

Waitlists, Quality of Life, and Functional Status: A Preoperative and Postoperative  
Examination of Total Hip and Total Knee Replacement Patients

by

Lynda L. Mandzuk

A Thesis submitted to the Faculty of Graduate Studies

of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

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Winnipeg, Manitoba

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**Lynda L. Mandzuk © 2008**

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Although he passed away before I started this journey, he instilled in me the meaning of  
working hard and doing well and for that I am grateful.

## Abstract

Many individuals wait for arthroplasty surgery and little is known about their perceived quality of life and functional status. This longitudinal study ( $N = 1,228$ ), guided by the Symptom Management Model (Dodd et al., 2001), measured quality of life (SF-12) and functional status (Oxford-12). The mean wait time was 48.4 ( $SD$  29.1) weeks. Patients who reported below average mental and physical health at 12 months prior to surgery tended to report below average mental ( $r = .694$ ) and physical health ( $r = .648$ ) at 1 month prior to surgery, and 12 months following surgery ( $r = .474$  and  $r = .302$  respectively) ( $p < .001$ ). They also reported severe functional impairment at one month prior to surgery however they had positive clinical functional improvements following surgery. Total hip patients had higher mental health, physical health, and functional status when compared to total knee patients plus they also tended to have a greater rate of physical health improvement when compared to total knee patients ( $p < .05$ ).

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## Abbreviations

BMI	Body mass index
CIHI	Canadian Institute of Health Information
CIHR	Canadian Institute of Health Research
CJRR	Canadian Joint Replacement Registry
CNA	Canadian Nurses Association
COA	Canadian Orthopaedic Association
DVT	Deep vein thrombosis
FS	Functional status
ICC	Intraclass correlation coefficient
JRR	Joint Replacement Registry
MCNHR	Manitoba Centre for Nursing and Health Research
MCS	Mental Component Summary
OA	Osteoarthritis
OHS	Oxford Hip Score
OKS	Oxford Knee Score
PCS	Physical Component Summary
QOL	Quality of Life
SF-12	12-Item Medical Outcomes Short Form
SF-36	36-Item Medical Outcomes Short Form
SMM	Symptom Management Model
TH	Total Hip

TK	Total Knee
UCSF	University of California, San Francisco
WCWL	Western Canada Waiting List
WHO	World Health Organization
WOMAC	Western Ontario McMaster University Osteoarthritis Index
WTA	Wait Time Alliance

## Chapter 1

### Statement of the Problem

Yearly, over 37,000 Canadians undergo joint replacement surgery to improve their quality of life (QOL) and functional status (FS) (Arthritis Society, 2004). According to the Canadian Joint Replacement Registry (CJRR), 58,714 Canadians had either total hip (TH) or total knee (TK) replacement surgery in 2004-2005 (Canadian Institute of Health Information, 2006). Many of these patients experience lengthy waits for their surgeries. In Manitoba the wait for surgery is a healthcare concern with median wait times, as of May 2006, of 31 weeks for hip replacements (Manitoba Health, 2006a) and 47 weeks for knee replacements (Manitoba Health, 2006b). This longitudinal, retrospective study of TH and TK replacement patients aimed to examine changes in and the relationship between QOL and FS across the wait period and following surgery.

This chapter describes the current study in regards to its background, the problem, and the significance. An overview of the framework that guided the study—the Symptom Management Model (SMM) (Dodd et al., 2001; Larson et al., 1994) is provided. The study aims and research questions are presented as well as definitions of the key variables and the assumptions of the study.

### Background

Healthcare is in a state of crisis and prolonged wait times are a major contributing factor (McIntosh, 2005). The Canadian Nurses Association (CNA) identifies that waiting for healthcare has turned out to be the litmus test of access to services (2004). While the Canadian healthcare system prides itself on accessibility for all, many patients and those undergoing elective TH/TK replacements in particular, have lengthy wait times for their

surgery. A discussion of the underlying health problem and more specifically, the current orthopaedic healthcare climate, including outcomes from TH/TK wait time initiatives provided the background for this study.

### *Health Problem*

Arthritis is increasing and it is one of the major reasons that patients require joint replacement surgery (Canadian Institute of Health Information, 2005). Increasing rates of obesity have compounded the problem, adding significant stress on weight bearing joints and escalating joint damage (Masri et al., 2005). The Arthritis Society estimates that approximately 3 million Canadians have osteoarthritis (OA) (2004). Total joint replacement surgery, also known as arthroplasty surgery, is commonly performed to treat this form of arthritis. Arthroplasty surgery not only decreases pain and improves FS, it also improves QOL for the patient (Canadian Orthopaedic Association, 2005).

Waiting times for patients requiring joint replacements "...are consistently and significantly longer than physicians feel is clinically reasonable" (Esmail & Walker, 2005, p. 5). The potential costs associated with long waits are many. These costs include: compromised patient QOL and FS; the development of additional mental and physical health problems due to inactivity, disability, and pain; and the economic and social costs associated with chronic pain and disability (Masri et al., 2005). Clearly, surgical delays have a significant impact on orthopaedic patients, affecting most areas of their lives.

### *Orthopaedic Healthcare Climate*

An increased awareness of arthritis has occurred within the health professional and public arenas. The World Health Organization (WHO) declared the year 2000 as the start of the Bone and Joint Decade. In 2002, Canada joined this international movement,

that focuses on musculoskeletal health. There has also been an increased awareness of arthritis due to endeavors such as Hip Hip Hooray, a yearly walk held in Canadian cities. This walk, which is endorsed by the Canadian Orthopaedic Foundation and the Canadian Orthopaedic Association (COA), raises money for orthopaedic patient care, education, and research. This increased awareness coupled with the growing health needs of patients requiring joint replacement surgery is placing an incredible strain on the Canadian healthcare system.

While there is pressure on the healthcare system, the legal system is recognizing a related increased accountability. A recent legal case (Supreme Court of Canada: Chaoulli v. Québec, 2005) involving a one year wait for hip replacement surgery sparked national recognition of the impact of orthopaedic surgery wait times on QOL. After reviewing both the Québec Charter of Human Rights and the Canadian Charter of Rights and Freedoms, the Courts identified that QOL is negatively affected by waiting for services and that “the right to life and to personal inviolability is therefore affected by the waiting times” (Supreme Court of Canada: Chaoulli v. Québec, p. 5). This ruling opened the door to privately insured and delivered healthcare in Québec. Clearly, the impact of wait times on QOL of orthopaedic patients is viewed as an important factor in ethical healthcare delivery.

#### *Wait Time Initiatives*

Initiatives to reduce and manage wait times have been developed at multiple governmental and organizational levels. At the federal government level, Prime Minister Stephen Harper states that healthcare is one of his government’s priorities. As reinforced in the Canada Health Act, this includes delivery of that care in an accessible and



equitable manner (Prime Minister of Canada, 2006). The former Prime Minister Paul Martin and the premiers signed an agreement supporting the decrease in wait times and identifying strategies such as collaboration between governments, active participation among stakeholders, and federal investments (First Ministers Accord, 2004).

Thomson and Jeanes (2006) offer that one national outcome of the Chaoulli verdict was the First Ministers' Health Accord 2004. At that time, the Canadian First Ministers acknowledged that access to healthcare was a nationwide concern and set a goal to establish and implement acceptable wait times by March 2007. In their report entitled '*A 10-year plan to strengthen healthcare*', the stage was set for a number of wait time initiatives, with efforts focused on timely access in five priority clinical areas, one of which was joint replacements (First Ministers Accord, 2004).

Another major national level thrust has been the Wait Time Alliance (WTA), formed in 2004 by a group of national medical specialty societies. Using an evidence-based approach and broad-based consultative process the WTA developed wait time guidelines, including benchmarks for joint replacements. Scheduled cases (non-emergency and non-urgent cases) were benchmarked to receive surgery within six months of specialist consultation. The Alliance strongly recommended Canada-wide wait time benchmarks and continued partnership between stakeholders. Reflective of their priorities for stakeholder involvement, the WTA also developed strategies for mitigating, measuring, monitoring, and managing wait times to improve access to healthcare (WTA, 2005).

Three of the WTA strategies have particular significance for understanding QOL and FS during the wait period. The standardized measurement of wait times allows both

the public and the healthcare system to determine actual waiting times and enable performance assessment of the healthcare system. Monitoring of the patient while on the waiting list can avoid undue stress for patients and their families plus it can assess wait list progress, and provide insight into benchmark adjustments and wait time management strategies. Lastly, managing of wait times allows the patient appropriate access to care and facilitates productivity of the entire system.

Meanwhile, regional initiatives also were underway to improve the delivery of services to orthopaedic patients. The Western Canada Waiting List (WCWL) project was a collaborative, multidisciplinary, federally funded partnership. The first phase of the WCWL project, initiated in November 1998, had key stakeholders concentrate on the development of valid and reliable tools to assist in identifying priority patients for care (Noseworthy et al., 2001). Project goals were to define waiting times and create tools that could assist in wait list management.

The second phase of the WCWL project continued to focus on timeliness of access to care. In regards to orthopaedics, there were three major tasks in this phase. Firstly, the implementation and evaluation of the hip and knee assessment tools occurred in British Columbia, Alberta, and Saskatchewan. Secondly, the development of benchmarks or maximum acceptable wait times occurred with input from patients, physicians, and the public. These criteria stipulated that the most urgent hip and knee replacement surgeries should be performed in 4 weeks with less urgent cases in 12 weeks and least urgent surgeries in 20 weeks. Lastly, the tools that were developed earlier were adapted to facilitate orthopaedic surgeon referrals from family practice physicians (Noseworthy et al., 2005). Recommendations from the 2005 final report include:

implementation of the tools in other health regions, obtaining additional feedback from stakeholders, and putting the referral tools in practice.

Survey research also has been used to explore wait times. Statistics Canada (2005) explored patients' experiences accessing care in their survey entitled '*Access to Healthcare Services in Canada*' and found that 20-30% of Canadians believe that they are waiting too long for care. Similar public concerns for access were identified by the '*Healthcare in Canada Survey*' (Healthcare in Canada Partners, 2004), and by Esmail and Walker (2005) in the Fraser Institute Report entitled '*Waiting your turn: Hospital waiting lists in Canada*'. Esmail and Walker also report that physicians identify that wait times are consistently longer than "clinically reasonable" (p. 5). Similar to other surgeries, the wait for orthopaedic surgery has increased, notably, however, compared to other surgeries, the wait for orthopaedic surgery is the longest (Esmail & Walker).

Two other organizations that have addressed wait times are the Canadian Institute of Health Research (CIHR) and the Canadian Institute of Health Information (CIHI). In response to federal and provincial initiatives, these institutes have offered support for research on surgical wait times, and helped to disseminate those research findings to professionals and the public. Two major orthopaedic research projects that have been funded by the CIHR include: '*Priority criteria for hip and knee replacement: Addressing health service wait times*' (Masri et al., 2005) and '*Toward Canadian benchmarks for health service wait times—Evidence, application and research priorities*' (Sanmartin et al., 2005). One research priority identified in these reports is the study of patients' health status or consequences while waiting for TH/TK replacements.

The provincial and federal governments encouraged the CIHI to provide more complete health information about the people and the healthcare system of Canada. One of the groups that the CIHI works closely with is the CJRR. The CJRR gathers information about TH/TK replacements that are performed in Canada and aims to improve the care and outcomes for these patients. The CJRR and the CIHI collaborated to produce the report entitled *'Total hip and total knee replacements in Canada'* (CIHI, 2006). This report provided useful background information for this study, such as the characteristics of the patients and surgical statistics from the past year.

The international movement, the Bone and Joint Decade, started the dialogue relating to musculoskeletal health. Then the discussion moved to national and regional initiatives such as Hip Hip Hooray, the Chaoulli case, the First Ministers Accord, WCWL, and WTA. Various surveys by Statistics Canada, the Fraser Institute, and the Healthcare in Canada Survey were reported. Other orthopaedic-specific initiatives have included the CIHR, CIHI, and CJRR. The last piece in the puzzle that is missing is what is being done at the local level.

At our own provincial level, Manitoba Health has a public website that identifies provincial median wait times for joint replacement surgery plus computer links to wait time strategies. Wait time initiatives are occurring as described in the report entitled *'Working for better healthcare sooner: A report to Manitobans on healthcare services'* (Government of Manitoba, 2006). According to this report, 40% more hip and knee surgeries occurred in Manitoba during 2005-2006 fiscal year, plus an additional 2,500 joint replacements will be performed over the next three years. Attention is obviously being given to the wait lists for TH/TK surgeries but what remains unknown is patients'

perceptions of their QOL and FS before and after their surgery. The discussion will now move to the statement of the problem of this research project.

### The Problem

Over 20,000 individuals are waiting for hip or knee replacement surgery in Canada (Arthritis Society, 2004). It is estimated that for Canadians, the average wait for joint arthroplasty surgery is 25 weeks (Arthritis Society). In the annual report on waiting for healthcare in Canada, median wait times from April to December 2005 for eight provinces were 18 weeks for TH and 28 weeks for TK replacements (CIHI, 2006). According to the WTA (2005) the maximum wait time for TH and TK replacement surgeries should be 24 weeks from the time of specialist consultation until the surgery is performed.

Statistics on the Manitoba government website, in September 2006, indicated that the wait for TH surgery was 20 weeks (Manitoba Health, 2006e) and for TK surgery was 47 weeks (Manitoba Health, 2006f). This is down from median wait times reported in May 2006, of 39 weeks (Manitoba Health, 2006c) and 51 weeks (Manitoba Health, 2006d) for TH/TK replacements respectively. It is important to note that the numbers of surgeries have increased but that recent surgical management efforts in Manitoba to address the wait list have lead to an overall decrease in wait times. The COA (2005) believes that the demand for TH/TK replacement surgery will continue to increase. It was not known how these patients perceive their QOL and FS before and after their surgery, plus what relationship existed between QOL and FS over time. The purpose of this study was to address those clinical knowledge gaps.

### Significance of the Study

This study is significant for two reasons. Besides determining how patients evaluated their QOL and FS before and after their TH/TK replacement surgery, it also evaluated the relationship of QOL and FS over time.

As people age, there is an increased incidence of OA, the leading cause for joint replacement surgery (Felson et al., 2000). It is estimated that 3 million Canadians have OA and 20,000 of them are waiting for joint replacement surgery (Arthritis Society, 2004). The current rates of joint replacement surgery will not be sufficient to meet the demands. The Canadian Medical Association (2008) believes that when individuals wait for surgery there are associated costs for patients, caregivers, and the medical system.

Health Canada (2003) estimates that in the year 2026, there will be 6 million Canadians suffering from arthritis. They also identify that patients with arthritis suffer from pain and a limited activity level. This study facilitates knowledge development in regards to how these patients perceived their QOL and FS and the relationship of their QOL and FS over time.

The CNA (2006) advocates that in the year 2020, nurses will play a larger role in guiding and steering patients through the healthcare system. Findings from this study will guide future interventions that specifically enhance the care of the TH/TK replacement patient population. They will also help examine practice and will facilitate improved patient outcomes that will address the pain, suffering, and disability in this growing population.

Given the current trends, the number of total joint replacement surgeries are expected to continue to increase. This study can significantly inform our understanding of

arthroplasty health outcomes. Ultimately, this research may lead to better care of patients throughout their total hip and total knee replacement surgical experience.

### Conceptual Framework

The SMM (Dodd et al., 2001; Larson et al., 1994) was used to guide the study. The SMM was chosen because of its emphasis on patient perceptions and its belief in the dynamic nature of symptom management (Dodd et al.). The SMM is built on the premise that symptoms are subjective and that bothersome symptoms require attention (Larson et al.).

Larson et al. (1994) developed the SMM at the University of California San Francisco (UCSF), School of Nursing, Centre for Symptom Management, to provide a broad view of symptom management and a tested model of symptom management that could guide patient care and research. Following the model's use in clinical research and practice, Dodd et al. (2001) revised the model. It is the revised SMM that guided this study (see Figure 1).

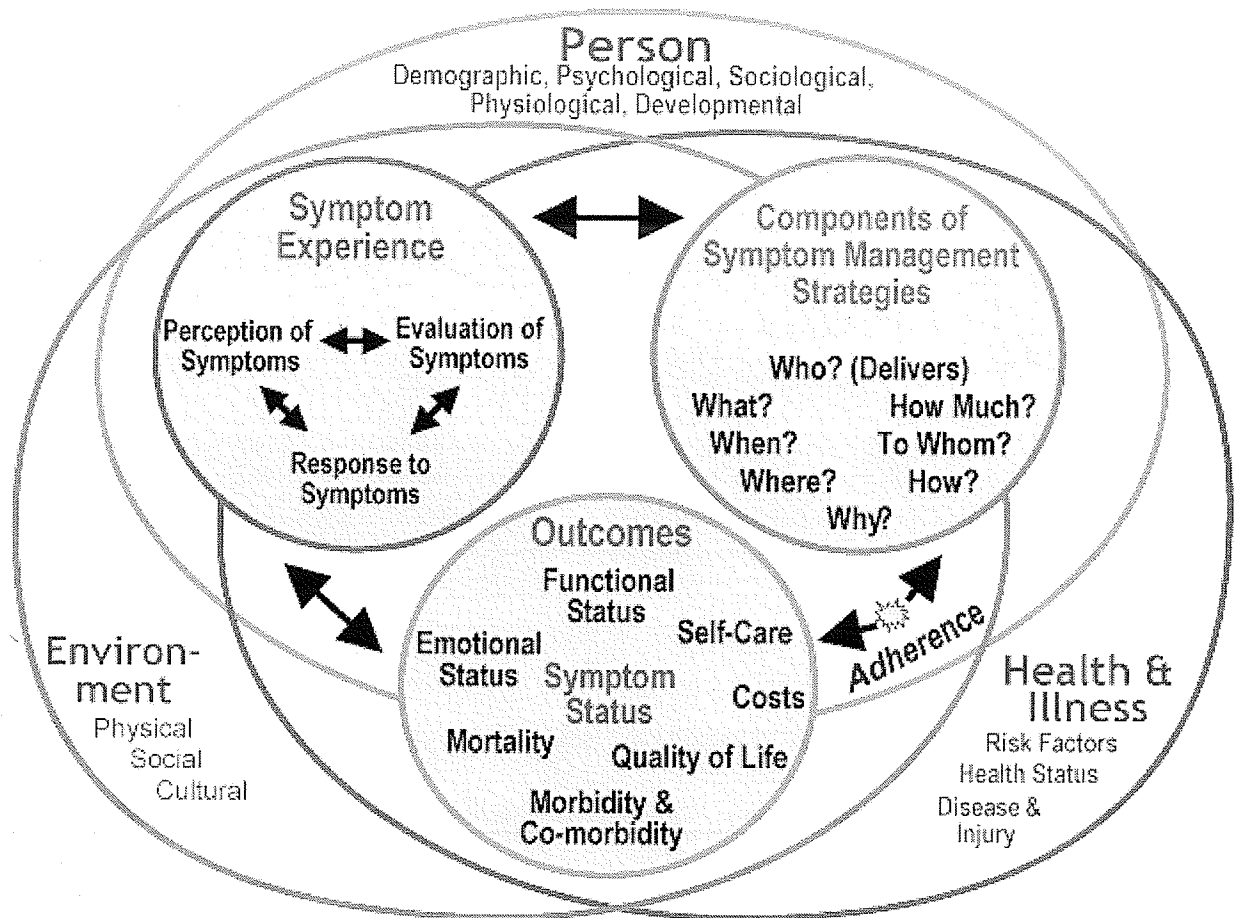


Figure 1. Symptom Management Model (Dodd et al., 2001).

Note. From "Advancing the science of symptom management," by M. Dodd et al., 2001, *Journal of Advanced Nursing*, 33(5), p. 668-676. Copyright 2001 by Blackwell Publishing. Reprinted with permission.

The SMM (Dodd et al., 2001; Larson et al., 1994), a relatively new model, focuses on the management of symptoms within the nursing domains of person, health/illness, and environment. Within their spheres, these domains encompass and influence the entire model. This multidisciplinary model strives to expand the symptom management body of knowledge (UCSF School of Nursing Website, 2006). The domains



influence the model dimensions of symptom experience, symptom management strategies, and outcomes. They enhance the model's comprehensiveness as they surround the dimensions. The discussion will first focus on the model domains, then the three dimensions.

### *Domains*

#### *Person Domain.*

The person domain is described by demographic, psychological, sociological, physiological, and developmental variables. Examples of demographic variables could include age and gender, whereas psychological and sociological variables include emotional states and social roles, respectively. Physiological variables include physical status while developmental variables refer to a stage of life, such as midlife or old age. This study referred to the person domain in regards to demographic variables such as age and gender. The person domain can influence the model dimensions of symptom experience, symptom management strategies, and outcomes.

#### *Environment Domain.*

The environment domain is defined broadly to include the physical, social, and cultural environments. The physical environment could refer to a patient's home and the social environment could include the patient's support system. One type of environment that could be added to the SMM is the political environment. In this study, the political environment is a prominent environmental factor that influences wait times for TH/TK replacement surgery. The environment domain can influence all three of the model dimensions.

### *Health and Illness Domain.*

The health and illness domain is reflected in the model and consists of variables that are exclusive to the health/illness of the individual. Dodd et al. (2001) describe this domain as risk factors, health status, disease, or injury. In this study, examples of these include co-morbidities or complications. It is apparent that the individuals' health/illness can influence their symptom experience, symptom management strategies, or outcomes.

### *Model dimensions*

The three interconnected dimensions of the SMM—symptom experience, symptom management strategies, and outcomes—will now be discussed. These dimensions are central to the model and are surrounded and influenced by the domains that have been previously discussed. It is generally believed that adequate symptom management requires that all three dimensions be included since the dimensions are interconnected (Dodd et al., 2001). Bi-directional arrows have been placed between each of the three dimensions indicating that the flow of information is bi-directional. In this study, the symptom experience influences the symptom management strategies, the outcomes and vice versa. Likewise, the outcomes affect the symptom management strategies and vice versa. Each of these dimensions has an effect on the other.

