2 year college, technician
7.	3-4 years of university
8.	Postgraduate degree

1. Primary	2. Secondary	3. Tertiary

4. Are you working currently?

1.	Working full time
2.	Working part time
3.	Not working due to retirement age
4.	Not working due to disability
	Comments:(Reason for part time?)

Employed	1. Yes	0. No

4.1 What type of work? What previous jobs did you do?

Occupation	Years spent

4.2 Do you participate in any recreational or social activities?

Activity	Years spent / current time spent
Church	
Social club	

5. What chores do you do at home? ***(comment on facilities)***

1.	Laundry	
2.	Cooking	

3.	Washing dishes	
4.	Cleaning floors	

6. What is your current source of income?

1.	Salary
2.	Pension
3.	Grant
4.	Donations
5.	Partner's income
5.	Other:(describe)

1. Salary (own or spouse)	2. Grant / Donation / Pension

7. Are you currently looking after anyone, financially or physically?

	Dependants	***Number / full or part time***	
1.	Adult physical		
2.	Adult financial		
3.	Children < 18 physical		Ages:
4.	Children < 18 financial		Ages:
5.	None		

1. Yes	0. No

8. Is there someone at home to help take care of you?

	Caregiver	***Details***
1.	Adult full time	
2.	Adult part time	
3.	Live in a home	
4.	No	
	If yes to adult – are they sacrificing employment	

1.Yes	0.No

9. In what type of house do you live? (Barbarin & Khomo 1997)

1.	None, homeless
2.	Shack
3.	Hostel
4.	Room, garage

5.	Flat, cottage
6.	Home shared with other families
7.	Home not shared with other families

10. Does your house have… (Barbarin & Khomo 1997)

1.	A separate kitchen	No	Yes
2.	A separate bathroom	No	Yes

11. What type of toilet facilities does your home have? (Barbarin & Khomo 1997)

1.	None
2.	Pit or bucket
3.	Outside flush toilet
4.	Inside flush toilet

12. How far do you walk to get running water?

1.	It is inside the house
2.	Less than 10 m from the house
3.	10 to 25 m from the house
4.	More than 25 m from the house

13. What is the ground around your house like?

1.	Smooth sand / lawn
2.	Smooth paved
3.	Smooth gravel
4.	Bumpy gravel
5.	Rocky
6.	Hilly
7.	Other: (describe)

14. What form of transport do you use to get to Johannesburg hospital? (can tick more than one)

1.	Own car
2.	Family member's car
3.	Employer's car
4.	Taxi (car)
5.	Taxi (minibus, Venture)
6.	Bus
7.	Train
8.	Other: (describe combination)

15. How far do you have to walk to get to your transport?

1.	Not at all
2.	Less than 15 minutes
3.	15 – 30 minutes
4.	More than 30 minutes

16. How long does it take you to get to Johannesburg hospital?

1.	Less than 30 minutes
2.	30 minutes to 1 hour
3.	1 to 2 hours
4.	More than 2 hours

17. Who comes with you when you come to Johannesburg hospital?

1.	Nobody – I come alone
2.	Family member (employed)
3.	Family member (unemployed)
4.	Employer
5.	Other:

1.Yes	0.No

17.1 Why do you take someone with you to the hospital?

18. How much does your transport to Johannesburg hospital cost?

1.	Less than R 15
2.	R15 to R 30
3.	R 30 to R 50
4.	More than R 50

19. What are your 3 nearest clinics?

Clinic	Physiotherapy Services(days, format)

20. What form of transport do you use to get to your clinic?

1.	Own car

2.	Family member's car
3.	Employer's car
4.	Taxi (car)
5.	Taxi (minibus, Venture)
6.	Bus
7.	Train
8.	Other: (describe combination)