### *Symptom Experience.*

Symptom experience refers to the interpretation of the symptoms by patients. This dimension includes the following variables: the perception of symptoms, the evaluation of symptoms, and the response to symptoms. There are bi-directional arrows between these variables as each relates to the other and there is no set order through which a patient progresses.

Symptom perception is when the patient acknowledges that something is different (Dodd et al., 2001). A symptom, such as arthritic pain in the hip or knee is noticed by the individual. Symptom evaluation involves the patient making judgments about the characteristics of the symptoms (Dodd et al.). The patient decides whether to seek help for the pain in their hip or knee. Symptom response refers to the patient's reaction to the symptom (Dodd et al.). Patients' responses to a symptom can be physiologic, psychological, sociocultural, or behavioral (Dodd et al.). For instance, the patient's response to arthritis pain in the hip or knee may be a noticeable limp.

In this study, the symptom experience refers to arthritis and the health status of the patient. The patient evaluates and responds to the symptom and this in turn will influence the symptom perception.

#### *Symptom Management Strategies.*

Components of the symptom management strategies include questions such as: Who delivers? What? When? Where? How much? Why? How? and To whom? These questions lead us to answers regarding the symptom management strategies that have been utilized. In the context of this study, the 'when' of the symptom management strategies is the wait for surgery. There is a broken arrow between the symptom management strategies and the outcomes to signify non-adherence to the strategies. Adherence to symptom management strategies is briefly described in the SMM but according to Dodd et al. (2001) it needs to be explored further. Adherence was not discussed in this study.

### *Outcomes.*

The outcomes dimension focuses on the symptom status or the resulting situation. Factors within this dimension include QOL, FS, self-care, costs, morbidity, co-morbidity, mortality, and emotional status. There is a reciprocal relationship between these factors and the symptom status. In the context of this study, the major outcomes are QOL and FS. There is also a reciprocal relationship between the outcomes, symptom experience, and symptom management strategies. For example, QOL and FS influence the patient's symptom experience and the symptom management strategies.

### *Appropriateness of the Symptom Management Model*

The SMM has made significant contributions to healthcare within a short period of time. It has heightened the awareness of patients' perceptions, symptom management strategies, and outcomes. The importance of the patients' perceptions is a common thread throughout the model. The model has been used extensively in research (Kemper, 2002), practice (Dodd et al., 2003), and pre-doctoral and doctoral education (UCSF, School of Nursing Website, 2006). The SMM can enhance our understanding of patients' symptoms, facilitate the symptom management strategies, and help address outcomes.

The SMM was chosen to guide the current research because of its focus on patients' perceptions of their symptoms and its emphasis on outcomes. This study examined patients' symptom experiences before and after their TH/TK replacement surgery. It also described the relationship between the symptom experience and outcomes (i.e., QOL and FS) within the context of wait times for surgery.

This model provided the framework to address the research questions as stated. If we can be responsive to patients' perceptions of their symptoms, then we can intervene

appropriately, and ultimately we will have a positive impact on the lives of patients and their symptom management. Although this model has been used much less in acute care, Dr. Dodd is supportive of its use in other settings (M. Dodd, personal communication, November 16, 2005). To date, the SMM had not been used with TH/TK replacement patients to evaluate their QOL and FS (Dodd).

### Study Aims and Specific Research Questions

The overall study aimed to gain a better understanding of the outcomes of QOL and FS in TH/TK replacement patients. The symptom management strategies variables in this case, referred to the 'when' which includes, the length of wait prior to surgery and the duration of the recovery period. These strategy components or time periods, were predicted to impact outcomes specifically QOL and FS. Hence, the outcomes were examined during the wait period and the recovery period. Secondly, it was not known what impact the length of the wait period would have on the relationship between these outcomes over time.

The following were the specific research questions for this study.

1. What is the impact of the preoperative wait on QOL and FS during the wait?
2. What is the impact of the preoperative wait on QOL and FS following surgery?
3. What is the relationship of QOL to FS over time?

## Definitions of Variables

### *Total Joint Replacement*

Conceptual definition: The replacement of a joint, which has been destroyed.

Operational definition: This study focused on the hip and knee joints that have been replaced with artificial joints.

### *Wait Time*

Conceptual definition: The period of time from when the orthopaedic surgeon and the patient agree that a total joint replacement is required to the time when the surgery is performed.

Operational definition: The number of weeks that the patient waited for surgery.

### *Quality of Life*

Conceptual definition: QOL is multidimensional (Ferrans & Powers, 1992), subjective (Ager, 2002), and dynamic in nature (Berra, 2003). The QOL domains are described as physical, psychological, and social (Hacker, 2003).

Operational definition: The score on the 12-Item Medical Outcomes Short Form (SF-12) (Ware, Kosinski, & Keller, 1996).

### *Functional Status*

Conceptual definition: FS is described as physical, psychological, and social (Patrick & Chiang, 2000). It is the balance between what the individual does and desires to do (Wang, 2004).

Operational definition: The score on the Oxford-12 Hip Score (OHS) (Dawson, Fitzpatrick, Carr, & Murray, 1996) or the Oxford-12 Knee Score (OKS) (Dawson, Fitzpatrick, Murray, & Carr, 1998).

### Assumptions

The following assumptions were made in this study:

1. Symptom management is a dynamic process.
2. The patients' perceptions are imperative in symptom management.
3. Patients can provide significant feedback regarding their QOL and FS.
4. QOL and FS are dynamic, multidimensional concepts.
5. The dimensions and domains of the SMM are interrelated and this facilitates the study of QOL and FS.

### Summary

This chapter has provided the background of this study, the problem, and the significance of the study. In addition, it provided an overview of the SMM and demonstrated that it was a particularly appropriate model to guide this research study as it focused on the interrelated dimensions of symptom management: symptom perception, symptom management strategies, and symptom outcomes. The study aims and research questions were discussed. Attention was given to the definitions of variables and assumptions.

The following chapter provides a review of the literature regarding the wait for surgery, QOL, and FS as they relate to patients having TH/TK replacement surgery.

## Chapter 2

### Review of the Literature

This chapter provides an analysis of the literature as it relates to the study foci, namely, TH/TK replacement surgery, wait time, and the impact of wait time on health status, specifically QOL and FS. The three dimensions of the SMM, symptom experience, symptom management strategies, and outcomes, organize this literature review.

The literature under review was compiled based on electronic searches, hand searches, and search engines associated with relevant journals. The MEDLINE<sup>R</sup>, CINAHL<sup>R</sup>, Cochrane Collaboration, ERIC<sup>R</sup>, and PsycINFO<sup>R</sup> databases were searched with the phrases ‘quality of life’, ‘quality of life and total hip arthroplasty/total joint replacement’, ‘quality of life and total knee arthroplasty/total joint replacement’, ‘functional status’, ‘functional status and total hip arthroplasty/total joint replacement’, ‘functional status and total knee arthroplasty/total joint replacement’ and ‘waiting for total hip and total knee replacement surgery’. Search limits included articles from the past five years, English articles with abstracts, and studies pertaining to humans. Article reference lists were reviewed to identify classic articles that were not revealed in the previous searches due to the imposed limitations. Articles were eliminated that were repeated or that did not address the topics. Over 250 articles or reports were reviewed.

#### *Symptom Experience*

This section reviews literature that relates to the symptom experience associated with the period prior to and following TH/TK replacement surgeries. As was discussed in the previous chapter, the symptom experience dimension is expressed by the symptom



perception, symptom evaluation, and symptom response. Two topics that provide background information in relation to the symptom experience will be addressed. First, an overview of arthritis, the most common medical diagnosis leading to TH/TK replacements is provided. Second, a discussion regarding health status, namely QOL and FS follows, which focuses on the period before and after TH/TK replacement surgeries.

### *Arthritis.*

Arthritis, a group of conditions that affect the musculoskeletal system and specifically patients' QOL and FS, is expected to affect 4 million Canadians over the age of 15, by the year 2026 (Health Canada, 2003). OA is not only the most common type of arthritis but it is the most frequent preoperative diagnosis prior to TH/TK replacement surgery (Felson et al., 2000). It is estimated that 3 million Canadians have OA and that it is two and a half times more common than heart disease and six times more common than cancer (Arthritis Society, 2004).

OA, a complex degenerative joint disease, is characterized by destruction of the entire joint including the articular surface, synovium, capsule, and bone (American Academy of Orthopedic Surgeons, 2004a). Typical clinical presentation includes pain, tenderness, decreased movement, crepitus, and varying amounts of effusion and inflammation, generally in weight bearing joints such as the hip or knee (Woolf & Pfleger, 2003).

TH/TK replacements, are some of the most common surgeries performed in Canada (CIHI, 2006) and are usually extremely successful surgeries to treat arthritis (American Academy of Orthopedic Surgeons, 2004b), typically leading to enhanced QOL and FS for patients (CIHI). Total joint replacement surgery entails excising the

damaged joint and replacing it with an artificial joint that reduces pain and stiffness and allows the joint to function like a healthy one (Masri et al., 2005).

The demand for TH/TK replacement surgery partially reflects the ageing of 'baby boomers' (Masri et al., 2005). According to the Arthritis Society (2004) over 20,000 individuals are waiting for either TH or TK replacement surgery. Masri et al. note that the demand for this surgery is anticipated to increase from 20 to 50% during the next 20 to 30 years and there is a struggle to meet this growing waiting list.

#### *Health Status.*

Health status is a general term that describes a state of mental and physical well-being (Barber, 1998). Larson et al. (1994) view health status as the integration of "physiological rhythms, bodily structure and function" (p. 274). It can be measured objectively by healthcare providers or subjectively by patients. Health status is closely linked to QOL and FS. Important considerations in the context of this study are the QOL and FS of TH/TK replacement patients during the wait for surgery, following surgery, and the relationship between QOL and FS over time during their perioperative trajectory.

When discussing health status it is important to recognize the influence of co-morbidities on outcomes. Classic work by Charnley (1972) set the ground work for the relationship between co-morbidities and outcomes. The Charnley Classification (Charnley) was developed to stratify patients according to their mobility. The classification uses letters for the different levels, for instance, level A indicates that the patient has only one hip involved and nothing else impedes their mobility. Level B indicates that the patient has both hips involved but nothing else hinders their walking. Level C signifies there is another factor such as widespread rheumatoid arthritis,

confusion, hemiplegia, and cardiovascular or respiratory disease that influences the patients' ability to ambulate. Münger, Röder, Ackermann-Liebrich, and Busato (2006) discuss the Charnley Classification and interpret that Level C includes patients whose ambulation is limited by multiple joint disease or systemic conditions. Dunbar, Robertsson, and Ryd (2004) adapted the Charnley Classification to be used with TK replacement patients so that it could be used to determine the effect of co-morbidities on outcomes. Their results emphasize the magnitude of identifying co-morbidities when studying patient outcomes.

Reports on the impact of orthopaedic patients' health status while waiting for TH/TK replacement surgery are mixed. Two research studies support that there are no changes to patients' health status while waiting for TH/TK replacement surgery (Derrett, Paul, & Morris, 1999; Kelly, Voaklander, Johnston, Newman, & Suarez-Almazor, 2001).

Derrett et al. (1999) utilized the 36-Item Medical Outcomes Short Form (SF-36) and the Lequesne Index of Severity for Hip and Knee Disease to measure respectively, changes in health-related QOL and the severity of condition ( $N = 47$ ) during face-to-face interviews. Forty two percent of their patients waited longer than one year. Neither the SF-36 nor the Lequesne Index of Severity for Hip and Knee Disease detected negative changes in health status during the wait. Health status referred to general health, pain, and difficulty with physical/social roles, mobility, and activities of daily living. Limitations of this study include a small sample, only one preoperative measurement point plus the results were not analyzed by procedure.

Similarly, Kelly et al. (2001) investigated the change in pain and function for 313 patients who awaited either TH/TK replacement surgery. They administered the Western

Ontario McMaster Osteoarthritis Index (WOMAC) and the SF-36 to the patients when they were placed on the waiting list and again just before their surgery. The WOMAC, which measures changes in health status, focuses on pain, stiffness and physical function. They did not find any evidence that the waiting time had a negative impact on the patients' pain, disability, and overall health status. The mean waiting time was only 18 weeks and Kelly et al. speculate that possibly that the length of the waiting period was inadequate to capture changes in pain and FS.

In contrast, other investigators found that there were significant changes in health status while patients waited for joint replacement surgery (Kili, Wright, & Jones, 2003; Mahon et al., 2002; Ostendorf, Buskens et al., 2004). Kili et al. investigated 167 TH replacement patients using the Harris Hip Score when they were placed on the waiting list and two weeks prior to surgery. The Harris Hip Score studies hip functioning by specifically addressing not only function, but pain, range of motion, and deformity. The mean wait time was lengthy at 47 weeks and during the wait there was a significant decrease ( $p < .0001$ ) in health status. Kili and colleagues reported an 8.9 point mean decrease in the scores over time which is the equivalent of a change from 'moderate pain' to 'marked pain' or 'a slight limp' to 'unable to walk'. Using their clinical judgement, clinicians prioritized patients with lower scores for surgery (Kili et al.).

Mahon and colleagues (2002) studied 99 TH replacement patients with the WOMAC, the Six-Minute Walk, and the SF-36 when placed on the waiting list and every 12 to 24 weeks until at least 12 weeks after surgery and found similar results to Kili et al. (2003). The Six-Minute Walk instrument measures how far the patient can walk in six minutes. In this Canadian study, Mahon et al. concluded that there were significant

changes in QOL as measured by increased pain and decreased mobility when patients waited in excess of 26 weeks. This was measured by the WOMAC ( $p < .001$ ), the Six-Minute Walk ( $p = .04$ ), and the SF-36 ( $p = .002$  for bodily pain and  $p = .04$  for physical function). Mahon et al. also reported that patients with greater impairment waited less time for surgery.

Similar support was found by Ostendorf, Buskens, et al. (2004). In their study of 161 TH patients Ostendorf and researchers also noted some deterioration prior to surgery. The OHS, WOMAC, SF-36, and the EuroQol health status instruments were administered when patients were placed on the waiting list, preoperatively, and postoperatively at 12 and 52 weeks. The OHS investigates functional change by referring to pain, walking, and activities of daily living. The EuroQol measures general health status and QOL. The preoperative measurement point was not specifically identified and the mean waiting time was 26 weeks with a large range in waiting time being 3 to 72 weeks. Results demonstrated that there was a significant ( $p < .05$ ) but small amount of decline during the wait. This decline was in FS and WOMAC and SF-36 scores representing changes in pain, stiffness, and general health status. Only waiting time was identified as a predictor of worsening in FS and QOL in the analysis (Ostendorf, Buskens, et al.). The previous studies have demonstrated that there are varying results in relation to health status changes while waiting for TH/TK surgery.

Other studies have evaluated both the preoperative and postoperative patient outcomes (Knutsson & Engberg, 1999; March et al., 1999; McMurray, Grant, Griffiths, & Letford, 2002). Knutsson and Engberg studied QOL using the Sickness Impact Profile at approximately 1 week prior to TH replacement surgery and postoperatively at 6 weeks

and 26 weeks. Only one week of the preoperative period was investigated and Knutsson and Engberg reported that there was significant improvement ( $p = .05$ ) in QOL scores from before surgery to 26 weeks after surgery. It is also important to note that the sample size started at 51 patients but by the 26 week measurement point there were only 40 patients in the sample.

Based on the SF-36, March et al. (1999) examined QOL and outcomes of patients having TH/TK replacement surgery. Their baseline data varied greatly in regards to when it was taken (between 1 week to 3 months before surgery) while postoperative data was taken every 12 weeks for the first 52 weeks following surgery. The greatest improvements at 52 weeks were in scores related to pain, function, and physical roles ( $p = .05$ ). The results were analyzed separately by procedure and QOL scores for TH improved to equal or exceed population norms while TK patients' scores for physical FS and pain scores remained lower than the population norms.

In addition, some researchers focus on pain, QOL, and FS. McMurray et al. (2002) administered the SF-36 at 1, 2, 4, 8, and 12 weeks post-TH surgery through telephone interviews. They believe that a decrease in pain positively affected QOL. It is important to remember that 12 weeks is early in the postoperative phase of recovery.

On the contrary, Bischoff-Ferrari et al. (2004) concentrated on a postoperative follow-up of 755 TH patients. Patients were contacted three years after surgery and the WOMAC was utilized to identify that although pain was closely connected with poor FS, there were other related issues. These issues were medical, geriatric, or psychosocial in nature and affected both FS and QOL at the three-year point. Mental health was emphasized as being linked to poor FS.

The next area to be examined is the relationship between preoperative and postoperative health status. The classic studies by Fortin et al. (1999) and Fortin et al. (2002) shed light on this relationship for TH/TK replacement patients. In the 1999 study, Fortin et al. examined the preoperative and 12 and 26 week postoperative status of 222 patients from either Boston or Montreal. The exact preoperative measurement point was not identified. Fortin and colleagues (1999) utilized the SF-36 and WOMAC and their findings illustrate that those patients with lower scores in general health, QOL, and FS preoperatively also had lower postoperative scores in the same areas. The baseline pain and FS for both TH and TK replacement patients reflected their pain and FS at 6 months following surgery. In their subsequent study, they obtained two-year follow-up scores for 165 of the original patients. It was striking to note that the trend in health status that was made at 26 weeks continued at the two-year mark. Their analysis identified that patients' preoperative function scores predicted postoperative scores over time. These results support the importance of timing TH/TK replacements before patients have shown marked deterioration (Fortin et al., 2002). Fortin and colleagues (2002) recognize that the lower two-year FS scores could have been related to issues with other joints and not necessarily the surgical joint.

Other investigators also have focused on the relationship between a patients' preoperative and postoperative health status and found that an inferior preoperative status is reflected in the postoperative status (Hajat et al., 2002; Holtzman, Saleh, & Kane, 2002; Nilsson & Lohmander, 2002; Ostendorf, Buskens, et al., 2004). As noted by Holtzman et al., "there may be a price to be paid for waiting to have surgery" (p. 1947).

The price of waiting too long to have surgery occurs when patients' health status deteriorates prior to surgery and then has disadvantageous results after surgery.

Hajat et al. (2002) in their prospective cohort study examined preoperative, 12 weeks postoperative and 52 weeks postoperative OHS to investigate pain and disability status. The one preoperative measurement was completed immediately prior to surgery. In their 7,151 TH patients, those with poorer functional scores prior to surgery continued to have poorer functional scores postoperatively. They concluded that waiting for surgery is associated with worse outcomes following surgery. These findings are similar to Holtzman et al. (2002) who surveyed 1,120 TH patients approximately 8, 16 to 26, and 52 weeks following their surgery. Their survey focused on mobility ( $p < .01$ ), pain ( $p < .05$ ), and their ability to perform the activities of daily living ( $p < .01$ ). Their findings agree with the previous studies that patients with lower functional status and more pain before surgery have poorer outcomes postoperatively. A comprehensive review of co-morbidities was made as co-morbidities were identified by reviewing patients' medical records. One limitation of this study was that they relied on patients to recall their preoperative status at eight weeks following surgery.

Similarly, Nilsson and Lohmander (2002) studied 124 TH replacement patients utilizing the WOMAC and SF-36 the day before surgery and then postoperatively at 12, 26, and 52 weeks. Less than half of the patients (56) were also evaluated when placed on the waiting list. Likewise, preoperative scores influenced the postoperative scores. They concur with preceding studies concerning the relationship between preoperative and postoperative health status specifically pain ( $p = .041$ ) and function ( $p = .001$ ) both on the WOMAC subscales and the SF-36 pain subscale ( $p = .05$ ). This study identifies that at



least one year is required for the maximum benefits of TH surgery to occur. One drawback of the study was that most patients only had one preoperative measurement which was done the day before surgery.

Ostendorf, Buskens, and colleagues (2004) evaluated the association between preoperative and postoperative health status with their 161 TH replacement patients. As with the previously cited studies, those patients with lower function levels preoperatively continued with this trend at 12 and 52 weeks following surgery ( $p < .05$ ). It is interesting to note that the exact time of the preoperative measurement point was not identified.

Lingard and colleagues (2004) agree with Hajat et al. (2002) and Holtzman et al. (2002) but collected data preoperatively and postoperatively at 12 weeks, 52 weeks, and two years with the WOMAC and SF-36 from 701 TK replacement patients. The exact preoperative measurement point was not identified. Like previous studies, TK patients with worse pain and function before surgery had worse measurements at one and two years after surgery.

In conclusion, there is evidence that patients' health status declines while waiting for TH/TK replacement surgery due to a decrease in function and an increase in pain (Noseworthy et al., 2005). There is also support that postoperative health status can be forecasted by the preoperative health status. Patients' symptom experiences are described by their perceptions, evaluations, and responses to symptoms.

Many researchers (Derrett et al., 1999; Kelly et al., 2001; Mahon et al., 2002) have evaluated the waiting period before joint replacement surgery while others (Hajat et al., 2002; Holtzman et al., 2002; Lingard et al., 2004; Nilsson & Lohmander, 2002) have sufficiently researched the postoperative phase. Fortin et al. (2002) adequately

studied both the preoperative and postoperative phases. The literature review reveals clinical knowledge gaps that this study addresses. The most obvious gap pertained to how TH/TK replacement patients perceived their health status before and after their surgery.

However, there is a more significant gap that is addressed. A significant contribution that this study provides is a more inclusive examination of QOL and FS *both* before and after TH/TK replacement surgery. The current study utilized the SF-12 and the OHS/OKS as recommended by Ostendorf, van Stel et al. (2004) for health status assessment. The measurement points were different from the above stated studies. Data was collected when patients were placed on the waiting list and then again approximately four weeks prior to surgery. This more completely reflects the preoperative phase. Some studies (Fortin et al., 1999; Hajat et al., 2002; Nilsdotter & Lohmander, 2002; Lingard et al., 2004) utilized only one preoperative measurement when investigating preoperative health status. As a result, they could not detect changes during the preoperative phase. Another study (Holtzman et al., 2002) surveyed patients at eight weeks after surgery and inquired about their preoperative health status. Because of the discrepancies in the literature, a more accurate picture of the trajectory of QOL and FS during the wait period was needed. Patients were surveyed at approximately 4 weeks prior surgery and 52 weeks following surgery and this is thought to adequately study the postoperative phase. Although Fortin et al. (2002) and Ostendorf, Buskens et al. (2004) have evaluated the QOL and FS before and after TH/TK replacement surgery, the current study, due to its choice of instruments and measurement points, captured these distinct time frames in their entirety.

The most significant contribution that this study uniquely addresses is the relationship of QOL and FS over time during the orthopaedic surgical experience. This study contributes to orthopaedic health outcomes research significantly. The next section will consider the wait for surgery.

### *Symptom Management Strategies*

The symptom management strategies dimension asks the pertinent questions of who, what, when, where, how, to whom, how much and why as they relate to the symptom management strategies. This section addresses the ‘when’ of the symptom management strategies or the wait for surgery.

### *The Wait for Surgery.*

The wait for surgery is an important Canadian healthcare issue. The CIHI (2006) in the report entitled *‘Waiting for healthcare in Canada: What we know and what we don’t know’* identifies that stakeholders such as the media, the public, the healthcare providers, the governments, and the courts are interested in the length of the wait and what is being done to address it. Needless-to-say there have been numerous reports and many conferences focused on wait times. This discussion will highlight progress towards managing wait times, surgical wait times, and then specifically TH/TK replacement wait times.

The report by the Association of Canadian Academic Healthcare Organizations (2005) entitled *‘Wait Watchers... Weighing in on wait time initiatives’* provides feedback from teaching hospitals and health regions regarding their progress. Wait time progress is being made across Canada. It is believed that the “most important barometer of the

public's confidence in the health system is linked to their assessment of timely access to care" (Association of Canadian Academic Healthcare Organizations, p. 2).

For the past three years, there have been colloquiums entitled '*Taming of the Queue*'. Dr. Ginette Lemire-Rodger, co-chair of the second symposium, identified that "the issue of wait times could not be tackled in isolation from other challenges facing the healthcare system" (McIntosh, 2005, p. 1). In the most recent '*Taming of the Queue: Wait time measurement, monitoring, and management- where the rubber meets the road*' (Torgerson & McIntosh, 2006), progress was noted such as the 2004 First Ministers Accord, the Chaoulli decision, and the appointment of the federal advisor for wait times.

The Fraser Institute (Esmail & Walker, 2007) believes that "the medical system's most curable disease is waiting times" (p. 5). Canada has made great strides in TH/TK replacement surgery with estimated maximum acceptable waiting times of 4 weeks (most urgent cases), 12 weeks (next urgent cases), and 20 weeks (least urgent cases) (WCWL, 2005). Masri and colleagues (2005) believe that there are many reasons to decrease wait times for TH/TK replacement surgeries. When the waits are long, there may be undesirable consequences for patients (Masri, et al.). The next section of the review will focus on these patient consequences or outcomes.

### *Outcomes*

The outcomes dimension of the SMM (Dodd et al., 2001) concentrates on QOL, FS, morbidity and co-morbidity, mortality, emotional status, self-care, and costs. The outcomes explored in this study will be QOL and FS. There has been increasing interest in recent years in QOL and FS for TH/TK replacement patients and this is demonstrated by the growing number of publications in this area. This section begins with an overview

of QOL and FS. The discussion concludes with a review of the impact of waiting for TH/TK replacement surgery on these outcomes.

*Quality of Life.*

The first outcome to be analyzed will be QOL. This literature review provides a discussion of the use of this concept, its characteristics, domains, and critical attributes.

A great deal has been written about QOL. Originally, the concept was utilized in the area of sociology, but today it is frequently used in other fields. Schalock (2004) recognizes that QOL has been studied in the areas of families, education, social sciences, and healthcare.

The healthcare literature frequently refers to the concept as “health-related QOL” (Derrett et al., 1999; Gill & Feinstein, 1994). This concept is essential in healthcare as it recognizes the impact of illness (Schweitzer, Kelly, Foran, Terry, & Whiting, 1995), evaluates treatments (Rotstein, Barak, Noy, & Achiron, 2000), and assists with resource decisions (Ager, 2002). Furthermore, there has been an increase in QOL in healthcare research (McCorkle & Cooley, 1998). Although commonly used, this concept is sometimes poorly defined and consequently not clearly understood (Gill & Feinstein, 1994; Meeberg, 1993). The WHO QOL Group (1995) characterizes QOL as “individuals’ perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns” (p. 1405).

QOL is viewed as multidimensional (Cimete, Gencalp, & Keskin, 2003; Efficace & Marrone, 2002; Ferrans & Powers, 1992; Foreman & Kleinpell, 1990; Hacker, 2003; Jabowiec, 1990; Kaasa & Loge, 2003; Wilson, Dowling, Abdoell & Tannock, 2000;

WHO QOL Group, 1995). QOL characteristics are interrelated and Jalowiec refers to it as the “domino effect” (p. 272) in that one aspect affects the other.

Culture and spirituality influence perceptions of QOL. According to Marshall (1990) and Collinge, Rüdell, and Bhui (2002) people’s roles are culturally engrained. Efficace and Marrone (2002), Ferrell, Grant, Funk, Otis-Green, and Garcia (1998) and Horton (2002) believe that spiritual health is also instrumental. Efficace and Marrone discuss the dimensions of “the mind, body, and spirit” (p. 743) and their influence on the subjective nature of QOL.

The subjective aspect of QOL is frequently cited in the literature (Ager, 2002; Cohen, Mount, Tomas & Mount, 1996; Collinge et al., 2002; Ferrans, 1990; Ferrans, 1996; Gill & Feinstein, 1994; Hacker, 2003; Han, Lee, Park, Park, & Cheol, 2005; Hill, 2002; King, Hinds, Dow, Schum, & Lee, 2002; Rotstein et al., 2000; Scherer & Cushman, 2001; Shephard & Franklin, 2001; WHO QOL Group, 1995; Wilson et al., 2000). In comparison, objective factors play a more minor role in QOL debates. Rotstein et al. study both the subjective and objective aspects of QOL. However, Allison, Locker, and Feine (1997) indicate that there may be incongruence between these subjective and objective perspectives. Ferrans (1990) deems that the focus is on “the experience and not the conditions of life” (p. 15).

QOL is on a continuum and is dynamic (Berra, 2003; Shephard & Franklin, 2001). Berra and Allison et al. (1997) agree that the concept is constantly changing. They believe that this continuum or dynamic state occurs when patients alter their “internal standards, values and the conceptualization of QOL” (p. 1507) due to their illness. The evaluation of QOL over the course of an illness is complex. It is “difficult to study QOL

since it not only means different things to different people, but can also mean different things to the same person over a disease trajectory” (Sprangers & Schwartz, 1999, p. 1507).

Satisfaction also plays a role in QOL debates. QOL is “a person’s sense of well-being that stems from satisfaction or dissatisfaction with areas of life that are important to him/her” (Ferrans & Powers, 1992, p. 29). Rahmqvist (2001) agrees that satisfaction is essential to the discussion while Kaasa and Loge (2003) comment not only on satisfaction but on happiness and morale.

The domains or components of QOL can also be identified within the healthcare environment. Schweitzer et al. (1995), Garratt, Schmidt, and Fitzpatrick (2002), Goodridge, Trepman, and Embil (2005), and Hacker (2003) identify the domains of QOL as physical, psychological, and social while Ferrell, Dow, Leigh, Ly, and Gulasekaram (1995) and Ferrell et al. (1998) recognize spiritual well-being. In contrast, Wilson et al. (2000) add cognitive functioning while Meeberg (1993) includes “the mental capacity to evaluate one’s own life” (p. 34). Collinge et al. (2002) agree with the addition of cognitive functioning but substitute an emotional component rather than psychological functioning. Horton (2002) believes that the physical, psychological, and spiritual health domains are critical to QOL discussions.

Goodridge et al. (2005) emphasize that patients’ QOL may be “affected by or may affect a health issue” (p. 368). Berra (2003) identifies QOL domains as physical, emotional status, intellectual, economic, social, self-perceived health status, and work-related factors. Shephard and Franklin (2001) view the domains as personal perceptions, coping mechanisms, and environmental constraints. Others (MacKenzie & Chang, 2002)

report that the physical and psychosocial domains are significant components of QOL. Classic research by Ferrans and Powers (1992) concentrates on the importance of satisfaction with health and functioning, socioeconomic, psychological/spiritual, and family needs. The WHO QOL Group (1995) recognizes physical and psychological health, personal beliefs, social relationships and their relationship to important aspects of their environment as major features in QOL discussions.

Individuals' functioning and health are reflected in the physical domain. The psychological domain can include emotional well-being, fulfillment, personal satisfaction, and spirituality. The social domain can include social support, social roles, friendship, family, and feelings of belonging. Individuals' unique views are key but objective measures such as housing, finances, and education also can play a role.

Critical attributes are repeated in the literature and further explain the concept. Three critical attributes of QOL are that: 1) individuals make subjective QOL appraisals; 2) individuals identify satisfaction in terms of the physical, psychological, and social aspects of their lives; and 3) objective measures may supplement subjective QOL appraisals.

#### *Functional Status.*

FS is also an inadequately understood concept and it is this lack of understanding that has placed us on a "functional status merry-go-around" according to Leidy (1994, p. 196). A starting point in this section will be the use of the term, its characteristics, domains, and critical attributes.

The significance of function in healthcare has been evident for at least the last hundred years (Katz & Shroud, 1989). Although FS measurement began in the



rehabilitation area of healthcare (Cohen & Marino, 2000; Wang, 2004), many other areas now frequently refer to this concept. Initially it had a disability perspective but that focus has changed (Wang). Knight (2000) asserts that the term has now been introduced to other areas. For example, FS has been studied in orthopaedics with a particular emphasis on total joint replacement patients (Fortin et al., 1999; Fortin et al., 2002; Kane, Saleh, Wilt, & Bershadsky, 2005; Salmon, Hall, Peebhoy, Shenkin & Parker, 2001).

Wang (2004) believes that one characteristic of FS is a balance between what the individual does and aspires to do. Other researchers believe that the ability to perform daily tasks is what describes FS (Cohen & Marino, 2000). Curry, Hogstel, and Davis (2003) agree with the latter, and refer to these tasks as the activities of daily living.

Leidy (1994) in her classic work discusses FS in relation to functional capacity, functional performance, functional reserve, and functional capacity utilization. Functional capacity is described as individuals' maximum potential to do activities that allows them to function normally. Functional performance is the actual activities that individuals do. Functional reserve is the difference between capacity and performance. And lastly, functional capacity utilization is the extent to which individuals reach their potential.

Patrick and Chiang (2000) describe the domains of FS as physical, psychological, and social. Keith (1994) agrees and adds cognitive features and restrictions in roles, activity, and intimacy. Knight (2000) emphasizes that the key dimension in FS is the patient's cognitive ability.

Other researchers, such as Wang (2004) and Cohen and Marino (2000) are in agreement but Wang includes the domains of spirituality, intellectuality, and the presence of roles while Cohen and Marino add the occupational and economic activities to their

definitions. On the other hand, Leidy (1994) not only emphasizes the needs and roles of individuals but also sees FS as reflecting the maintenance of health and well-being.

Critical attributes are present in the literature and further explain FS: 1) activities are those that individuals do as a usual part of their lives (Wang, 2004); 2) these activities are those that help them achieve their fundamental needs, roles, and health; and 3) above all, these activities are in response to normal expectations.

In summary, Wang (2004) believes that individuals who sustain their FS will be actively involved in their own lives. If individuals cannot preserve their FS, then various activities will not be able to be done, difficulties will result, and the outcome will be poorer FS.

The previous discussion has explored the concept of functional status. The focus will now move to research that has investigated the relationship between wait times for TH/TK replacement surgery and the outcomes of QOL and FS.

#### *Relationship Between Wait Times, Quality of Life and Functional Status.*

The evaluation of QOL and FS over the course of an illness is complex. There is no consensus regarding whether there is a relationship between waiting times for TH/TK replacement surgery and outcomes. Some researchers (Mahon et al., 2002; Nilsson & Lohmander, 2002; Ostendorf, Buskens, et al., 2004) found no association but others (Hajat et al., 2002; Knutsson & Engberg, 1999; March et al., 1999) found a relationship between wait times and QOL and FS.

Mahon et al. (2002) in the prospective study previously described, found that the wait for TH replacement surgery did not have a relationship with postoperative QOL and FS for their cohort of 99 TH patients. They compared patients who waited lesser than and

greater than 26 weeks from the time of their appointment with the surgeon until they had their surgery. Mahon and colleagues noted that there was no relationship between the amount of time that the patients waited and their QOL and mobility following surgery. However, patients who waited more than six months had greater losses in QOL and mobility postoperatively. Interestingly, they also identified that patients with greater disability waited less time for their TH replacement surgery but surgeons were not aware of the patients' QOL and mobility scores when they were slated for surgery. They do not give any further details regarding this finding.

Ostendorf, Buskens, et al. (2004) also did not find a direct association between the wait for their 161 TH replacement patients surgery and their postoperative outcomes. Patients were surveyed with the OHS, WOMAC, SF-36, and the EuroQOL instruments when they were placed on the waiting list, preoperatively, and then again postoperatively at 12 and 52 weeks. The mean wait time was 26 weeks. Interestingly, the patients who were more progressed in their disease process did not improve to the same extent as those patients who had higher preoperative FS as measured by the above instruments.

There is also agreement from Nilsson and Lohmander (2002) in that the wait did not influence the postoperative outcomes as measured by the WOMAC or the SF-36 instruments immediately prior to surgery, and postoperatively at 12, 24, and 52 weeks. They compared patients who had waited for less than and greater than 13 weeks. In their prospective study, the amount of time that the 124 patients were on the waiting list demonstrated no difference in the postoperative pain or function as measured by the WOMAC or the SF-36.

On the contrary, Hajat et al. (2002) assert that waiting for surgery did negatively affect the outcomes for their TH replacement patients. In this prospective cohort study, most patients waited 13 to 52 weeks for their surgery. They also concluded that patients who were further in their disease process or who waited a longer period of time for their surgery had poorer FS postoperatively.

Total hip and total knee surgeries are commonly performed surgeries that have proven to improve patients' QOL (Jones, Voaklander, Johnston, & Suarez-Almazor, 2000; March et al., 1999; Salmon et al., 2001) and FS (Fitzgerald et al., 2004; Jones et al.). Although de Pablo et al. (2004) assert that TH replacement surgery has transformed the care of patients with severe arthritis. Ayers, Franklin, Ploutz-Snyder, and Boisvert (2005) observe that discrepancies exist in the long-term outcomes following surgery. While Salmon et al. reported that TK patients were just as happy as TH replacement patients, Jones et al. identified that TH patients were 91% satisfied with their outcomes following surgery while TK replacement patients were only 77% satisfied. Researchers reveal that TH replacement patients make better progress in their return to function and pain level (Jones et al.) with ultimately a more complete recovery (Ethgen, Bruyère, Richy, Dardennes, & Reginster, 2004). In other words, some believe that TK replacement patients simply have a slower recovery (Fitzgerald et al.; Salmon et al.) but others deem that the outcomes for TH patients are substantially better than those for TK patients (Bachmeier et al., 2001; Ethgen et al.). Some investigators have pointed out that it takes a year for TH (Nilsson & Lohmander, 2002) and TK replacement patients (Jorn, Johnsson & Toksvig-Larsen, 1999) to benefit fully from their surgery.

## Summary

Arthritis is a prevalent and disabling musculoskeletal disease and the usual reason for TH/TK replacement surgery to be performed. There are varying reports regarding the changes in health status while waiting for surgery. Worse preoperative health status is associated with worse postoperative health status. Whereas, QOL and FS are multidimensional and relevant to TH/TK patients, some researchers did not find a relationship between the wait and these outcomes. Meanwhile other investigators found that a lengthy wait negatively affected patients' outcomes.

Only one study (Ostendorf, Buskens et al., 2004) was found that had sufficient measurement points to evaluate both the preoperative and postoperative QOL and FS for TH/TK patients. The current study provides not only a more complete examination of QOL and FS during these preoperative and postoperative phases but also determined the relationship between QOL and FS over time. No studies were found that addressed the relationship between QOL and FS over time for TH/TK replacement patients. This study addresses that unique clinical knowledge gap and significantly contributes to orthopaedic health outcomes research.

This review of the literature has provided a link to the research questions that address the effect of waiting on patients' QOL and FS over time. The three dimensions of the SMM have provided structure to the review. First, literature that relates to the symptom experience was reviewed and then material that related to the symptom management strategy or the wait for surgery was reviewed. Lastly, the outcomes dimension lead the discussion regarding postoperative QOL and FS. The next chapter discusses the study's methodology.

## Chapter 3

### Methodology

This chapter provides a discussion regarding the study's methodology. An overview is given of the research design, setting, sample, sampling procedures, study approval, data collection, measures, and data analysis.

#### Research Design

A retrospective, longitudinal analysis of self-reported patient data examined changes in QOL and FS across the preoperative wait period and the postoperative phase for TH/TK replacement patients. This study involved a quantitative, secondary analysis of data sets drawn from a regional Joint Replacement Registry (JRR). In order to capture multiple data points both across the waiting phase and the perioperative phase, three datasets were required.

#### Sample and Setting

The patients in this study had their surgery in an urban community hospital in a mid-western city in Canada. The study sample consisted of data drawn from a regional JRR. The combined datasets represent a convenience sample of 1,228 patients who had either waited for, or who had waited and then had, either a primary TH replacement or primary TK replacement. Using the SF-12 and OHS or OKS as measurement tools, the primary study outcome variables were QOL and FS. Using a sample size of 174 patients, Dunbar, Robertsson, Ryd, and Lidgren (2000) were able to find a correlation between the OKS against the domains of the SF-12 with  $r$  values of  $-.56$  and  $-.50$  for the physical and mental components summaries respectively. We would have at least 90% power to detect

such correlations with an  $N = 37$  assuming two-tailed significance of .05, therefore the datasets of our sample were more than adequate.

Considering our sample sizes (Dataset 1,  $n = 440$ ; Dataset 2,  $n = 890$ , and Dataset 3,  $n = 102$ ) we had at least 80% power to detect a clinically significant difference of 2.6 and 2.65 points in OHS/OKS respectively, assuming a standard deviation (SD) of 9.6 and 9.8 (J. Dawson, personal communication, February 28, 2007). We would also be able to detect a difference with both scales (the physical and the mental component summaries) of the SF-12 as small as 2.7 points assuming a SD of 1.0 (M. Cheang, personal communication, February 28, 2007).

Inclusion criteria for the research study were as follows: 1a) either a primary TH or primary TK replacement was proposed for the patient; 1b) either a primary TH or primary TK replacement surgery was conducted; 2) patient understood verbal and written English; 3) patient was cognitively capable of completing the instruments; and 4) patients' anonymized data was accessible from the JRR database.

The study involved three approximate measurement points: 12 months prior to surgery (waitlist measurement), 1 month prior to surgery (preoperative measurement), and 12 months following surgery (postoperative measurement). Dataset 1 provides measures of QOL taken within the wait period at 12 months prior to surgery and 1 month prior to surgery. This dataset also provides a measure of FS taken at one month preoperatively. Dataset 2 provides measures of QOL and FS taken at 1 month prior to surgery and 12 months following surgery. Dataset 3 provides measures of QOL at 12 months prior to surgery, 1 month prior to surgery, and 12 months following surgery and measures of FS at 1 month prior to surgery and 12 months following surgery.

Specifically, data were based on responses to questionnaires given to the patients when they first visited the orthopaedic surgeon (approximately 12 months preoperatively), when they attended the preoperative assessment clinic (approximately 1 month preoperatively), and when they attended their annual follow-up appointment with the orthopaedic surgeon (approximately 12 months postoperatively).

### Sampling Procedure

When the data were gathered by the JRR, all patients completed the waitlist entry questionnaire (including the SF-12) about 12 months preoperatively (i.e. when they were placed on the waitlist). Patients were provided with a *Patient Information Sheet and Consent Form* (see Appendix A) at approximately one month prior to surgery (at the preoperative assessment clinic appointment). The *Patient Information Sheet* explains the purpose of the JRR, the importance of the information, and the rationale for the research. Patients signed the regional registry consent form and gave permission to have their medical information analyzed. At the one month prior to the surgery appointment, patients also completed the OHS or OKS, and medical/musculoskeletal co-morbidities questionnaire. At the one year postoperative appointment (i.e. at their first annual follow-up appointment), patients completed the SF-12 and OHS/OKS, complications, and satisfaction questions.

### Study Procedures

#### *Study Approval*

Ethical approval was obtained from the Education and Nursing Ethics Review Board at the University of Manitoba. Approval was also received by the regional



Research Review Committee for access to the regional JRR data. This study analyzed secondary data that had been collected but not analyzed.

### Data Collection Procedures

#### *Data Extraction*

The data were extracted from the JRR by a regional data analyst. It was given to the researcher in a de-identified format along with basic demographic information such as age, gender, and body mass index (BMI). Results are reported in a de-identified fashion.

#### *Data Storage*

During the research study, the coded data were stored on a computer that had locked computer access and was kept in a secure room. It was only accessible to the researcher and the thesis committee, who were Personal Health Information Act trained and aware of their ethical obligations. The data is now stored on a compact disc that is locked in a cabinet in the Manitoba Centre for Nursing and Health Research (MCNHR) at the University of Manitoba. After seven years the data will be destroyed.