21. How far do you have to walk to get to your transport to the clinic?

1.	Not at all
2.	Less than 15 minutes
3.	15 – 30 minutes
4.	More than 30 minutes

22. How long does it take you to get to your clinic?

1.	Less than 15 minutes
2.	15 minutes to 30 minutes
3.	30 minutes to 1 hour
4.	More than 1 hour

23. Who goes with you to the clinic?

1.	Nobody – I come alone
2.	Family member (employed)
3.	Family member (unemployed)
4.	Employer
5.	Other:

23.1 Why do you take someone with you to the clinic?

24. How much does your transport to the clinic cost?

1.	No cost
2.	Less than R 15
3.	R15 to R 30
4.	R 30 to R 50

25. Have you been for physiotherapy treatment before for your knee or any other condition?

1. Yes	0. No

25.1 Where did you go for physiotherapy treatment?

1.	Government Hospital
2.	Government Clinic
3.	Private Sector

25.2 Would you make use of physiotherapy services again?

1. Yes	0. No

25.3 Answer yes or no to the following questions about your experience of going to physiotherapy.

(Goldstein et al 2000, Beattie et al 2002, Monnin & Perneger)

1	Was it is easy to pay and get your file before the appointment?	No	Yes
2	Was it is easy to get appointments at the time you wanted them?	No	Yes
3	Could you start treatment very soon after you were referred?	No	Yes
4	Could you get physiotherapy appointments as often as you needed?	No	Yes
5	Were your appointments kept on time?	No	Yes
6	Did you have the same physiotherapist each time?	No	Yes
7	Did you feel comfortable in the physiotherapy treatment area?	No	Yes
8	Was the treatment area clean?	No	Yes
9	Was your privacy respected in the treatment area?	No	Yes
10	Could find your way easily to the physiotherapy rooms?	No	Yes
11	Was it difficult to get to the hospital / clinic?	No	Yes
12	Did you feel the treatment helped your problem?	No	Yes
13	Could you afford to pay the fees for treatment?	No	Yes

28. How painful do you expect your knee to be after the operation? (Mahomed et al 2002)

1.	Not at all
2.	Slightly
3.	Moderately
4.	Very painful

1. Yes	0.No

29. How limited do you expect to be in your usual activities? (Mahomed et al 2002)

1.	Not at all
2.	Slightly
3.	Moderately

4.	Very limited

1.Yes	0.No

CUMULATIVE ILNESS RATING SCALE

Patient Code:_____ **Age:**_____
Rater:_____ **Date:**_____

1.	Cardiac (heart only)	0	1	2	3	4
2.	Vascular (hypertension)	0	1	2	3	4
3.	Haematological / haematopoetic (bv, marrow, cells etc)	0	1	2	3	4
4.	Respiratory	0	1	2	3	4
5.	Ears, eyes, nose, throat and larynx	0	1	2	3	4
6.	Upper GI (oesophagus, stomach, duodenum, pancreas)	0	1	2	3	4
7.	Lower GI (intestines, hernias)	0	1	2	3	4
8.	Hepatic (liver and biliary tree)	0	1	2	3	4
9.	Renal (kidneys only)	0	1	2	3	4
10.	Genito-urinary (ureters, bladder, urethra, prostate)	0	1	2	3	4
11.	Musculo-skeletal-integumentary	0	1	2	3	4
12.	Neurological (excluding dementia)	0	1	2	3	4
13.	Endocrine-metabolic -breast (diabetes, thyroid, systemic infections)	0	1	2	3	4
14.	Psychiatric (dementia, depression, anxiety, delirium, psychosis)	0	1	2	3	4
15.	**Total Score**					
16.	**Total number categories endorsed**					
17.	**Severity index (Total score/total categories endorsed)**					
18.	**Number of categories at level 3**					
19.	**Number of categories at level 4**					