#### *Data Preparation Procedures*

The data include self-report responses to the SF-12 and the OHS or the OKS. Data also result from the annual questions that address co-morbidities, complications, and patient satisfaction. Once the data were entered, data cleaning occurred. This involved observing the data for outliers and codes that were not possible.

#### *Missing Data*

Once the datasets were prepared they were examined for missing data. Missing data were reviewed with the statistician and thesis advisor to explore the impact of the missing data on the data analysis, to determine how much missing data was acceptable,

and to decide what would be done about it. Minimal data was missing and was not significant to the study's results.

### *Scoring Procedures*

The data were scored according to the scoring information that accompanies the SF-12, the OHS and OKS instruments by the data analyst prior to giving the data to the researcher. A tally was done of the results from the questions that addressed co-morbidities, complications, and satisfaction.

### *Measures*

Three data collection tools were utilized, and basic demographic information such as age, gender and BMI was gathered. The data collection tools included: the SF-12 (see Appendix B), the OHS or OKS (see Appendix C) and questions that refer to co-morbidities, complications, and satisfaction (see Appendix D).

The measurement points and respective instruments included: 1) 12 months prior to surgery: SF-12 and demographic data; 2) 1 month prior to surgery: SF-12, OHS or OKS, medical and musculoskeletal co-morbidities questionnaire; and 3) 12 months following surgery: SF-12, OHS or OKS, and the complications and satisfaction questions (see Table 1). Each of these data collection tools will now be reviewed.

Table 1

*Datasets, Measures, and Timelines*

Dataset	Data Points	Measures
Dataset 1 (n = 440)	12 months prior to surgery	SF-12
	1 month prior to surgery	SF-12
		OHS/OKS
		Co-morbidities / Pain
Dataset 2 (n = 890)	1 month prior to surgery	SF-12
		OHS/OKS
		Co-morbidities / Pain
	12 months following surgery	SF-12
Dataset 3 (n = 102)		OHS/OKS
		Complications
		Satisfaction
	12 months prior to surgery	SF-12
Dataset 3 (n = 102)	1 month prior to surgery	SF-12
		OHS/OKS
		Co-morbidities
	12 months following surgery	SF-12
Dataset 3 (n = 102)		OHS/OKS
		Complications
		Satisfaction

As discussed earlier the SMM (Dodd et al., 2001) guided the study. The SMM includes the domains of person, environment, and health/illness and the dimensions of symptom experience, symptom management strategies, and outcomes. The measures utilized in this study relate to the person and health status domains, and the outcomes dimension.

### *Domains*

#### *Person Domain.*

For the purposes of this study the person domain was measured by looking at basic demographic information and health history measures. Person factor information gathered included age, gender, and BMI. Annual questions target information regarding patients' health status and satisfaction.

#### *Health and Illness Domain.*

The co-morbidities, complications, and satisfaction questions refer to the patients' health status. The patient was asked to check off any applicable co-morbidities or postoperative complications from a given list. The co-morbidities questions were adapted from work by the American Academy of Orthopedic Surgeons (1998). The complications question was piloted to ensure face validity and readability, but the accuracy has not been verified by comparing the patient responses to hospital or physician office records.

Information about the patients' health status was obtained with the satisfaction question. Patients were also asked about their satisfaction with their surgery through the use of a five-point Likert scale that has been used in other studies.

### *Outcomes*

Instruments were utilized to help measure the outcomes of QOL and FS. In the context of this study, the QOL was measured with the SF-12 and FS was measured with either the OHS or OKS.

#### *Quality of Life Measures.*

The SF-12, a generic health outcome 12-item tool, was used as a subjective measure of the QOL of patients before and after their TH/TK replacement surgery. Ware et al. (1996) developed the SF-12 from its parent tool, the SF-36. The SF-36 and SF-12 focus on eight concepts: physical function, role limitation because of physical health, bodily pain, general health, social function, vitality, role limitation because of emotional health, and mental health. Both tools yield the mental component summary (MCS) and the physical component summary (PCS). The SF-12 and the SF-36 have strong positive relationships with  $r$  values that range between .92 – .96 at baseline, and weeks two, four, and six (Gandhi et al., 2001). Some researchers consider reliability coefficients over .70 as satisfactory (Polit & Beck, 2004).

The SF-12 has been used extensively in various adult patient populations, has been translated into over 60 languages (Mapi Research Institute, 2005), and is internationally accepted (McDowell, 2006). Of particular interest to this study, it has been applied to older adults (Haywood, Garratt & Fitzpatrick, 2005; Resnick & Nahm, 2001; Resnick & Parker, 2001), patients with arthritis (Gandhi et al., 2001; Hurst, Ruta, & Kind, 1998; Jakobsson & Hallberg, 2006; Kovac, Mikuls, Mudano, & Saag, 2006), orthopaedic patients (Luo et al., 2003), and total joint replacement patients (Dunbar,

Robertsson, Ryd, & Lidgren, 2001; Illgen et al., 2004; Ostendorf, Buskens et al., 2004; Wang et al., 2004; Wu et al., 2003).

The SF-12 is either self-administered or administered via interviews and can be completed in less than two minutes. It contains one or two items that measure each of the same eight domains and although it is brief, it is able to duplicate mean summary scores and the eight domain scores of the SF-36 (Ware et al., 1996). Subscale scores for the physical component and the mental component range from 0 to 100 with the higher scores reflecting greater well-being in each subcomponent (Jakobsson & Hallberg, 2006). In the general US population, the mean score is 50 while the standard deviation is 10 (Kovac et al., 2006).

This study utilized the updated second version of the SF-12 that was developed in 1998 and aims to enhance completion and decrease error rates (Utah Department of Health, 2001). This version includes 12 items, scored along a 3- or 5-point ordinal scale, with a standard recall time of four weeks. The Likert scale yields a score that ranges from one to three or one to five, depending on the question. Lower scores indicate lower QOL while higher scores indicate greater QOL. This version of the SF-12 includes revisions to the wording, the directions, the basic layout, and several questions were changed to have five potential responses.

The SF-12 is a psychometrically-sound instrument (Gandhi et al., 2001; Luo et al., 2003; Resnick & Nahm, 2001; Resnick & Parker, 2001; Salyers, Bosworth, Swanson, Lamb-Pagone & Osher, 2000). Compared to the SF-36, it is found to decrease participant burden and save resources (Müller-Nordham, Roll, & Willich, 2004) such as time (Globe,

Levin, Chang, Mackenzie, & Azen, 2002; Luo et al., 2003; Pezzilli et al., 2006) and cost (Gandhi et al., 2001).

The reliability and validity of the SF-12 have been evaluated. Reliability refers to the ability of a scale to produce the same value when measuring an unchanged attribute on separate occasions. The reliability of an instrument is examined by looking at its internal consistency, test-retest, and responsiveness. Validity can be subdivided into content, construct, and criterion.

Internal consistency examines whether the questionnaire addresses the concept which it is supposed to measure. It is expressed by Cronbach's alpha. Scores can range from zero to one; the closer the score is to one, the more consistency within the instrument (Polit & Beck, 2004). Research has shown that internal consistency for the SF-12 ranges from .70 to .89 depending on the study (Resnick & Nahm, 2001; Resnick and Parker, 2001). The Cronbach alpha has also been identified for the MCS as .80 (Luo et al.) and .79 (Larson, 2002) while the PCS is rated as .77 (Luo et al., 2003) and .82 (Larson).

Test-retest reliability, which is measured by the Intraclass Correlation Coefficient (ICC), examines the ability of the measure to replicate similar results with repeated use. ICC scores range from zero to one with scores closer to one indicating better reliability. Ware and colleagues (1996) focused on test-retest and ICC levels for the SF-12 and they were only slightly lower than those of the SF-36. They found that the ICC for the PCS-12 was .89 and for the MCS-12 was .76 in the United States. ICC scores have ranged from PCS at .79 to .92 while the MCS has ranged from .79 to .92 (Amir, Lewin-Epstein, Becker & Buskila, 2002; Dunbar et al., 2001; Salyers et al., 2000).

Responsiveness or sensitivity to change is an important measure that indicates if the instrument is able to detect changes within the patient. There was support for responsiveness in the SF-12 (Bohannon, Maljanian, Lee, & Alquist, 2004; Haywood et al., 2005; Hurst et al., 1998; Sanderson, Andrews, and Jelsma, 2001). Jenkinson et al. (1997) and Müller-Nordham et al. (2004) agree and state that the SF-36 and the SF-12 are comparable in their response to changes over time.

The SF-12 will now be discussed in regards to construct, content, and criterion validity. Construct validity refers to the extent to which a tool measures the construct being examined (Polit & Beck, 2004). The SF-12 demonstrated construct validity with a correlation of physical and mental components with six other measures in the study by Luo et al. (2003). Jenkinson, Chandola, Coulter, and Bruster (2001) investigated construct validity across various ethnic minority groups in the United Kingdom and they found proof of construct validity. Other researchers agree and found evidence that the SF-12 demonstrated construct validity when used with various patient populations such as those who have anxiety disorders (Sanderson et al., 2001), are homeless (Larson, 2002), have ophthalmology disorders (Globe et al., 2002), or have back pain (Luo et al.).

Content validity assesses the ability of an instrument to measure the area of interest. Content validity in the SF-12 was studied by Bohannon et al. (2004) and Dunbar et al. (2001). Bohannon et al. performed a factor analysis and their results were supportive of content validity. Dunbar et al. examined the SF-12 and believe that it is the best questionnaire for general health as they found no ceiling or floor effect.



Criterion validity was examined by comparing the instrument with another alternate tool. Globe et al. (2002) found evidence of criterion validity for the PCS and MCS when they compared the SF-12 to the SF-36.

The SF-12 appears to have been an appropriate tool for this study as it has proven to be a psychometrically-sound instrument. The SF-12 due to its succinctness is usually used in conjunction with condition-specific surveys (International Quality of Life Assessment, 2005), as was done in this study. The OHS/OKS, which measure FS, will now be the focus of the discussion.

#### *Functional Status Measures.*

The OHS and OKS were developed with patient input in 1996 and 1998 respectively. These joint specific outcome tools, respectively measure function and pain specifically in TH/TK replacement patients. It has been estimated that these patient-centred, self-report measures take 2 to 15 minutes to complete (McMurray, Heaton, Sloper & Neeleton, 1999; Wylde, Learmonth, & Cavendish, 2005).

The 12-item, single scale instruments ask patients about their functioning over the past four weeks through self assessment of a single joint. Garbuz, Xu, and Sayre (2006) believe it “captures joint arthroplasty outcomes” (p. 999) whereas McMurray et al. (1999) credit it as providing “quantitative data regarding disability particularly pain and immobility” (p. 228). Each item has a five point ordinal scale from which patients choose their responses. The Likert scale yields a score that ranges from 12 to 60. Lower scores indicate less perceived disability while higher scores indicate greater disability or less function in regards to activities of daily living.

Two research teams (McMurray et al., 1999; Wylde et al., 2005) have identified limitations with the use of OHS. Wylde et al. focused on patients' perspectives of the OHS. Some patients commented that the questions were unclear, asked more than one question, or were irrelevant. Patients' pain fluctuated therefore it was difficult to determine if it was due to co-morbidities or the affected joint. McMurray et al. identified some difficulties with the questionnaire from clinicians' perspectives. A few questions were not clear as to what they were asking and other questions seemed to have more than one response in an answer. Comments were also made about the questionnaire's ability to capture the pain experience and its exclusion of co-morbidities. The advantages of the instrument (i.e. its conciseness, simplicity, and focus) may account for its restrictions and lack of clarity (McMurray et al.).

Despite the shortcomings that have been identified by some researchers, the OHS has been found to be a psychometrically sound instrument by other researchers (Dawson et al., 1996; Fitzpatrick et al., 2000; Suk, Hanson, Norvell, & Helfet, 2005). Those psychometric properties will now be discussed in relation to the tool's reliability and validity.

The reliability of the OHS will be discussed in regards to its internal consistency, test-retest, and responsiveness. The OHS has been found to be internally consistent as measured by Cronbach's alpha. Internal consistency ranged from .84 to .93 (Dawson et al., 1996; Fitzpatrick et al., 2000; Wylde et al., 2005). Test-retest or reproducibility was rated as high by Gosens et al. (2005) with the ICC at .97. Dawson et al. (1996) agree and believe that the OHS has satisfactory test-retest ability. The OHS is believed to be very sensitive to change over time (Fitzpatrick & Dawson, 1997; Fitzpatrick et al., 2000).

Next, the OHS will be discussed in regards to its validity. The OHS is seen to have construct validity as it correlates highly with the WOMAC and the SF-12 (Garbuz, Xu, Duncan, Masri, & Bobolev, 2006; Ostendorf, Buskens et al., 2004). Preoperatively it had no ceiling or floor effects and postoperatively it had had few ceiling effects and no floor effect (Ostendorf, Buskens et al.). Fitzpatrick and Dawson (1997) also found evidence of construct validity.

Suk et al. (2005) evaluated the OHS and found evidence that it was reliable, valid, and responsive. The OHS was critiqued in regard to content, construct and criterion validity as well as internal consistency, reproducibility, and responsiveness. The critique yielded a score of five out of six. The last dimension of the evaluation was the tool's clinical utility as expressed by patient friendliness and clinician friendliness. This resulted in a score of three out of four. The overall score for the OHS was eight out of ten. The OKS also has been found to be psychometrically sound (Dawson et al., 1998; Dunbar et al., 2001; Garratt, Brealey, & Gillespie in collaboration with DAMASK Trial Team, 2004; Liow, Walker, Wajid, Bedi & Lennox, 2003; Suk et al., 2005).

The reliability of the OKS will be described in regards to its internal consistency, test-retest, and responsiveness. Cronbach's alpha scores ranged from .87 to .93 (Dawson et al., 1998; Dunbar et al., 2001; Whitehouse, Blom, Taylor, Pattison, & Bannister, 2005). Reproducibility, which is examined by test-retest, was found to be satisfactory by Dawson et al. (1998). The ICC was also satisfactory at .94 (Dunbar et al., 2001). The OKS was also viewed as highly responsive (Harcourt, White, & Jones, 2001) and sensitive to change when the preoperative and postoperative OKS were compared (Dawson et al., 1998).

The validity of the OKS will be described in regards to its content and construct validity. The content validity was addressed in the OKS as its questionnaire items were developed from patient interviews (Dawson et al., 1998). The construct validity was evaluated by examining the amount of agreement between the OKS and clinical data (American Knee Society Score) plus other existing health outcome questionnaires (SF-36 and the Stanford Health Assessment Questionnaire). Dawson and colleagues found that construct validity was highest ( $p < .01$ ) in regards to pain (preoperatively: -.71 and postoperatively: -.78) and physical function (preoperatively: -.69 and postoperatively: -.66).

Suk et al. (2005) also appraised the OKS and verified that it was valid, reliable, and responsive. The tool was critiqued by considering content, construct and criterion validity, and internal consistency, reproducibility, and responsiveness and was rated six out of six. The last dimension of the evaluation was its clinical utility as expressed by patient friendliness and clinician friendliness and it received three out of four. The final score for the OKS was nine out of ten.

The OHS and OKS are concise tools that measure FS. More importantly though, based on the definition of FS that has been provided previously, the OHS and OKS will adequately measure the concept. The tools focus on the physical, psychological, and social aspects of FS while concentrating on pain, function, and activity.

There is evidence that the SF-12, OHS and OKS are psychometrically sound instruments and that they were suitable for this study. The SF-12 has been recommended as a generic health outcome tool and the Oxford instruments have been recommended as

appropriate site-specific instruments (Dunbar et al., 2001) especially for health outcome research that emphasizes patient perception.

### Data Analysis

Statistical advice was sought from the statistician at the MCNHR Statistical Advisory Service. The statistical consultations provided guidance for the selection of the appropriate statistical tests, assistance with analysis, the interpretation of the results, and the presentation of the final results in the thesis. The Statistical Package for the Social Sciences (SPSS 15.0 for Windows Grad Pack), a data analysis software program, was utilized to import and analyze the data.

Descriptive statistics were used to analyze the demographic data. This included the use of means and standard deviations. Significance was set at  $p \leq .05$  for all tests initially. Information was used from the Canadian normative data for the SF-36 (Hopman et al., 2000) to establish cut-off points for the SF-12 scores. These cut-off points were calculated with the mean age of the sample and the 95% confidence interval. The mean age of the total sample was 65.2. The age range of 65 – 74 years of age was used to find the MCS and PCS standardized scores and confidence intervals. The confidence interval for the MCS is 53.4 – 54.0 and for the PCS it is 46.8 – 47.6. Scores less than this range indicate below average health and scores greater than this range indicate above average health. Cheang (M. Cheang, personal communication, February 28, 2007) recommends that a significant clinical difference for the MCS and PCS in the SF-12 is 2.7 points.

Cut-off points were also explored for the OHS/OKS. Kalairajah, Azurza, Hulme, Molloy, and Drahu (2005) compared the OHS with the Harris Hip Score and developed OHS cut-off points. They reported classifications of excellent, good, and fair outcomes.

However, Murray et al. (2007) discuss the possibility of categories and caution against their use as presently they are involved with developing categories through a large international dataset. Since there are no similar cut-off points for the OKS as for the OHS, plus given that it is not recommended by the original researchers who developed the OHS/OKS, no cut-off points were used for the OHS/OKS. Murray et al. identified that the minimal clinically important difference in OHS/OKS scores is 3 – 5 and perhaps even lower. Dawson (J. Dawson, personal communication, February 28, 2007) agrees and recommends that significant clinical differences for the OHS and OKS are 2.6 and 2.65 points respectively.

Correlations were performed to answer several of the research questions and descriptors were used to explain the strength of the relationships. The descriptors and parameters used to describe the relationships conveyed by  $r$  values include: .00 - .25 = little if any, .26 - .49 = low, .50 - .69 = moderate, .70 - .89 = high, and .90 – 1.00 = very high (Munro, 2001, p. 234).

*Research Question 1: What is the impact of the preoperative wait on quality of life and functional status during the wait.*

The SF-12 and the OHS/OKS were used to evaluate QOL and FS in TH/TK patients before their surgery. Data were collected at 12 months prior to surgery (SF-12) and 1 month prior to surgery (SF-12 and OHS/OKS). The above parameters for interpretation were also used.

To answer the first question, the change of the subject mean from 12 months preoperative to one month preoperative was calculated. Data were examined to determine

if there were correlations between: 1) twelve months preoperative QOL and one month preoperative QOL; 2) one month preoperative QOL and time spent waiting in weeks; and 3) one month preoperative FS and time spent waiting in weeks.

*Research Question 2: What is the impact of the preoperative wait on quality of life and functional status following surgery?*

The SF-12 and the OHS/OKS were used to evaluate QOL and FS in TH/TK patients following their surgery. Data were collected at 1 month prior to surgery (SF-12 and OHS/OKS) and 12 months following surgery (SF-12 and OHS/OKS). The above parameters for interpretation were also used.

To answer this question, the change of the subject mean from one month preoperative to 12 months postoperative was calculated. Data were examined to determine if there were correlations between: 1) one month preoperative QOL and 12 months postoperative QOL; 2) twelve months postoperative QOL and time spent waiting in weeks; 3) one month preoperative FS and 12 months postoperative FS; and 4) twelve months preoperative FS and time spent waiting in weeks.

*Research Question 3: What is the relationship of quality of life to functional status over time?*

Two approaches were used to analyze this data. In the first approach, Dataset 2 (n = 890) was used to look at the relationship of QOL to FS over time. This approach was inferential in nature. In the second approach, all patients in the analysis had measurements from all three measurement points (Dataset 3, n = 102) as patients' scores

were across the continuum, from 12 months prior to surgery, 1 month prior to surgery, and 12 months following surgery.

To answer question three, the data were examined to determine if there were changes to the correlations between: 1) QOL and FS at the one month preoperative data measurement point; and 2) QOL and FS at the 12 month postoperative data measurement point. The statistician assisted by performing a multi-level analysis with the General Linear Model (GLM) and this enabled us to include all three data points and to control for potential extraneous variables.

### Summary

This chapter has reviewed the methodology of the study in relation to the research design, setting, sample, sampling procedures, study approval, data collection, measures, and data analysis. The next chapter discusses the findings of the study.



## Chapter 4

### Findings

This chapter describes the findings of this longitudinal, correlational study that examined changes in and the relationship between QOL and FS across the wait period and following surgery for TH and TK replacement patients. A summary of the findings, including an overview of the demographics of the sample, and the results related to the three research questions are presented.

#### Total Sample Demographics

The total sample included 1,228 patient records. It was composed of 568 males (46.3%) and 660 females (53.7%). The mean age for males and females was 64.4 years and 65.9 years respectively while for the total sample it was 65.2 years (*SD* 11.6) (see Table 2).

The mean BMI of the total sample was 30.7 kg/m<sup>2</sup> (*SD* 6.4) while the mean value for the TH patients was 28.8 kg/m<sup>2</sup> and for the TK patients was 32.1 kg/m<sup>2</sup> (see Table 3). According to Health Canada (2003) a BMI of less than 18.5 kg/m<sup>2</sup> is considered underweight while a BMI between 18.5 and 24.9 kg/m<sup>2</sup> is classified as a normal weight. For the total sample (*N* = 1,228), only 4 patients (.33%) reported a BMI that would indicate that they were underweight; 149 patients (12.13%) identified that they had a BMI that would indicate a normal weight. Many patients (TH = 35.6%, TK = 55.4%) had a BMI > 30 kg/m<sup>2</sup>, a value considered indicative of obesity (Health Canada). Females were slightly heavier with a mean BMI of 31.4 kg/m<sup>2</sup> (*SD* 7.3), whereas males had a mean BMI of 29.8 kg/m<sup>2</sup> (*SD* 5.1).

Table 2

*Demographic Characteristics for Total Sample and by Dataset*

Variables	Total Sample <i>N</i> = 1228	Dataset 1 <i>n</i> = 440	Dataset 2 <i>n</i> = 890	Dataset 3 <i>n</i> = 102
Age (years)				
Mean ( <i>SD</i> )	65.2 (11.6)	63.2 (11.1)	66.2 (11.3)	65.0 (10.7)
Range	18 – 92	22 - 90	18 - 92	41 – 87
Gender <i>n</i> (%)				
Male	568 (46.3)	215 (48.9)	403 (45.3)	50 (49.0)
Female	660 (53.7)	225 (51.1)	487 (54.7)	52 (51.0)
BMI (kg/m <sup>2</sup> )				
Mean ( <i>SD</i> )	30.7 (6.4)	30.6 (6.2)	30.5 (6.3)	29.6 (5.1)
Range	16.1 - 65.3	18.6 - 65.3	16.1 - 60.7	19.4 – 47.0
Length of Wait (weeks)				
Mean ( <i>SD</i> )	48.4 (29.1)	50.1 (23.3)	47.6 (30.7)	48.2 (19.3)
Median	45	48	43	47.5
Mode	20	54	21	54
Range	0 – 162	4 - 132	0 - 162	4 – 103
Procedure <i>n</i> (%)				
Hip	528 (43.0)	201 (45.7)	384 (43.1)	57 (55.9)
Knee	700 (57.0)	239 (54.3)	506 (56.9)	45 (44.1)
Side <i>n</i> (%)				
Left	557 (45.4)	184 (41.8)	420 (47.2)	47 (46.1)

Right	621 (50.6)	212 (48.2)	463 (52.1)	54 (52.9)
Bilateral	49 (4.0)	44 (10.0)	6 (0.7)	1 (1.0)

*Note.* Total sample contains patients who are in either Dataset 1, 2, or 3. The total sample is not the simple sum of the datasets as some patients were included in more than one dataset. Dataset 1 has two measurement points: waitlist and preoperative; Dataset 2 has two measurement points: preoperative and postoperative; and Dataset 3 has three measurement points: waitlist, preoperative, and postoperative.

Fewer patients (528 or 43.0%) had a primary TH replacement performed than a primary TK replacement (700 or 57.0%). Four percent of all procedures performed were bilateral. Patients who had TH replacement surgery were slightly younger and had a slightly lower BMI compared with patients who had TK replacement surgery. The mean age and mean BMI of TH replacement patients was 63.8 years (*SD* 12.5) and 28.8 kg/m<sup>2</sup> (*SD* 5.3) respectively, while TK replacement patients were 66.3 years (*SD* 10.8) and had a mean BMI of 32.1 kg/m<sup>2</sup> (*SD* 6.8). On average, patients waited almost a year (48.4 weeks, *SD* 29.1, range 0 -162) for surgery. Only 11.1% of the delays for surgery were the patients' choice. When these 11.1% were excluded from the data, the wait was shorter (46.1 weeks, *SD* 28.0, range 0 – 162). Males and females had similar lengths of wait for surgery, (48.5 weeks, *SD* 28.7; 48.4 weeks, *SD* 29.5 respectively). TH patients (43.2 weeks, *SD* 27.3, range 0 – 162) had a slightly shorter wait than TK patients (52.4 weeks, *SD* 29.8, range 0 – 143). Male patients scored slightly better than female patients in all measurements of QOL and FS (see Table 4).

Table 3

*Percentage of Patients with a Body Mass Index Less than 25 kg/m<sup>2</sup> and Greater than 25 kg/m<sup>2</sup> in the Total Sample*

		Body Mass Index			
<i>N</i> = 1,228	< 25 kg/m <sup>2</sup>	>25 kg/m <sup>2</sup>	> 30 kg/m <sup>2</sup>	>35 kg/m <sup>2</sup>	>40 kg/m <sup>2</sup>
TH (528)					
%	23.3	76.7	35.6	11.4	3.6
TK (700)					
%	10.4	89.6	55.4	28.6	11.7

*Note.* Each 5 point increase in body mass index increases the individual's risk of developing health problems (Health Canada, 2003). TH = total hip; TK = total knee. Body mass index of 25 to 29.9 kg/m<sup>2</sup> is considered overweight; body mass index of BMI 30 kg/m<sup>2</sup> and over is considered obese (Health Canada).

#### Description of Datasets

Dataset 1 (*n* = 440), Dataset 2 (*n* = 890), and Dataset 3 (*n* = 102) made up the total sample of patient records (*N* = 1,228). Note that the total sample is not the simple sum of the datasets as these datasets were overlapping and not independent since some patients were included in more than one dataset. Demographic data for the total sample and each of the individual datasets are shown in Table 2. The three datasets varied in the number of patient records but were comparable with respect to age, gender, BMI, length of wait, type of procedure, and surgical involvement (i.e. unilateral versus bilateral). The total sample and three datasets were comparable in regards to gender specific QOL and FS scores with females scoring slightly lower in their QOL and FS (see Table 4).

Table 4

*Gender Specific Scores for Mental Component Summary, Physical Component Summary, and Oxford-12 Hip/Oxford-12 Knee in the Total Sample*

Scores (N = 1,228)								
Gender	MCS	MCS	MCS	PCS	PCS	PCS	Oxford	Oxford
	12/12	1/12	12/12	12/12	1/12	12/12	1/12	12/12
	preop	preop	postop	preop	preop	postop	preop	postop
Male								
Mean	50.2	52.1	53.6	29.2	30.4	43.1	40.0	20.8
(SD)	(12.6)	(11.5)	(9.5)	(8.4)	(8.3)	(10.1)	(7.6)	(8.6)
Female								
Mean	48.8	49.6	52.9	27.3	27.7	39.5	42.7	22.9
(SD)	(12.4)	(12.1)	(10.9)	(7.3)	(7.4)	(11.7)	(7.5)	(9.4)

*Note.* Total sample contains patients who are in either Dataset 1, 2, or 3. The total sample is not the simple sum of the datasets as some patients were included in more than one dataset. 1/12 = 1 month; 12/12 = 12 months. Range of scores for the MCS and the PCS is 0-100; higher scores reflect better perceived quality of life. Range of scores for the Oxford is 12-60; lower scores indicate less perceived difficulty with function. MCS = mental component summary; PCS = physical component summary; Oxford = Oxford-12 Hip Score/Oxford-12 Knee Score.

The measurement points for each of the datasets were approximate as it depended upon when the patient returned the instrument to the regional JRR. For each measurement point there was a range of time (see Table 5).

Table 5

*Comparison of Approximate and Actual Measurement Points for Datasets*

	Approximate Measurement Points	Actual Minimum and Maximum Measurement Points in Months
Dataset 1	12 months prior to surgery	0 – 25
	1 month prior to surgery	0 – 2
Dataset 2	1 month prior to surgery	0 – 2
	12 months following surgery	10 – 17
Dataset 3	12 month prior to surgery	0 – 16
	1 month prior to surgery	0 – 1
	12 months following surgery	11 – 16

Patients completed a medical/musculoskeletal co-morbidity questionnaire at one month prior to surgery. In the total sample, 46.9% of patients identified the presence of hypertension while 45.6% stated that OA or degenerative arthritis other than in their hip or knee was present. Back pain was reported by 38.2% of the total sample. Additional co-morbidities that were frequently noted were diabetes (14.0%), heart disease (11.3%), and depression (9.6%). In the second section of the questionnaire patients were asked about the presence of pain. The five most frequently identified painful areas were: right knee

(54.8%), left knee (51.2%), lower back (37.7%), right hip (33.2%), and left hip (32.9%).

Complete results are given for the total sample and each dataset in Table 6 and Table 7 respectively. The number of patient records in each dataset varied but they were similar with respect to the presence of co-morbidities and pain.

Table 6

*Co-morbidities for Total Sample and by Dataset*

Co-morbidity	Total Sample	Dataset 1	Dataset 2	Dataset 3
	<i>N</i> = 1228	<i>n</i> = 440	<i>n</i> = 890	<i>n</i> = 102
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Anemia	32 (2.6)	8 (1.8)	27 (3.0)	3 (3.0)
	[12]	[3]	[10]	[1]
Back Pain	464 (38.2)	153 (35.1)	340 (38.6)	29 (28.8)
	[13]	[3]	[11]	[1]
Cancer	55 (4.5)	15 (3.4)	46 (5.3)	6 (6.0)
	[12]	[3]	[10]	[1]
Depression	116 (9.6)	45 (10.3)	82 (9.4)	11 (10.9)
	[16]	[4]	[13]	[1]
Diabetes	170 (14.0)	56 (12.8)	128 (14.6)	14 (13.9)
	[12]	[3]	[10]	[1]
Heart Disease	138 (11.3)	49 (11.3)	104 (11.9)	15 (14.9)
	[13]	[3]	[11]	[1]
High BP	570 (46.9)	191 (43.7)	424 (48.3)	45 (44.6)
	[12]	[3]	[10]	[1]
Kidney Disease	21 (1.7)	6 (1.3)	17 (2.0)	2 (2.0)
	[12]	[3]	[10]	[1]
Liver Disease	6 (0.5)	1 (0.2)	5 (0.6)	0 (0.0)
	[12]	[3]	[10]	[1]



Lung Disease	48 (3.9)	19 (4.3)	35 (4.0)	6 (6.0)
	[12]	[3]	[10]	[1]
Osteo/Degenerative	553 (45.6)	182 (41.6)	412 (46.9)	41 (40.6)
Arthritis Other Than	[14]	[3]	[12]	[1]
Hip/Knee				
Rheumatoid Arthritis	113 (9.3)	44 (10.1)	83 (9.5)	14 (13.9)
	[14]	[3]	[12]	[1]
Ulcer/Stomach Disease	78 (6.5)	29 (6.7)	53 (6.0)	4 (4.0)
	[12]	[3]	[10]	[1]

*Note.* Total sample contains patients who are in either Dataset 1, 2, or 3. The total sample is not the simple sum of the datasets as some patients were included in more than one dataset. Dataset 1 has two measurement points: waitlist and preoperative; Dataset 2 has two measurement points: preoperative and postoperative; and Dataset 3 has three measurement points: waitlist, preoperative, and postoperative. Missing cases are identified in [ ].

Table 7

*Pain Location for Total Sample and by Dataset*

Body Area	Total Sample	Dataset 1	Dataset 2	Dataset 3
	<i>N</i> = 1228	<i>N</i> = 440	<i>n</i> = 890	<i>n</i> = 102
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Right Neck	110 (9.2)	45 (10.6)	73 (8.4)	8 (8.0)
	[32]	[15]	[19]	[2]
Right Shoulder	172 (14.4)	58 (13.6)	125 (14.4)	11 (11.0)
	[32]	[15]	[19]	[2]
Right Elbow	58 (4.8)	26 (6.1)	37 (4.2)	5 (5.0)
	[32]	[15]	[19]	[2]
Right Wrist	167 (14.0)	67 (15.8)	116 (13.3)	16 (16.0)
	[32]	[15]	[19]	[2]
Right Hip	397 (33.2)	152 (35.8)	285 (32.7)	40 (40.0)
	[32]	[15]	[19]	[2]
Right Thigh	131 (11.0)	45 (10.6)	97 (11.1)	11 (11.0)
	[33]	[15]	[20]	[2]
Right Knee	655 (54.8)	218 (51.3)	482 (55.3)	45 (45.0)
	[32]	[15]	[19]	[2]
Right Calf	91 (7.6)	27 (6.4)	71 (8.2)	7 (7.0)
	[32]	[15]	[19]	[2]
Right Ankle	188 (15.7)	67 (15.8)	135 (15.5)	14 (14.0)
	[32]	[15]	[19]	[2]

Left Shoulder	150 (12.6)	44 (10.0)	115 (13.2)	9 (9.0)
	[33]	[15]	[20]	[2]
Left Elbow	43 (3.6)	17 (4.0)	30 (3.4)	4 (4.0)
	[33]	[15]	[20]	[2]
Left Wrist	157 (13.1)	56 (13.2)	113 (13.0)	12 (12.0)
	[33]	[15]	[20]	[2]
Left Hip	393 (32.9)	145 (34.1)	282 (32.4)	34 (34.0)
	[33]	[15]	[20]	[2]
Left Thigh	130 (10.9)	49 (11.5)	93 (10.7)	12 (12.0)
	[33]	[15]	[20]	[2]
Left Knee	612 (51.2)	215 (50.6)	438 (50.3)	41 (41.0)
	[33]	[15]	[20]	[2]
Left Calf	85 (7.1)	27 (6.4)	65 (7.5)	7 (7.0)
	[33]	[15]	[20]	[2]
Left Ankle	176 (14.7)	54 (12.7)	134 (15.4)	12 (12.0)
	[33]	[15]	[20]	[2]
Neck	113 (9.5)	39 (9.2)	81 (9.3)	7 (7.0)
	[33]	[15]	[20]	[2]
Lower Back	450 (37.7)	155 (36.5)	327 (37.6)	32 (32.0)
	[33]	[15]	[20]	[2]

*Note.* Total sample contains patients who are in either Dataset 1, 2, or 3. The total sample is not the simple sum of the datasets since some patients were included in more than one dataset. Dataset 1 has two measurement points: waitlist and preoperative; Dataset 2 has

two measurement points: preoperative and postoperative; and Dataset 3 has three measurement points: waitlist, preoperative, and postoperative. Missing cases are identified in [ ].

At approximately 12 months following surgery, patients were also asked about the incidence of complications. Since patients identified their complications at approximately 12 months following surgery, these results are reported for Dataset 2 ( $n = 890$ ) and Dataset 3 ( $n = 102$ ). Advantages to reporting the complications from both datasets are that Dataset 2 had the greatest number of patients making it suitable to use for generalizations to the patient population while Dataset 3 was more representative of the total sample since it included patients who had reported data at all three measurement points. In Dataset 2 the most frequently identified complication was infection that was treated with antibiotics for both TH replacement patients (3.4%) and for TK replacement patients (8.4%). In Dataset 3 the most common complications for TH replacement patients were dislocation (1.8%) and blood clots in lungs (1.8%). For TK replacement patients the most commonly reported complication was infection that was treated with antibiotics (4.4%) (see Table 8).

Table 8

*Postoperative Complications by Dataset 2, Dataset 3 and by Procedure*

Complications	Dataset 2		Dataset 3	
	n = 890		n = 102	
	TH	TK	TH	TK
	n = 384	n = 506	n = 57	n = 45
	n (%)	n (%)	n (%)	n (%)
Dislocation	4 (1.1)	11 (2.2)	1 (1.8)	1 (2.2)
	[9]	[6]	[2]	[0]
DVT	1 (0.3)	6 (1.2)	0	1 (2.2)
	[3]	[7]	[0]	[0]
Blood Clot in Lungs	1 (0.3)	1 (0.2)	1 (1.8)	0
	[3]	[8]	[0]	[0]
Infection: Antibiotics	13 (3.4)	42 (8.4)	0	2 (4.4)
	[4]	[7]	[0]	[0]
Infection: Surgery	6 (1.6)	4 (0.8)	0	1 (2.2)
	[3]	[7]	[0]	[0]

*Note.* These self-reported complications were measured at 12 months following surgery and therefore are only reported for Dataset 2 and Dataset 3. Missing cases are identified in [ ]. TH = total hip; TK = total knee; DVT = deep vein thrombosis.

At approximately 12 months following surgery, patients were also asked to report satisfaction with their surgery (see Table 9). Since patients identified their satisfaction

level at approximately 12 months following surgery, these results are reported for Dataset 2 (n = 890) and Dataset 3 (n = 102). Advantages to reporting results from Dataset 2 and 3 were discussed earlier. Most patients were either very satisfied or satisfied with their surgery. In Dataset 2 (n = 890), 91.6 % of TH replacement patients were either very satisfied or satisfied while 3.8% were neutral, and 4.6% were either unsatisfied or very unsatisfied. In the same dataset, 82.9% of TK replacement patients were either very satisfied or satisfied while 8.2% were neutral, and 8.9% were either unsatisfied or very unsatisfied.

In Dataset 3 (n = 102), 100% of TH replacement patients were either very satisfied or satisfied. In the same dataset, 75.6% of TK replacement patients were either very satisfied or satisfied, 12.2% were neutral, and 12.2% were either unsatisfied or very unsatisfied. In the category of 'very satisfied', twice as many TH replacement patients (85.7%) were very satisfied as compared to the TK replacement patients (41.5%).

Table 9

*Satisfaction by Dataset 2 and Dataset 3*

Satisfaction	Dataset 2		Dataset 3	
	n = 890		n = 102	
	TH	TK	TH	TK
	n = 384	n = 506	n = 57	n = 45
	[15]	[21]	[1]	[4]
	n (%)	N (%)	n (%)	n (%)
Very satisfied	243 (65.9)	239 (49.3)	48 (85.7)	17 (41.5)
Satisfied	95 (25.7)	163 (33.6)	8 (14.3)	14 (34.1)
Neutral	14 (3.8)	40 (8.2)	0	5 (12.2)
Unsatisfied	10 (2.7)	31 (6.4)	0	4 (9.8)
Very Unsatisfied	7 (1.9)	12 (2.5)	0	1 (2.4)

*Note.* Self-reported satisfaction was measured at 12 months following surgery therefore results are only available for Dataset 2 and 3. Missing cases are identified in [ ]. TH = total hip; TK = total knee.

The SF-12 scores (MCS and PCS) that measured QOL and the OHS/OKS that measured FS were comparable for patients who had either unilateral or bilateral joint replacement surgery (see Table 10). Both TH and TK replacement patients self-reported that their QOL and FS improved from baseline to 12 months following surgery as shown in Table 11.

Table 10

*Comparison of Mental Component Summary, Physical Component Summary, and Oxford-12 Hip/Oxford-12 Knee Scores for Unilateral and Bilateral Joints in Total Sample*

Surgical Involvement		
<i>N</i> = 1227 [1]		
Measure / Time	Unilateral	Bilateral
	<i>n</i> = 1178	<i>n</i> = 49
MCS		
12/12 preop		
Mean ( <i>SD</i> )	49.7 (12.3)	47.5 (14.2)
<i>n</i> [missing]	396 [782]	44 [5]
1/12 preop		
Mean ( <i>SD</i> )	50.7 (11.8)	52.0 (12.8)
<i>n</i> [missing]	1178 [0]	49 [0]
12/12 postop		
Mean ( <i>SD</i> )	53.1 (10.3)	62.1 (8.8)
<i>n</i> [missing]	883 [295]	6 [43]



PCS		
12/12 preop		
Mean ( <i>SD</i> )	28.1 (7.8)	29.4 (8.4)
n [missing]	396 [782]	44 [5]
1/12 preop		
Mean ( <i>SD</i> )	28.9 (8.0)	29.6 (7.4)
n [missing]	1178 [0]	49 [0]
12/12 postop		
Mean ( <i>SD</i> )	41.1 (11.1)	40.4 (15.1)
n [missing]	883 [295]	6 [43]
OHS/OKS		
1/12 preop		
Mean ( <i>SD</i> )	41.0 (7.8)	37.9 (6.4)
n [missing]	1039 [139]	42 [7]
12/12 postop		
Mean ( <i>SD</i> )	21.9 (9.1)	19.4 (9.3)
n [missing]	814 [364]	5 [44]

*Note.* Total sample contains patients that are in either Dataset 1, 2, or 3. The total sample is not the simple sum of the datasets as some patients were included in more than one dataset. 1/12 = 1 month; 12/12 = 12 months. Range of scores for the MCS and the PCS is 0-100; higher scores reflect better perceived quality of life. Range of scores for the OHS/OKS is 12-60; lower scores indicate less perceived difficulty with function. Missing

cases identified in [ ]. MCS = mental component summary; PCS = physical component summary; Oxford = Oxford-12 Hip Score/Oxford-12 Knee Score.

Table 11

*Comparison of Mental Component Summary, Physical Component Summary, and Oxford-12 Hip/Oxford-12 Knee Scores for Unilateral and Bilateral Joint Replacement Surgery for Total Hip and Total Knee Replacement Patients in the Total Sample*

Measures	Surgical Involvement			
	Unilateral		Bilateral	
	n = 1178		n = 49	
Time	Hip	Knee	Hip	Knee
	n = 522	n = 656	n = 6	n = 43
MCS				
12/12 preop				
Mean (SD)	49.6 (12.0)	49.8 (12.7)	48.5 (5.9)	47.4 (15.1)
n [missing]	195 [327]	201 [455]	6 [0]	38 [5]
1/12 preop				
Mean (SD)	49.6 (12.2)	51.6 (11.5)	53.7 (14.3)	51.7 (12.7)
n [missing]	522 [0]	656 [0]	6 [0]	43 [0]
12/12 postop				
Mean (SD)	53.7 (9.5)	52.7 (10.9)	57.1 (*)	63.0 (9.4)
n [missing]	383 [139]	500 [156]	1 [5]	5 [38]
OHS/OKS				
1/12 preop				
Mean (SD)	42.2 (8.0)	40.0 (7.4)	39.8 (4.7)	37.6 (6.7)
n [missing]	474 [48]	565 [91]	6 [0]	36 [7]

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12/12 postop				
Mean (SD)	19.7 (8.0)	23.7 (9.5)	12.0 (*)	21.3 (9.7)
n [missing]	363 [159]	451 [205]	1 [5]	4 [39]

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*Note.* Total sample contains patients who were in either Dataset 1 (n = 440), 2 (n = 890), or 3 (n = 102). The total sample is not the simple sum of the datasets as some patients were included in more than one dataset. 1/12 = one month; 12/12 = 12 months. Range of scores for the MCS and the PCS is 0-100; higher scores reflect better perceived quality of life. Range of scores for the OHS/OKS is 12-60; lower scores indicate less perceived difficulty with function. Missing cases identified in [ ]. \* no SD available as n = 1. MCS = mental component summary; PCS = physical component summary; OHS/OKS = Oxford-12 Hip Score / Oxford-12 Knee Score.