Score according to guidelines set out by Salvi et al 2008

Table A10.1 Marital status and socioeconomic environment

	Better outcome (n=14)(%)	Poorer outcome (n=10)(%)
Marital status		
Never married, not now living with partner	2(14)	1(10)
Was married, not now living with partner	4(29)	5(50)
Widowed	2(14)	4(40)
Never married, but now living with partner	1(7)	0
Married and living with partner	5(36)	0
Co-habiting with partner	6(43)	0
People currently living in household		
Co-inhabitants >18 years old	14(100)	7(70)
Co-inhabitants 6-18 years old	4(29)	2(20)
Co-inhabitants <6 years old	2(14)	1(10)
Economic status of household		
Monthly household income > national poverty line	9(64)	6(60)
Current dependents		
Adult physical	1(7)	0
Adult financial	4(29)	4(40)
Child physical	4(29)	2(20)
Child financial	1(7)	1(10)
None	7(50)	5(50)
Yes – has dependents	7(50)	5(50)
Current caregivers		
Adult full time	5(36)	2(20)
Adult part time	3(21)	6(60)
Old age home	0	2(20)
None	6(43)	0
Yes - has a caregiver	8(57)	10(100)

Table A10.2 Level of education, employment and source of income

	Better outcome (n=14) (%)	Poorer outcome (n=10) (%)
Level of education		
Less than standard 3	**0**	**3(30)**
Primary school (standard 3-4)	**0**	**1(10)**
Junior secondary (standard 5-7)	**4(29)**	**2(20)**
Senior secondary (standard 8-10)	**7(50)**	**2(20)**
Matric / Vocational training diploma	**1(7)**	**1(10)**
1-2 years college / technician	**2(14)**	**1(10)**
3-4 years university	**0**	**0**
Post graduate	**0**	**0**
Primary / secondary / tertiary	**1(7)/11(79)/2(14)**	**5(50)/4(40)/1(10)**
Current employment status		
Full time	**0**	**2(20)**
Part time	**1(7)**	**1(10)**
Retired	**5(36)**	**5(50)**
Not working due to knee	**8(57)**	**2(20)**
Yes - Employed	**1(7)**	**3(30)**

Current source of income		
Salary	**0**	**3(30)**
Pension	**9(64)**	**5(50)**
Grant	**2(14)**	**0**
Donations	**1(7)**	**0**
Partners income	**1(7)**	**0**
Other	**1(7)**	**2(20)**
Salary or pension	**9(64)**	**8(80)**

Table A10.3 Normal daily activities

	Better outcome (n=14) (%)	**Poorer outcome (n=10) (%)**
Laundry	**10(71)**	**6(60)**
Cooking	**11(79)**	**9(90)**
Dishes	**10(71)**	**7(70)**
Floors	**7(50)**	**5(50)**
Other	**3(21)**	**1(10)**
Church	**12(86)**	**6(60)**
Social club	**1(7)**	**0**
Other	**4(29)**	**1(10)**

Table A10.4 Physical home environment

	Better outcome (n=14) (%)	**Poorer outcome (n=10) (%)**
Type of house		
None	**0**	**0**
Shack	**1(7)**	**0**
Hostel	**0**	**0**
Room / garage	**0**	**0**
Flat / cottage	**4(29)**	**2(20)**
Home (shared)	**1(7)**	**1(10)**
Own home	**8(57)**	**7(70)**
Toilet		
None	**0**	**0**
Pit / bucket	**0**	**3(30)**
Outside flush	**1(7)**	**0**
Inside flush	**13(93)**	**7(70)**
Distance to running water		
Inside	**13(93)**	**7(70)**
<10 meters	**1(7)**	**0**
10-25 meters	**0**	**1(10**
> 25 meters	**0**	**2(20)**
Ground around house		
Smooth sand / lawn	**1(7)**	**0**
Smooth paved	**10(71)**	**5(50)**
Smooth gravel	**2(14)**	**2(20)**
Bumpy gravel	**1(7)**	**3(30)**
Rocky	**0**	**0**
Hilly	**0**	**0**