### Findings Related to Research Questions

*Research Question 1: What is the impact of the preoperative wait on quality of life and functional status during the wait?*

To answer the first research question, data from the SF-12, the OHS/OKS data, and the length of wait were examined. In this analysis all patients had SF-12 scores that were taken at approximately 12 months prior to surgery and approximately 1 month prior to surgery (Dataset 1, n = 440).

As noted earlier, the SF-12 measures QOL and yields two scores: a MCS and a PCS. FS of patients was measured with the OHS/OKS at approximately one month prior to surgery. The OHS/OKS yields one summary score. Information was used from the Canadian normative data for the SF-36 (Hopman et al., 2000) to establish cut-off points

for the SF-12 scores. No cut-off points are available for the OHS/OKS therefore absolute scores were examined. Total mean scores for these self-reported measures during the wait for surgery are presented in Table 12. Pearson correlations were performed to explain the relationships between the variables.

Table 12

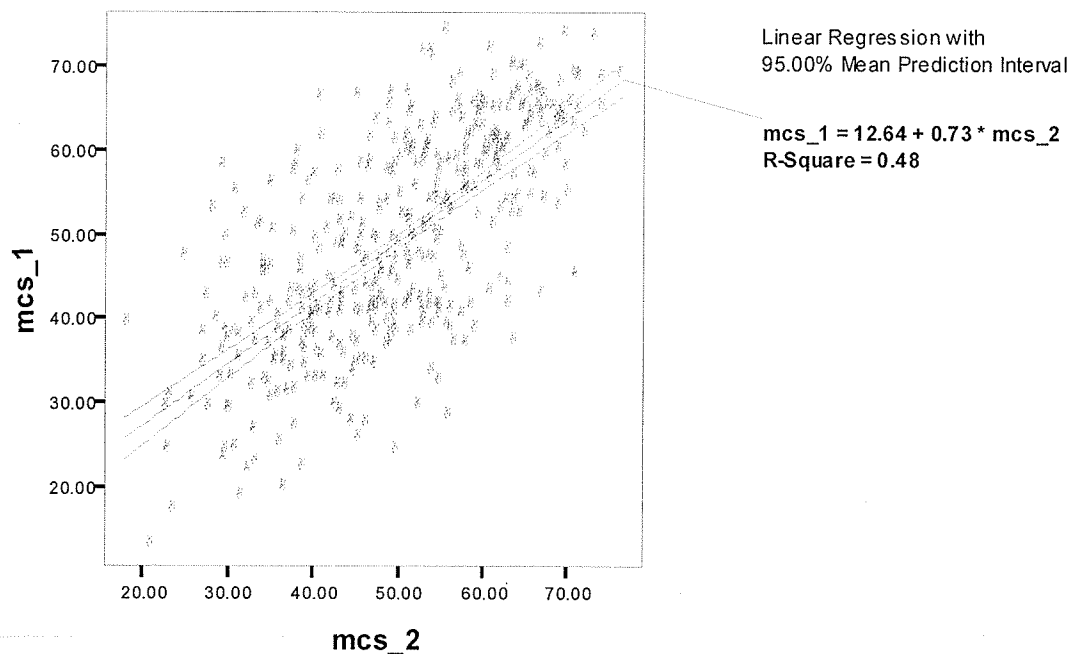
*Mental Component Summary, Physical Component Summary, and Oxford-12 Hip/Oxford-12 Knee Scores During the Wait for Surgery*

	12 Months Prior to Surgery			1 Month Prior to Surgery		
Measures	Dataset 1	TH	TK	Dataset 1	TH	TK
	n = 440	n = 201	n = 239	n = 440	n = 201	n = 239
MCS						
Mean	49.5	49.6	49.4	50.5	49.9	51.0
(SD)	(12.5)	(11.9)	(13.1)	(11.9)	(12.4)	(11.6)
PCS						
Mean	28.3	27.3	29.1	28.9	28.4	29.4
(SD)	(7.9)	(7.7)	(8.0)	(7.9)	(7.7)	(8.0)
OHS/OKS						
Mean	Not	Not	Not	40.5	41.7	39.5
(SD)	Measured	Measured	Measured	(7.9)	(8.0)	(7.8)
[missing]				[44]	[16]	[28]

*Note.* Range of scores for the MCS and the PCS is 0-100; higher scores reflect better perceived quality of life. Range of scores for the OHS/OKS is 12-60; lower scores indicate less perceived difficulty with function. Measurement points are approximate.

MCS = mental component summary; PCS = physical component summary; OHS/OKS = Oxford-12 Hip Score/Oxford-12 Knee Score. TH = total hip; TK = total knee.

To explore the mental component of QOL over the waiting period, the within subject MCS scores were examined in Dataset 1 ( $n = 440$ ). The Pearson correlation was calculated and the  $r$  co-efficient for the relationship between the MCS at 12 months prior to surgery and again at 1 month prior to surgery was  $r = .694$  ( $p < .001$ , one tailed). This was a moderately strong finding and the explanatory power was moderate ( $R^2 = .48$ ). The results indicate a significant positive relationship between the MCS scores at these two measurement points as demonstrated by the scatterplot (see Figure 2). In other words, individuals who had below average mental health at 12 months prior to surgery were more likely to have below average mental health at one month prior to surgery.

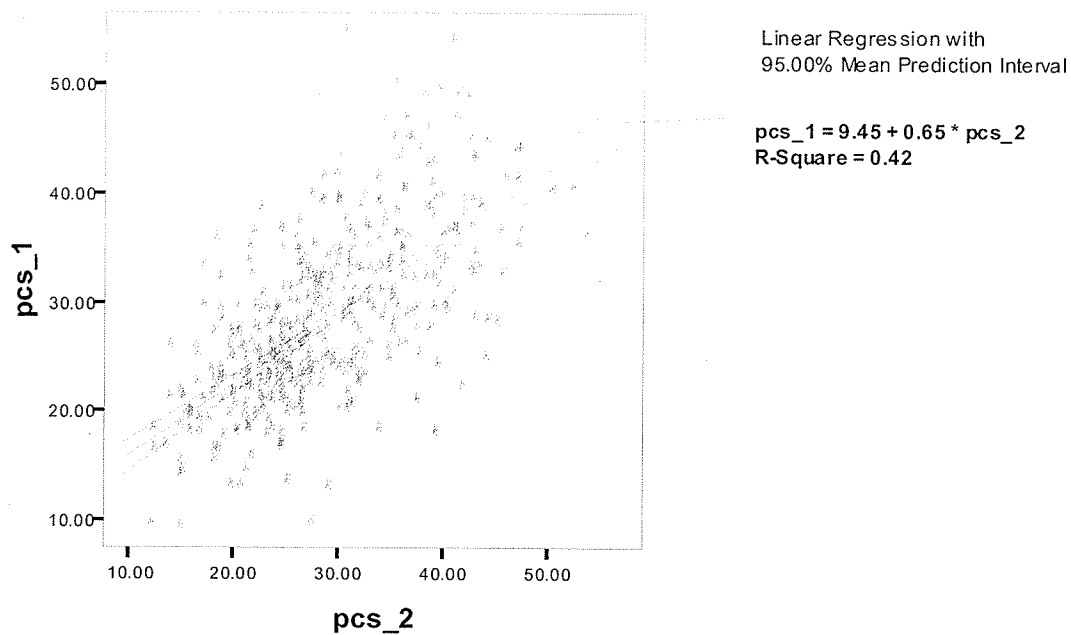


*Figure 2.* Scatterplot of Mental Component Summary Scores at Twelve Months Prior to Surgery (mcs\_1) and One Month Prior to Surgery (mcs\_2).

*Note.* Range of scores for the mental component summary is 0-100; the higher the score the greater the reported mental health component of quality of life. MCS\_1 = mental component summary score taken at 12 months prior to surgery; MCS\_2 = mental component summary score taken at 1 month prior to surgery.

The physical component of QOL over the waiting period was investigated by examining the within subject PCS scores at the preoperative measurement points in Dataset 1 ( $n = 440$ ). The Pearson correlation was calculated and the  $r$  co-efficient for the relationship between the PCS at 12 months and 1 month prior to surgery was  $r = .648$  ( $p < .001$ , one-tailed). This was a moderately strong finding and explanatory power was moderate ( $R^2 = .42$ ). This indicates a significant positive association between the PCS scores at these two measurement points and the scatterplot (see Figure 3) illustrates this relationship. Hence individuals with below average physical health at 12 months prior to surgery were more likely to have below average physical health at 1 month prior to surgery.





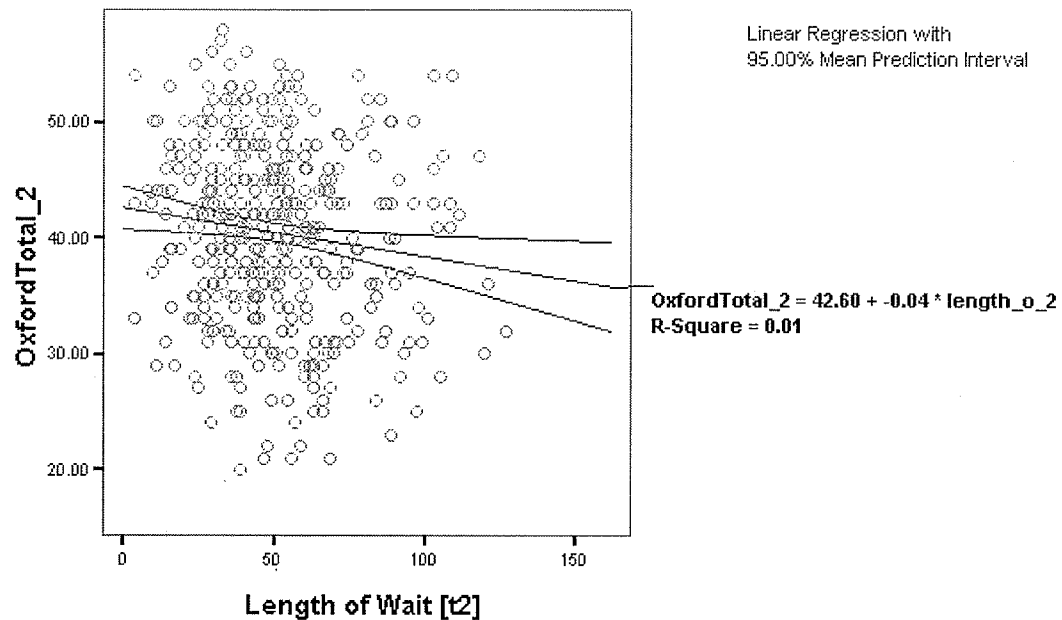
*Figure 3.* Scatterplot of Physical Component Summary Scores at Twelve Months Prior to Surgery (pcs\_1) and One Month Prior to Surgery (pcs\_2).

*Note.* Range of scores for the physical component summary is 0-100; the higher the score the greater the reported physical health component of quality of life. PCS\_1 = physical component summary score taken at 12 months prior to surgery; PCS\_2 = physical component summary score taken at 1 month prior to surgery.

The relationship between patients' mental and physical QOL and FS in relation to their wait (in weeks) for surgery was also considered. In Dataset 1 ( $n = 440$ ) the mean wait for surgery was 50.1 weeks ( $SD\ 23.3$ ). The Pearson correlation was calculated with the MSC scores taken at one month prior to surgery and the wait for surgery (in weeks). There was little if any relationship between these variables ( $r = -.032$ ) and it was not

significant ( $p = .508$ , two tailed). Likewise, to determine if there was a relationship between the QOL physical health scores at one month prior to surgery and the wait for surgery, the Pearson correlation was calculated. There was little if any relationship between these variables ( $r = .043$ ) and it was not significant ( $p = .370$ , two tailed). This means that the individuals' wait period prior to surgery was not associated with either their mental or physical QOL health scores taken at one month prior to surgery.

The OHS/OKS, which examine FS, were reported by patients at one month prior to surgery (Dataset 1,  $n = 440$ ). The Pearson correlation was calculated with the variables of FS at one month prior to surgery and the wait in weeks for surgery. In Dataset 1, the mean wait for surgery was 50.1 weeks ( $SD 23.3$ ). The  $r$  co-efficient for this relationship was  $r = -.122$  ( $p = .008$ , one tailed) (see Figure 4).



*Figure 4.* Scatterplot of Oxford-12 Hip/Oxford-12 Knee Scores at One Month Prior to Surgery (OxfordTotal\_2) and the Length of Wait in Weeks for Surgery (Length of Wait [t2]).

*Note.* Range of scores for the Oxford-12 Hip/Oxford-12 Knee Scores (OxfordTotal\_2) is 12-60; the lower scores indicate less perceived difficulty with function. Oxford Total\_2 = Oxford-12 Hip/Oxford-12 Knee scores taken at one month prior to surgery. Length of Wait [t2] = the length of time between when the physician and patient decide that surgery is required and the surgery takes place.

*Research Question 2: What is the impact of the preoperative wait on quality of life and functional status following surgery?*

To answer the second research question, all patient data including length of wait, and scores for QOL (SF-12 MCS and SF-12 PCS) and for FS (OHS/OKS) taken at

approximately 1 month prior to surgery and approximately 12 months following surgery were examined (Dataset 2,  $n = 890$ ). Table 13 presents the total mean scores for the self-reported measures.

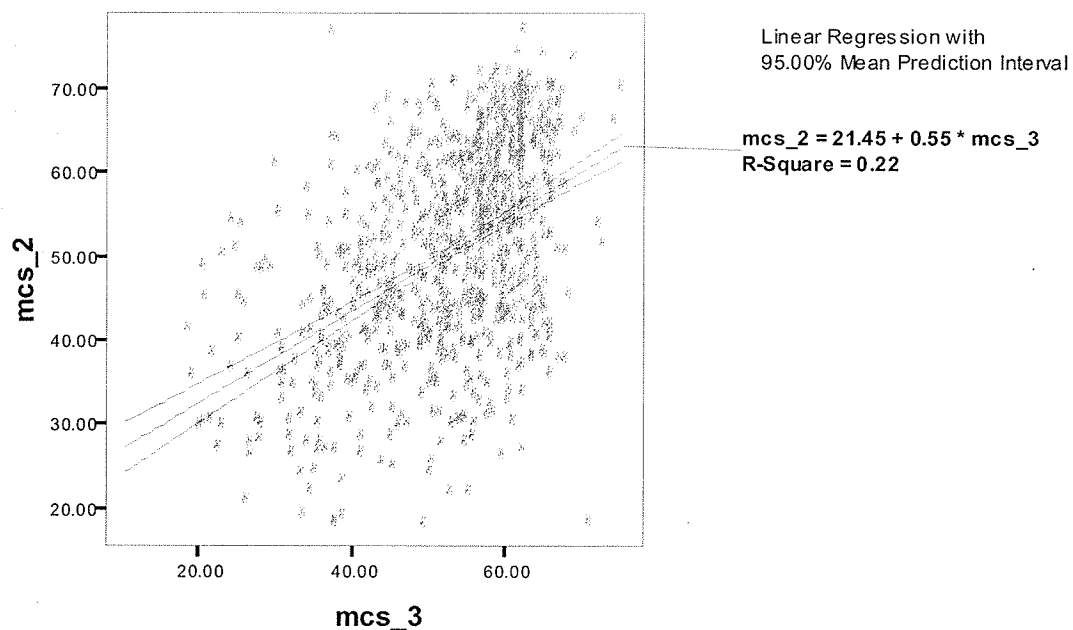
Table 13

*Mental Component Summary, Physical Component Summary, and Oxford-12**Hip/Oxford-12 Knee Scores One Month Prior to Surgery and Twelve Months Following Surgery*

	1 Month Prior to Surgery			12 Months Following Surgery		
Measures	Dataset 2	TH	TK	Dataset 2	TH	TK
	n = 890	n = 384	n = 506	n = 890	n = 384	n = 506
MCS						
Mean	50.8	49.4	51.7	53.2	53.7	52.8
(SD)	(12.0)	(12.3)	(11.6)	(10.3)	(9.4)	(10.9)
PCS						
Mean	28.8	28.2	29.2	41.1	42.7	39.9
(SD)	(7.9)	(8.4)	(7.6)	(11.1)	(11.0)	(11.1)
OHS/OKS						
Mean	41.3	42.5	40.3	21.9	19.7	23.7
(SD)	(7.6)	(8.0)	(7.2)	(9.1)	(8.0)	(9.5)
[missing]	[110]	[35]	[75]	[70]	[20]	[50]

*Note.* Range of scores for the MCS and the PCS is 0-100; the higher scores reflect better perceived quality of life. Range of scores for the OHS/OKS is 12-60; lower scores indicate less perceived difficulty with function. MCS = mental component summary; PCS = physical component summary; OHS/OKS = Oxford-12 Hip Score / Oxford-12 Knee Score; TH = total hip; TK = total knee.

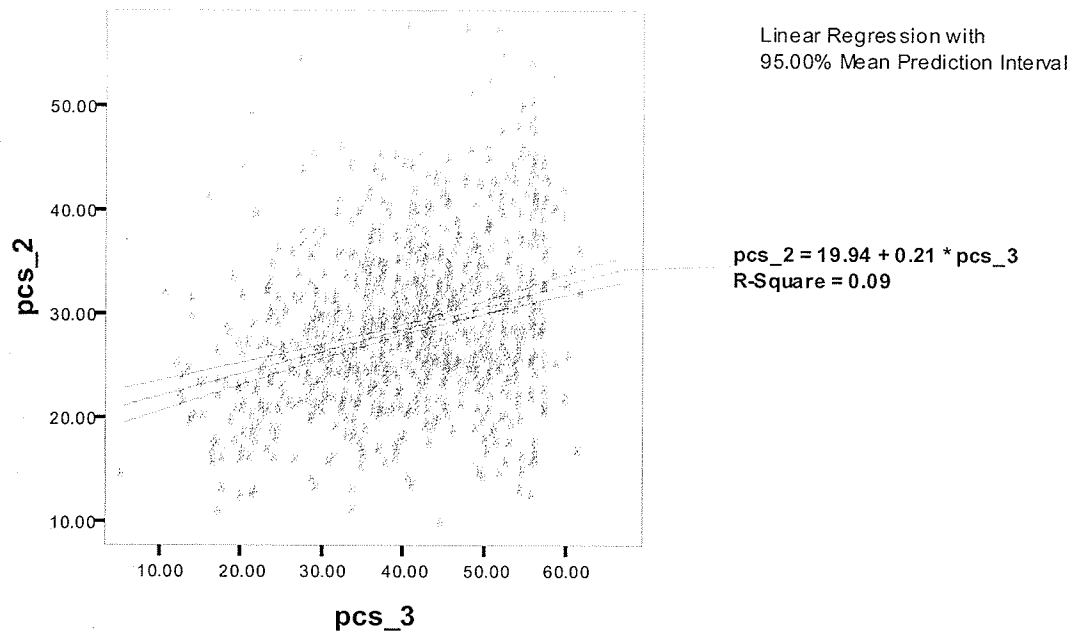
To explore the mental component of QOL, the MCS scores from 1 month prior to surgery and 12 months following surgery were examined. The Pearson correlation was calculated and the  $r$  value for the relationship between the within subject MCS at one month prior to surgery with that at 12 months following surgery was  $r = .474$  ( $p < .001$ , one tailed). This indicates a low but significant positive relationship between the MCS at these two measurement points as demonstrated by the scatterplot (see Figure 5). The explanatory power for this relationship was weak ( $R^2 = .22$ ) and the dataset was large ( $n = 890$ ) therefore other factors may be explaining this relationship. Individuals who had below average mental health at 1 month prior to surgery were more likely to have below average mental health at 12 months following surgery. This was not a strong finding.



*Figure 5.* Scatterplot of Mental Component Summary Scores at One Month Prior to Surgery (mcs\_2) and Twelve Months Following Surgery (mcs\_3).

*Note.* Range of scores for the mental component summary is 0-100; higher scores reflect better reported mental health component of quality of life. MCS\_2 = mental component summary taken at 1 month prior to surgery; MCS\_3 = mental component summary taken at 12 months following surgery.

The physical component of QOL pre to post-surgery was also investigated using the Pearson correlation test in Dataset 2 ( $n = 890$ ). As seen in Figure 6, there was a low but statistically significant relationship between the PCS scores of the SF-12 at 1 month prior to surgery and the PCS scores at 12 months following surgery ( $r = .302, p < .001$ , one tailed). The explanatory power of this relationship was weak ( $R^2 = .09$ ) and the dataset was large ( $n = 890$ ) thus suggesting that other factors may be influencing this model. This means that individuals with below average physical health at 1 month prior to surgery tended to have below average physical health 12 months following surgery. This was not a strong finding.



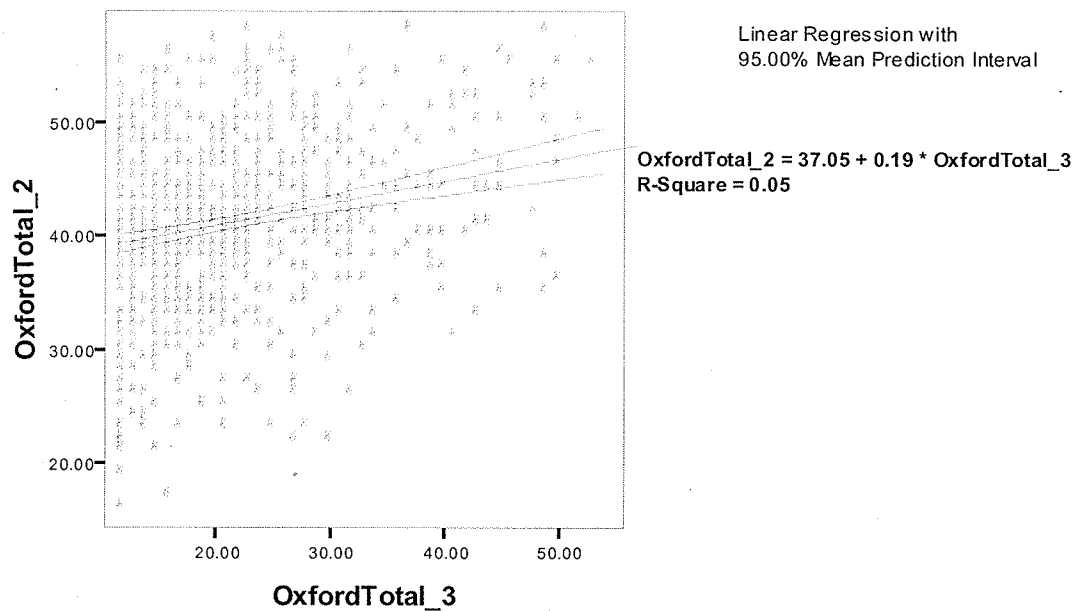
*Figure 6.* Scatterplot of Physical Component Summary Scores at One Month Prior to Surgery (pcs\_2) and Twelve Months Following Surgery (pcs\_3).

*Note.* Range of scores for the physical component summary is 0-100; the higher scores indicate greater reported physical health component of quality of life. PCS\_2 = physical component summary scores taken at 1 month prior to surgery; PCS\_3 = physical component summary scores taken at 12 months following surgery.

FS was measured with the OHS/OKS. The Pearson correlation test was utilized to analyze the relationship between the within subject OHS/OKS from 1 month prior to surgery to those findings at 12 months following surgery in Dataset 2 ( $n = 890$ ). The  $r$  coefficient demonstrates that there was little if any relationship present between these variables ( $r = .227$ ) but it was statistically significant ( $p < .001$ , one tailed) (see Figure 7).



Therefore, patients who had worse FS at 1 month prior to surgery were more apt to have a higher level of FS at 12 months following their surgery although the explanatory power of this relationship was very low ( $R^2 = .05$ ) and the dataset was large ( $n = 890$ ). (*Note.* The higher the OHS/OKS, the worse the perceived level of FS.) This was not a strong finding.

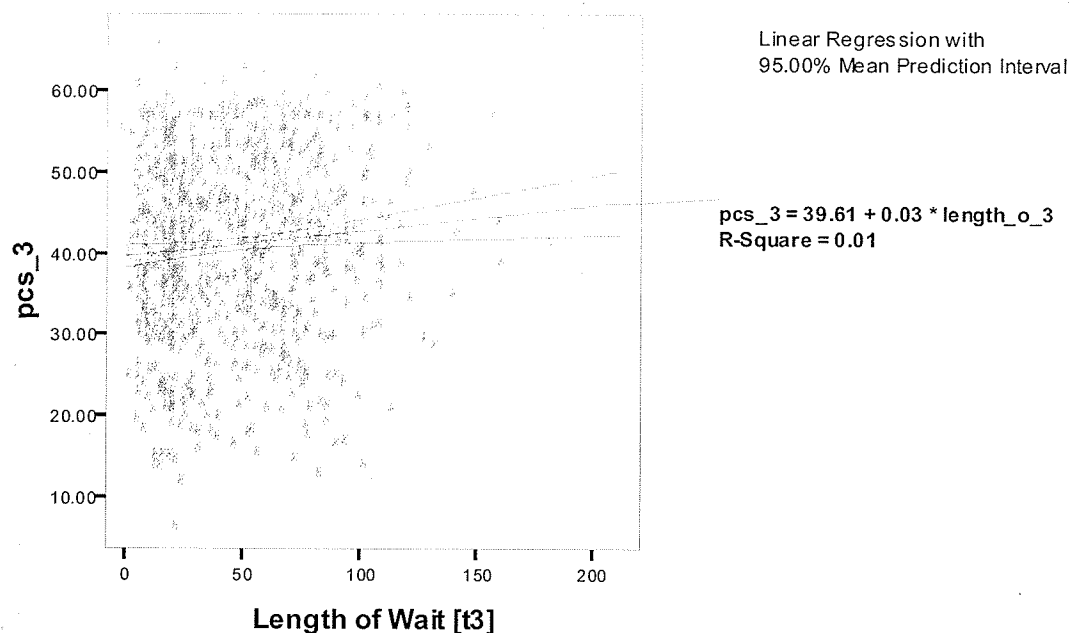


*Figure 7.* Scatterplot of Oxford-12 Hip/Oxford-12 Knee Scores at One Month Prior to Surgery (OxfordTotal\_2) and Twelve Months Following Surgery (OxfordTotal\_3).

*Note.* Range of scores for the Oxford-12 Hip / Oxford-12 Knee is 12-60; lower scores indicate less perceived difficulty with function. Oxford Total\_2 = was taken at 1 month prior to surgery; Oxford Total\_3 = was taken at 12 months following surgery.

The relationship between patients' mental and physical QOL and FS in relation to their wait (in weeks) for surgery was also considered. In Dataset 2 ( $n = 890$ ) the mean wait for surgery was 47.6 weeks ( $SD\ 30.7$ ). To test the relationship between the mental component of QOL at 12 months following surgery and the wait in weeks for surgery, the Pearson correlation was calculated. There was little if any relationship between how long patients waited and their mental component summary scores of QOL at 12 months following surgery ( $r = -.005$ ,  $p = .884$ , two tailed). This finding was not statistically significant.

Similarly, the relationship between the physical component of QOL at 12 months following surgery and the wait in weeks for surgery was tested. The Pearson correlation test was used to explore this relationship. There was little if any relationship ( $r = .086$ ) but it was statistically significant ( $p = .005$ , one tailed). While shorter waits were statistically related to better physical health at 12 months following surgery, it is important to note that the dataset was large ( $n = 890$ ) and the  $R^2$  value only provides a small explanatory power (see Figure 8).

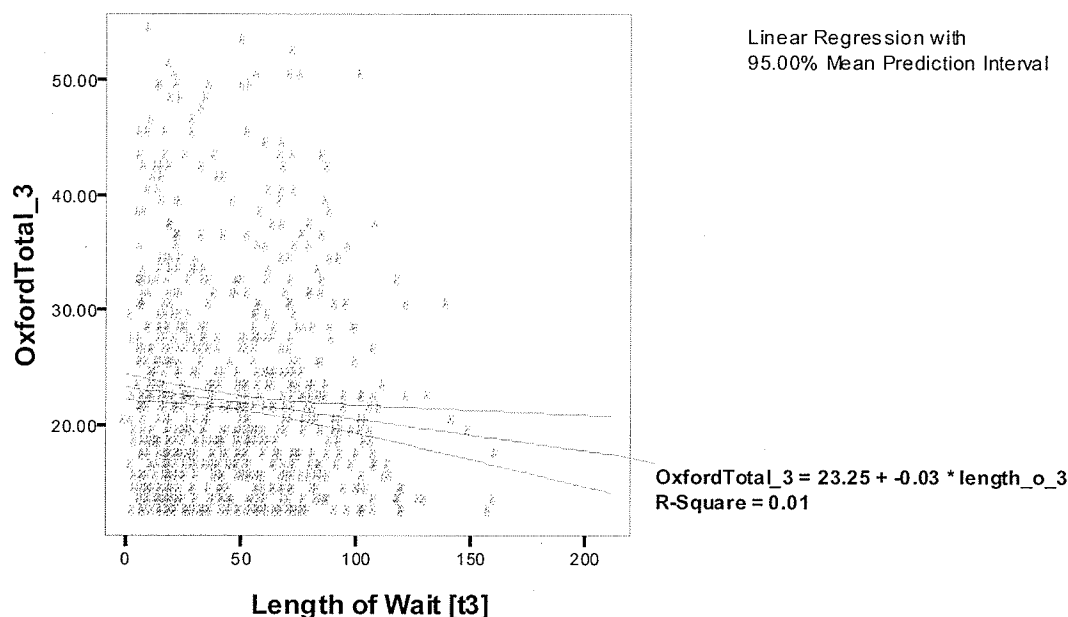


*Figure 8.* Scatterplot of Physical Component Summary Scores at Twelve Months Following Surgery (pcs\_3) and the Length of the Wait for Surgery in Weeks (Length of Wait [t3]).

*Note.* Range of scores for the physical component summary is 0-100; higher scores reflect better perceived physical health component of quality of life. PCS\_3 = physical component summary score taken at 12 months following surgery; Length of Wait [3] = the length of time between when the physician and patient decide that surgery is required and when the surgery takes place

The relationship between patients' FS postoperatively and the wait for surgery was calculated with the Pearson correlation test. The  $r$  co-efficient for the relationship between the Oxford-12 at 12 months following surgery and the wait for surgery in weeks

was  $r = -.094$  ( $p = .003$ , one tailed) (see Figure 9). There was little if any relationship between these variables. Although this relationship is statistically significant, it must be kept in context. The  $R^2$  value has a low explanatory power and Dataset 2 is large ( $n = 890$ ). This was not a strong finding but some individuals who waited a shorter period of time had better FS at 12 months following surgery.



*Figure 9.* Scatterplot of Oxford-12 Hip/Oxford-12 Knee Scores at Twelve Months Following Surgery (OxfordTotal\_3) and the Length of the Wait for Surgery in Weeks (Length of Wait [t3]).

*Note.* Range of scores for the Oxford-12 Hip/Oxford-12 Knee is 12-60; lower scores indicate less perceived difficulty with function. Oxford Total\_3 = Oxford-12 Hip/Oxford-12 Knee taken at 12 months following surgery; Length of Wait [t3] = the length of time

between when the physician and patient decide that surgery is required and when the surgery takes place.

*Research Question 3: What is the relationship of quality of life to functional status over time?*

In order to study the relationship of QOL to FS over time, scores were examined from 12 months prior to surgery, 1 month prior to surgery, to 12 months following surgery. Two approaches were utilized to explore the data. In the first approach, the relationship of QOL to FS was examined from 1 month prior to surgery to 12 months following surgery (Dataset 2,  $n = 890$ ). The second approach explored the relationship of QOL to FS over the three measurement points: 12 months prior to surgery, 1 month prior to surgery, to 12 months following surgery (Dataset 3,  $n = 102$ ). Theoretically, the second approach would be the proper design for the longitudinal nature of the question (M. Cheang, personal communication, July 17, 2008). (*Note.* QOL scores were available at all three measurement points, however, FS scores were only available from the last two measurement points.) There were advantages to the use of both approaches.

The first approach allowed for the largest number of patients possible in the analysis from Dataset 2 ( $n = 890$ ). This made the results generalizable to these patient populations. It is important to point out that the patients used in the first approach varied at each time point, as not all patients had completed all measurement tools. The number of patients who were in each analysis is identified in the appropriate tables.

In the second approach, the main advantage was that all patients in the dataset (Dataset 3,  $n = 102$ ) had results from each of the three measurement points. This provided

a longitudinal analysis of QOL which was a major strength of this study. The results of these two approaches are similar in relation to the strength and direction of the correlations although the  $p$  values vary depending on the size of the datasets (M. Cheang, personal communication, July 17, 2008).

Specifically, in relation to the first approach, SF-12 and OHS/OKS data that were collected from patients at 1 month prior to surgery and 12 months following surgery were analyzed. The SF-12 yields two QOL summary scores: the MCS (measures mental health), and the PCS (measures physical health) while the OHS/OKS yields one FS score. The relationship between these scores was explored by a General Linear Model (GLM). The GLM is a specific type of analysis that is multivariate in the sense that in the models, adjustments were made for covariates (simultaneously with PCS, MCS, OHS/OKS as applicable), wait times, and type of procedure. Therefore, this analysis helped study the interactions between the variables (MCS, PCS, OHS/OKS, and wait time) as well as their impact separately.

The GLM was used to explore the association between the MCS scores at one month prior to surgery and 12 months following surgery for TH and TK replacement patients. This within subject or repeated measures analysis was adjusted with scores from the PCS and OHS/OKS taken at one month prior to surgery. There was a significant contribution by the PCS and OHS/OKS ( $p < .001$ ). A significant interaction for group by time ( $p = .03$ ) was also seen. There was an increase in the MCS scores over time for both TH and TK patients but the difference in scores from 1 month prior to surgery to 12 months following surgery was only significant for TH patients ( $p < .05$ ) (see Table 14).

Table 14

*Mean Mental Component Summary Scores One Month Prior to Surgery and Twelve Months Following Surgery by Procedure*

Procedure / Time	Unadjusted	Adjusted	95% Confidence	
	Mean ( <i>SE</i> )	Mean ( <i>SE</i> )	Interval of Adjusted	
	n = 890	n = 780	Means	
			Lower	Upper
<b>TH MCS</b>				
1 month prior to surgery	49.45 (.61)	50.28 (.54)	49.22	51.33
12 months following surgery	53.71 (.53)	53.73 (.54)	52.67	54.78
Difference	4.27 (.60)	3.13 (.24)*	2.66	3.61
<b>TK MCS</b>				
1 month prior to surgery	51.75 (.53)	51.01 (.48)	50.06	51.96
12 months following surgery	52.84 (.46)	52.84 (.48)	51.89	53.79
Difference	1.09 (.50)	2.16 (.21)	1.75	2.57

*Note.* Mean MCS scores adjusted by PCS and OHS/OKS. TH = total hip; TK = total knee; MCS = mental component summary; PCS = physical component summary; OHS/OKS = Oxford-12 Hip Score / Oxford-12 Knee Score. \* indicates a significant  $p < .05$  adjusted mean difference over time. Difference scores are based on paired within subject scores.

The GLM was used to explore the relationship between the PCS scores at 1 month before surgery and 12 months following surgery for TH and TK replacement patients.

This within subject or repeated measures analysis was adjusted with scores from the MCS and the OHS/OKS taken at 1 month before surgery; both were significant ( $p < .001$ ) in their contribution in terms of adjustment. There was a significant interaction for group by time ( $p < .001$ ). Mean QOL physical health (PCS) scores changed significantly between 1 month before surgery and 12 months following surgery for both TH and TK patients ( $p < .05$ ), with TH patients tending to have the greatest rate of improvement (see Table 15).

Table 15

*Mean Physical Component Summary Scores One Month Prior to Surgery and Twelve Months Following Surgery by Procedure*

Procedure / Time	Unadjusted	Adjusted	95% Confidence	
	Mean (SE)	Mean (SE)	Interval of Adjusted	
	n = 890	n = 780	Means	
			Lower	Upper
TH PCS				
1 month prior to surgery	28.24 (.40)	28.67 (.31)	28.06	29.28
12 months following surgery	42.69 (.56)	43.52 (.56)	42.42	44.62
Difference	14.45 (.60)	12.85 (.25)*	12.36	13.35
TK PCS				
1 month prior to surgery	28.17 (.35)	28.62 (.28)	28.07	29.17
12 months following surgery	39.88 (.49)	39.67 (.50)	38.68	40.65
Difference	10.71 (.50)	12.63 (.22)*	12.20	13.06



*Note.* PCS means were adjusted by one month scores for MCS and OHS/OKS. TH = total hip; TK = total knee; PCS = physical component summary; MCS mental component summary; OHS/OKS = Oxford-12 Hip Score / Oxford-12 Knee Score; QOL = quality of life. \* indicates significant  $p < .05$ , adjusted mean differences over time. Difference scores are based on paired within subject scores.

The GLM was used to examine the OHS/OKS at 1 month prior to surgery and 12 months following surgery. Variables (wait time, MCS, and PCS) were explored for possible influences on the OHS/OKS. Wait time and MCS were not found to be significant contributors to the OHS/OKS, therefore that model was adjusted only by the PCS. A significant group by time interaction ( $p < .001$ ) was present. There was a significant change in FS for both TH and TK patients from 1 month prior to surgery and 12 months following surgery ( $p < .05$ ), however, TH patients tended to show a greater improvement over time (see Table 16).

Table 16

*Mean Oxford-12 Hip/Oxford-12 Knee Scores One Month Prior to Surgery and Twelve Months Following Surgery*

Procedure / Time	Unadjusted	Adjusted	95% Confidence	
	Mean (SE)	Mean (SE)	Interval of Adjusted	
	n = 727	n = 727	Means	
			Lower	Upper
<b>OHS</b>				
1 month prior to surgery	42.42 (.41)	42.15 (.34)	41.48	42.82
12 months following surgery	19.69 (.48)	19.59 (.47)	18.67	20.52
Difference	22.73 (.52)	19.25 (.15)*	18.95	19.54
<b>OKS</b>				
1 month prior to surgery	40.24 (.38)	40.47 (.32)	39.85	41.09
12 months following surgery	23.40 (.44)	23.48 (.43)	22.63	24.34
Difference	16.84 (.51)	18.81 (.13)*	18.55	19.06

*Note.* Mean OHS and OKS were adjusted by one month PCS scores. TH = total hip; TK = total knee; OHS = Oxford-12 Hip Score; OKS = Oxford-12 Knee Score; PCS = physical component summary. \* indicates significant,  $p < .05$ , adjusted mean difference over time. Difference scores are based on paired within subject scores.

The second, or three data point analysis approach to explore change in QOL and FS over time will now be presented. The GLM was used to study the relationship of the MCS over the three measurement points: 12 months prior to surgery, 1 month prior to

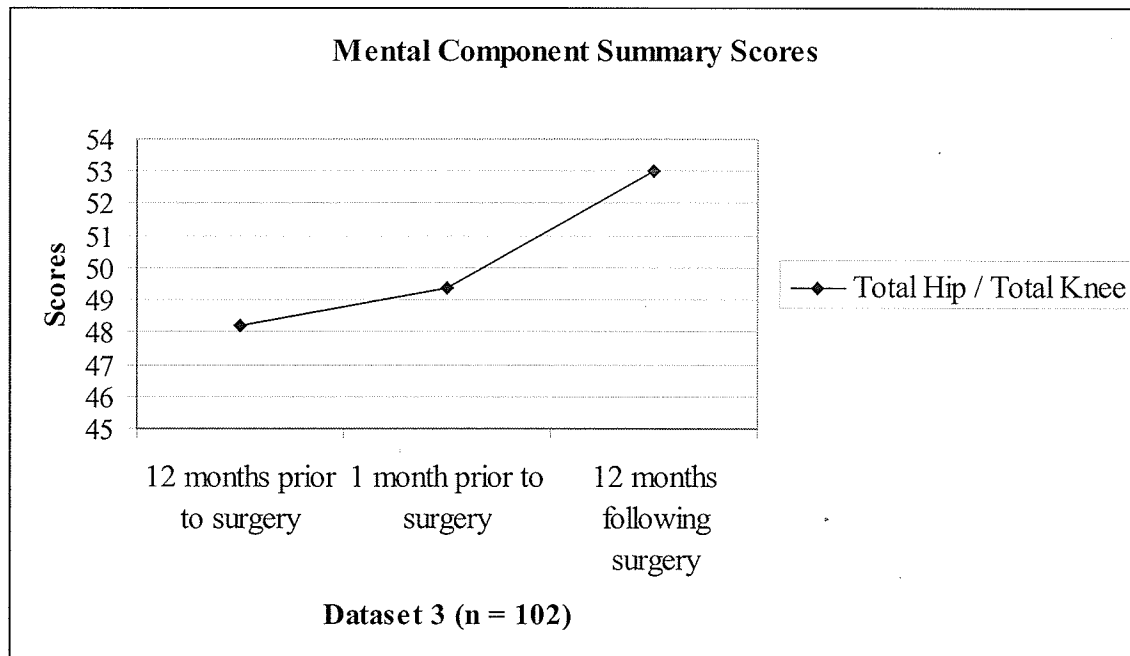
surgery, and 12 months following surgery. Repeated measures analysis of variance was used to explore the changes and possible impacts. PCS, OHS/OKS, and wait time were considered but were found non-significant to the model and therefore were dropped. There was no significant group by time interaction ( $p = .852$ ). When the TH and TK replacement patients were analyzed together ( $n = 102$ ) there was a significant change over time in MCS ( $p = .001$ ) (see Figure 10). However, there was not a significant difference in the change of scores between groups nor was there a significant difference in the change when groups were explored separately based on confidence levels (all group specific confidence levels overlapped) (see Table 17).

Table 17

*Mean Mental Component Summary Scores Twelve Months Prior to Surgery, One Month Prior to Surgery, and Twelve Months Following Surgery by Procedure*

Procedure / Time	Unadjusted	95% Confidence	
	Mean (SE)	Interval	
	N = 102	Lower	Upper
<b>TH MCS</b>			
12 months prior to surgery	48.42 (1.66)	45.12	51.71
1 month prior to surgery	49.29 (1.68)	45.96	52.63
12 months following surgery	53.38 (1.28)	50.85	55.92
Diff 12 months prior-1 month prior	0.88 (1.34)	-1.81	3.57
Diff 12 months post-12 months prior	4.97 (1.57)	1.82	8.12
Diff 12 months post-1 month prior	4.09 (1.54)	1.00	7.17
<b>TK MCS</b>			
12 months prior to surgery	47.95 (1.87)	44.24	51.66
1 month prior to surgery	49.61 (1.89)	45.85	53.37
12 months following surgery	52.61 (1.44)	49.76	55.46
Diff 12 months prior-1 month prior	1.66 (1.14)	-0.62	3.95
Diff 12 months post-12 months prior	4.66 (1.97)	0.69	8.64
Diff 12 months post-1 month prior	3.00 (1.67)	-0.37	6.36

*Note.* MCS = mental component summary; TH = total hip; TK = total knee; Diff = difference. Difference scores are based on paired within subject scores.



*Figure 10.* Mental Component Summary Scores for Total Hip and Total Knee Replacement Patients in Dataset 3 (n = 102).