Other	**0**	**0**

Table A10.5 Transport and access to the hospital

	Better outcome (n=14) (%)	**Poorer outcome (n=10) (%)**
Transport to hospital		
Own car	**1(7)**	**2(20)**
Family member's car	**7(50)**	**4(40)**
Employer's car	**0**	**1(10)**
Taxi (car)	**1(7)**	**1(10)**
Taxi (Minibus / venture)	**5(36)**	**3(30)**
Bus	**0**	**2(20)**
Train	**0**	**0**
Other	**0**	**0**
Time to walk to transport		
Not at all	**8(57)**	**4(40)**
Less than 15 minutes	**5(36)**	**3(30)**
15 to 30 minutes	**0**	**2(20)**
More than 30 minutes	**1(7)**	**1(10)**
Time of journey to the hospital		
Less than 30 minutes	**0**	**1(10)**
30 minutes to 1 hour	**11(79)**	**6(60)**
1 to 2 hours	**2(14)**	**2(20)**
More than 2 hours	**1(7)**	**1(10)**
Accompanied by		
Nobody	**5(36)**	**6(60)**
Family member (employed)	**4(29)**	**3(30)**
Family member (unemployed)	**5(36)**	**1(10)**
Employer	**0**	**0**
Other	**0**	**0**
Yes – accompanied to hospital	**9(64)**	**4(40)**
Cost of transport to the hospital		
Less than R15	**7(50)**	**2(20)**
R15 – R30	**6(43)**	**7(70)**
R30 – R50	**1(7)**	**0**
More than R50	**0**	**1(10)**

Table A10.6 Transport and access to local clinic

	Better outcome (n=14) (%)	**Poorer outcome (n=10) (%)**
Number of local clinics the subject could name		
0	**1(7)**	**3(30)**
1	**7(50)**	**4(40)**
2	**4(29)**	**3(30)**
3	**2(14**	**0**
Transport to clinic		
Own car	**2(14)**	**2(20)**
Family member's car	**4(29)**	**2(20)**
Employers car	**0**	**1(10)**

Taxi (car)	**1(7)**	**0**
Taxi (Minibus / Venture)	**5(36)**	**2(20)**
Bus	**1(7)**	**0**
Train	**0**	**0**
Other	**1(7)**	**4(40)**
Time to walk to transport		
Not at all	**8(57)**	**8(80)**
Less than 15 minutes	**3(21)**	**2(20)**
15 to 30 minutes	**3(21)**	**0**
More than 30 minutes	**0**	**0**
Time of the journey to the clinic		
Less than 15 minutes	**6(43)**	**5(50)**
15 to 30 minutes	**7(50)**	**3(30)**
30 minutes to 1 hour	**1(7)**	**1(10)**
More than 1 hour	**0**	**1(10)**
Accompanied by		
Nobody	**10(71)**	**9(90)**
Family member (employed)	**1(7)**	**0**
Family member (unemployed)	**3(21)**	**1(10)**
Employer	**0**	**0**
Other	**0**	**0**
Yes – accompanied to clinic	**4(29)**	**1(10)**
Cost of transport to clinic		
No cost	**4(29)**	**7(70)**
Less than R15	**10(71)**	**3(30)**
R15 – R30	**0**	**0**
R30 - R50	**0**	**0**

Table A10.7 Previous exposure to physiotherapy and post-operative expectations

	Better outcome (n=14) (%)	**Poorer outcome (n=10) (%)**
Previous physiotherapy treatment	**11(79)**	**3(30)**
Public hospital	**7(50)**	**2(20)**
Public clinic	**3(21)**	**0**
Private sector	**3(21)**	**1(10)**
Would like to make use of physiotherapy services again	**11(100)**	**3(100)**
Amount of pain expected after surgery		
None at all	**5(36)**	**2(20)**
Slight	**5(36)**	**3(30)**
Moderate	**2(14)**	**4(40)**
Severe	**2(14)**	**1(10)**
Pain expected	**9(64)**	**8(80)**
Amount of limitation expected after surgery		
None at all	**8(57)**	**4(40)**
Slight	**5(36)**	**4(40)**
Moderate	**1(7)**	**2(20)**
Severe	**0**	**0**
Limitation expected	**6(43)**	**6(60)**