The GLM was used to examine the relationship of the PCS over the three measurement points: 12 months prior to surgery, 1 month prior to surgery, and 12 months following surgery. Repeated measures analysis was used to explore potential changes and the possible impacts. The model was adjusted for the 12 months prior to surgery MCS ( $p < .001$ ). There was a significant group by time interaction for PCS ( $p < .001$ ). Specific exploration of mean scores at the group level indicating that there was no significant change by group from 12 months prior to surgery to 1 month prior to surgery for both TH and TK. However, there was a significant change by group from 1 month prior to surgery to 12 months following surgery and 12 months prior to surgery and 12 month following

for both TH and TK ( $p < .05$ ) (see Figure 11). A greater rate of change tended to be seen in the TH patients (see Table 18) and Figure 11..

Table 18

*Mean Physical Component Summary Scores Twelve Months Prior to Surgery, One Month Prior to Surgery, and Twelve Months Following Surgery by Procedure*

Procedure / Time	Unadjusted	Adjusted	95% Confidence	
	Mean (SE)	Mean (SE)	Interval of	
	n = 102	n = 102	Adjusted Means	
			Lower	Upper
TH PCS				
12 months prior to surgery	26.42 (.90)	26.65 (.90)	24.65	28.22
1 month prior to surgery	27.14 (.98)	27.14 (.98)	25.20	29.09
12 months following surgery	46.43 (1.50)	46.36 (1.41)	43.56	49.16
Diff 12 months prior-1 month prior	0.71 (.78)	0.63 (.07)	0.48	0.77
Diff 12 months post-12 months prior	20.00 (1.59)	15.00 (.59)*	13.82	16.18
Diff 12 months post-1 month prior	19.29 (1.66)	14.37 (.52)*	13.33	15.41
TK PCS				
12 months prior to surgery	28.19 (1.01)	28.19 (1.01)	26.18	30.19
1 month prior to surgery	28.14 (1.10)	28.14 (1.10)	25.94	30.33
12 months following surgery	39.24 (1.69)	39.32 (1.59)	36.17	42.47
Diff 12 months prior-1 month prior	-0.05 (.96)	0.60 (.09)	0.43	0.78
Diff 12 months post-12 months prior	11.04 (1.46)	14.83 (.72)*	13.37	16.28

Diff 12 months post-1 month prior	11.09 (1.55)	14.22 (.64)*	12.94	15.50
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*Note.* Mean PCS scores were adjusted by MCS 12 months prior to surgery. TH = total hip; TK = total knee; PCS = physical component summary; MCS = mental component summary. \* indicates significant,  $p < .05$ , adjusted mean difference over time between 1 month prior to surgery and 12 months following surgery. Diff = difference. Difference scores are based on paired within subject scores.

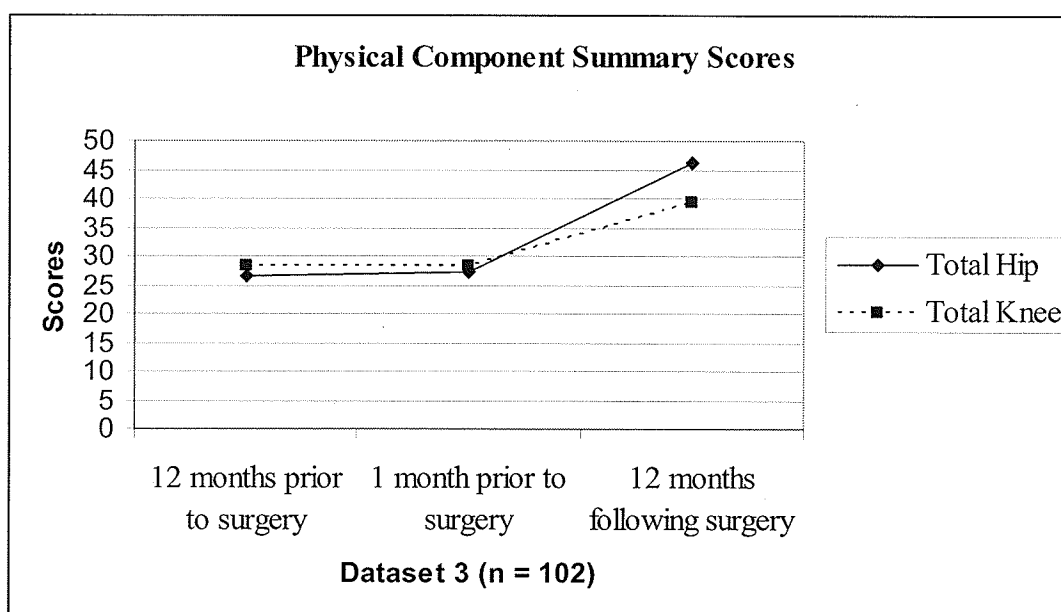


Figure 11. Comparing Physical Component Summary Scores for Total Hip and Total Knee Replacement Patients in Dataset 3 (n = 102).

### Summary

In this chapter the findings from this study have been discussed. Most patients were approximately 65 years of age, overweight, and had waited 48 weeks for surgery. Slightly more females (53.7%) than males and more TK (57%) than TH characterized the

sample. The most common co-morbidities were hypertension and degenerative arthritis plus patients reported painful knees, hips, and lower back. Few patients reported complications and the majority of patients were very satisfied with their surgery.

With respect to question one, the impact of the preoperative waiting period on QOL and FS during the wait was the focus. It was found that most patients had below average mental health at 12 months prior to surgery and were likely to continue to have below average mental health at 1 month prior to surgery. Likewise, most patients had below average physical health at 12 months prior to surgery and tended to continue to have below average physical health at 1 month prior to surgery. There was no significant relationship between individuals' wait period prior to surgery and their QOL (mental and physical) and FS scores.

Findings related to question two concentrated on the influence of the preoperative wait period on QOL and FS following surgery. The data supported a modest relationship predicting that individuals who had below average mental health at 1 month prior to surgery were more likely to have below average mental health at 12 months following surgery. Similarly, weak but significant data, supported that individuals who had below average physical health at 1 month prior to surgery tended to have below average physical health 12 months following surgery. There was little or no relationship between patients' FS 1 month prior to surgery and 12 months following their surgery. There was little or no relationship between individuals' QOL (mental and physical) and FS scores at 12 months following surgery and the wait for surgery.

Findings for question three centred on the relationship of QOL to FS over time. When the relationships between the variables (MCS, PCS, OHS/OKS, and wait time)



were examined with the GLM from 1 month prior to surgery to 12 months following surgery, the results were varied. There was an increase in the MCS scores over time for both TH and TK patients but the increase was only significant for TH patients. The PCS scores and the OHS/OKS changed significantly over time for both TH and TK patients with the trend for the greatest rate of improvement in the TH patients.

When the MCS and PCS scores were examined using the GLM over the three measurement points, the results again were mixed. Only when the MCS scores for TH and TK replacement patients were analyzed together was there was a significant positive change over time. There was not a significant change in the PCS from 12 months prior to surgery to 1 month prior to surgery for TH and TK patients. Although there was a significant positive change in the PCS in both TH and TK patients from 1 month prior to surgery to 12 months following surgery and 12 months prior to surgery and 12 months following surgery with a trend for the greater rate of change seen in the TH patients.

The next chapter will discuss the utility of the theoretical framework, the prominent findings, as well as the study's strengths and limitations. The implications for practice and suggestions for further research will conclude the chapter.

## Chapter 5

### Discussion

This chapter will discuss the findings of the study in relation to the utility of the theoretical framework, other research, and the study's questions. The study's strengths and limitations as well as implications for practice and recommendations for further research will also be explored.

The purpose of this study with TH and TK replacement patients was to examine changes in and the relationship between their QOL and FS across the wait period and following surgery. The SMM was used to frame this longitudinal, correlational study. The instruments utilized to measure QOL and FS were the SF-12 and OHS/OKS respectively. The total sample ( $N = 1,228$ ) was extracted from a regional JRR. These patient records made up Dataset 1 ( $n = 440$ ), Dataset 2 ( $n = 890$ ), and Dataset 3 ( $n = 102$ ) and were utilized to answer the following research questions:

1. What is the impact of the preoperative wait on quality of life and functional status during the wait?
2. What is the impact of the preoperative wait on quality of life and functional status following surgery?
3. What is the relationship of quality of life to functional status over time?

### Theoretical Framework

The SMM provided the framework for this research. This was the first known study that used the model to examine QOL and FS in TH/TK replacement patients prior to and following their surgery. The model was chosen to guide the study because of its focus on patients' perceptions. The major strength of this study was its emphasis on

patients' views, in other words, patients self-reported their QOL and FS during the wait for surgery and following surgery. Both the SMM and the study highlight the importance of patients' perceptions.

### *Domains and Dimensions*

The three nursing domains—person, environment, and health and illness as well as the three dimensions—the symptom experience, the symptom management strategies, and outcomes, were central to the model and to this research. The intent of the model is that the domains impact the dimensions plus the dimensions influence each other.

In the current study, the effect of the model domains on the dimensions was not measured. Information regarding the model domains was gathered in order to describe the sample such as the person factors (gender, age, BMI, type of procedure, side of surgery, and satisfaction) and the health and illness factors (co-morbidities, pain, and complications). The study's environment domain was discussed as the political environment. The political environment was not identified in the model therefore future research could be focused on the possibility of its inclusion in the SMM. Future studies could also examine the domains and their relationships to each other and to the dimensions.

Since this was the first orthopaedic study to utilize the SMM, no other studies could be found for comparison although the model has been used extensively in other clinical areas. Examples of the person domain that have been investigated in other areas include the relationship between gender and pain (Gear et al., 1996) or the influence of age on symptoms (Larson, Lindsey, Dodd, Brecht, & Packer, 1993). Dodd et al. (1999) explored the health and illness domain when they examined risk factors and disease. The

environment domain was investigated by examining the environmental influence on sleep perceptions (Lee, Zaffke, & McEnany, 2000). Future research with this current dataset could focus on the relationship between gender and pain, the influence of age on symptoms, or the association between co-morbidities and outcomes.

The model dimensions helped shape this study by guiding the literature review. Symptom experience focuses on the awareness of symptoms and responses to them. The symptom experience literature provided the background to the research by focusing on arthritis and the health status of the TH/TK patient. Symptom management strategies work to defer negative outcomes by implementing various interventions. In this study the symptom management strategies were related to the wait for TH/TK replacement surgery. The literature review also focused on the QOL and FS of TH/TK replacement patients before and after their surgery. The review of the literature concluded with the integration of the study variables as supported by the model—the patients' health status (symptom experience), the wait for surgery (symptom management strategy), and QOL and FS (outcomes).

The SMM uses the domains and dimensions to make predictions. For instance, the three domains influence the three dimensions and there are double-sided arrows between each of the dimensions. In this study the person, health and illness, and environment domains influenced the symptom perception, symptom management strategies, and outcomes. As mentioned earlier there were bidirectional relationships between each of the dimensions.

The model predicts that there will be two-way relationships between the symptom perception, symptom management strategies, and outcomes. The findings of this study

support those associations between the dimensions. There is a strong link between the symptom perception—preoperative and postoperative health status and the outcomes of the study—QOL and FS. The surgery (one of the symptom management strategies) influenced the symptom perception and postoperative outcomes. Of all the domains, the person domain in this study provided the most effect on the dimensions. As mentioned earlier, no other orthopaedic research could be found that was guided by the SMM although the use of the model dimensions in general, has been supported in other clinical research (Dodd et al., 1996; Facione & Dodd, 1995; Given, Given, & Stommel, 1994).

Although the SMM was not utilized in the following orthopaedic studies, the model dimensions can be seen in these studies' concepts. The association between the symptom experience and symptom management strategies could be illustrated when Ostendorf, Buskens et al. (2004) examined patients' health status while waiting for TH replacement surgery. The relationship between the symptom management strategies and outcomes was examined in research which addressed wait times, QOL, and FS (Hajat et al., 2002). The outcomes were compared preoperatively and postoperatively (Fortin et al., 2002). Additional research could be performed with this current dataset using the dimensions for guidance. For instance, the influence of symptom evaluation and response on symptom perceptions could be explored, or the costs associated with symptom management for TH/TK replacement patients could be examined.

It was evident that the SMM was appropriate for the current research as it provided the framework for the research questions, the review of the literature, and the discussion of the findings. The model was successfully utilized by researchers in non-orthopaedic clinical areas plus it may provide direction for future research with this

current dataset. The model dimensions have also provided the framework for understanding the results of several orthopaedic studies. In the next section a more detailed discussion of the study's prominent findings will be provided.

### Summary of Prominent Findings

Within the nursing domains, several factors were explored to describe the sample while the model dimensions will be used to frame the discussion of the prominent findings. The influence of the domains will also be discussed in relation to the three dimensions.

#### *Person Domain.*

In this study, the person domain was explored by examining the variables of age, gender, BMI, type of procedure, surgical involvement (i.e. unilateral versus bilateral), and satisfaction. These variables helped to describe the sample. The mean age of the patients was 65.2 years (*SD* 11.6) in the total sample and similar results were seen in the three datasets. Patients' mean ages were slightly lower in this study than what has been reported in the literature. The mean age for TH replacements was 63.81 (*SD* 12.55) and for TK replacements was 66.26 (*SD* 10.77). Other researchers (CIHI, 2006; Hirvonen et al., 2007; Kelly et al., 2001; Mahon et al., 2002) have reported a slightly higher mean age of approximately 68.0 years for TH/TK replacement patients.

In the total sample, there were slightly more females (53.7%) than males (46.3%). These results are slightly different from the Statistics Canada (2007) report that identifies gender statistics in the general population as 50.5% females and 49.5% males.

In this research, consistently more women than men had TK replacements whereas TH replacements were more equally distributed between the sexes. Female

patients accounted for 57.9% (405) of the TK replacements and 48.3% (255) of the TH replacements. Male patients had 42.1% (295) of the TK replacements and 51.7% (273) of the TH replacements. Similarly, the CJRR Annual Report (CIHI, 2007) found that 56% of hip replacements were females and 44% were males, while 61% of knee replacements were females and 39% were males. McKean and colleagues (2007) believe that the biomechanics of OA are gender specific as OA is two to three times more common in females than males. This increased incidence of OA in females compared to males was similarly reported by Jones, Beaupre, Johnston, and Suarez-Almazor (2007). Compared to men, women have also been reported to experience greater disease severity at the time of surgery (Kennedy, Newman, Ackroyd, & Dieppe, 2003), and greater disability while waiting for arthroplasty surgery (Kennedy, Stratford, Pagura, Walsh, & Woodhouse, 2002). Petterson, Rasis, Bodenstab, and Snyder-Mackler (2007) reported that women with knee OA were less apt to have TK replacement surgery even though they perceive their disability to be greater than men. Based on their research, Borkhoff and colleagues (2008), concluded that a treatment gender disparity exists because physicians under-recommend TK surgery to female patients. In their study, research patients followed a pre-determined script as they presented themselves to the physicians seeking assistance with their OA. Physicians had been notified of the research months prior and were given the opportunity not to take part in it. While Herrera (2008) praises this “undercover”, impromptu research, it does appear that some deceit may have occurred as the physicians were not cognizant of the research when it actually was going on. More research is needed to explore whether or not a treatment discrepancy exists.

The mean BMI values helped to further describe the sample. In the total sample ( $N = 1,228$ ), patients had a mean BMI of  $30.7 \text{ kg/m}^2$  ( $SD 6.4$ ), compared to the normal BMI range of  $18.5 - 24.9$  (Health Canada, 2003). Females in this study had on average, a higher BMI than male patients and similar results were identified in the CJJR report (CIHI, 2007). The mean BMI for females was  $31.4$  ( $SD 7.3$ ) while males had a mean BMI of  $29.8$  ( $SD 5.1$ ). Kennedy, Stratford, Riddle, Hanna, and Gollish (2008), in their research that focuses on TK replacement outcomes, also report higher BMIs in females than males.

In this study, the type of joint replacement performed appeared to vary depending on the BMI levels. For instance, TK replacement patients had a slightly higher BMI ( $32.07 \text{ kg/m}^2$ ,  $SD 6.81$ ) than TH replacement patients ( $28.78 \text{ kg/m}^2$ ,  $SD 5.25$ ). Health Canada (2007) identifies that 28.1% of Manitobans and 23.1% of Canadians reported that they were obese (BMI of  $> 30 \text{ kg/m}^2$ ). The 2005 Canadian Community Health Survey (Shields, Connor Gorber & Tremblay, 2008) consisted of an interview, self-reported height and weight, and then trained interviewers measured participants' height and weight. In their results they report that men on average over-reported their height by 1 cm and under-reported their weight by 1.8 kg. whereas women over-reported their height by .5 cm and under-reported their weight by 2.5 kg. The under-reporting of weight happened most frequently in overweight individuals especially those who were obese (BMI  $> 30 \text{ kg/m}^2$ ). Given the findings by Shields and colleagues there is a possibility that the patients in this study had even higher BMI levels than they reported.

This study's results are comparable to the CJRR (CIHI, 2007) results, which reported that the TK patients were more likely to be overweight than TH patients as 36%



of TH patients and 56% of TK patients had BMIs  $> 30 \text{ kg/m}^2$ . Changulani, Kalairajah, Peel, and Field (2008) found that BMI levels increased with lower mean ages for TH/TK replacement surgery. For example, morbidly obese patients ( $\text{BMI} > 40 \text{ kg/m}^2$ ) who had TH/TK replacement surgery were 10 years younger ( $p = .002$ ) and 13 years younger ( $p = .001$ ) respectively, than patients with a normal BMI. Future exploration of the current data set could determine the generalizability of this finding.

One variable that did not differ in regards to BMI was whether the surgery was unilateral or bilateral. In this study the mean BMI was similar for unilateral and bilateral joint replacement surgeries. The reported BMI for unilateral procedures was  $30.66 \text{ kg/m}^2$  and for bilateral surgery it was  $30.63 \text{ kg/m}^2$ . It is interesting to note that Marks (2007) reported that a higher BMI may increase the need for bilateral joint replacements.

The links between elevated BMI values, OA, and joint replacement surgery can not be overemphasized. Obesity is associated with a higher incidence of knee OA (Felson et al., 2000; Manek, Hart, Spector & MacGregor, 2003; Marks, 2007), and not surprisingly, with increased rates of joint replacement surgery (de Guia, Zhu, Keresteci, & Shi, 2006). De Guia and colleagues conclude that the strong relationship between obesity and the need for joint replacement surgery are important in future Canadian policy development. Additional research could consider the relationship between BMI, gender, type of procedure (TH/TK), age, and whether unilateral versus bilateral procedure was performed.

Satisfaction with the surgery (psychological variable in the person domain) was used to describe the sample in this study. Patients rated their satisfaction with their surgery very positively. For example, in Dataset 2 ( $n = 890$ ) and Dataset 3 ( $n = 102$ ) the

vast majority of patients (> 80%) were either very satisfied or satisfied. Similar high patient satisfaction rates with total joint replacements have been reported in the literature (Baumann et al., 2006; Jones, Voaklander et al., 2000). These results are encouraging as Learmonth, Young and Rorabeck (2007) report that patients have high expectations to improve their QOL and FS following joint replacement surgery. Nevertheless when the current study's datasets were divided by type of surgery, the TH patients were more satisfied than the TK patients following surgery. These results are supported by Jones et al. (2000) who identified that TH patients were 91% satisfied with their outcomes following surgery while TK replacement patients were only 77% satisfied.

In Dataset 2 ( $n = 890$ ) 91.6% of TH patients were either very satisfied or satisfied with their surgery and 82.9% of TK patients reported that there were either very satisfied or satisfied. Similar results were seen in Dataset 3 ( $n = 102$ ) whereas 100% of TH patients were either very satisfied or satisfied and only 75.6% of TK patients were either very satisfied or satisfied. The TH patients in this study were significantly more satisfied ( $p < .001$ ) than the TK patients.

Kennedy et al. (2002) examined joint replacement patients preoperatively ( $N = 1,805$ ) and discovered that TH replacement patients reported greater functional disability and less satisfaction with their FS than TK replacement patients. Other researchers (Baumann et al., 2006) studied joint replacement patients ( $N = 210$ ) following discharge. They reported that when evaluating satisfaction with care immediately following discharge the TK patients are more satisfied than the TH patients. These are important differences as the patients in the current study were asked if they were satisfied with their surgery while other researchers have inquired about patients' satisfaction with their

function or care. Additional research is required that examines patient satisfaction before and after TH/TK replacement surgery that is analyzed by procedure.

When gender differences were examined in relation to satisfaction, it was found that gender was not significant but males tended to be more satisfied than females. For instance, in Dataset 2 ( $n = 890$ ) 89.1% of males and 84.7% of females were either very satisfied or satisfied. Similar numbers of males and females were either unsatisfied or very unsatisfied (7.0% and 8.9% respectively). When Dataset 3 ( $n = 102$ ) was examined in relation to gender and satisfaction, the same trends were noted. In Dataset 3, 91.8% of males were either very satisfied or satisfied while 87.6% of females reported the same levels of satisfaction. The categories of unsatisfied and very unsatisfied were reported by 6.1% of males and 4.2% of females. Satisfaction was also studied in relation to age, but the relationship was not significant. Further research is necessary which examines gender differences and satisfaction with TH/TK surgery. The next domain which influenced the study was the environment domain.

#### *Environment Domain.*

The environment domain is reflected as the political environment of this study. The political environment alludes to issues relating to the funding for joint replacement surgery and the management of waitlists. Although the political environment was expected to have impacted the waitlist, this element of the environment domain was not measured specifically in the current analysis.

#### *Health and Illness Domain.*

Factors that fall into the health and illness domain include health and illness factors (BMI, co-morbidities, pain, and complications). A detailed discussion occurred

regarding BMI levels within this study in the person domain section already although it could have been discussed within the health and illness domain. According to Health Canada (2003) when BMI rates increase so do health risks. Some of these health risks present themselves as co-morbidities and Taylor and Gropper (2006) believe that orthopaedic patients' co-morbidities play a critical role in the development of postoperative complications. These co-morbidities or chronic illnesses influence patients' health and impede recovery from surgery (Williams, Dunning & Manias, 2007) while significantly decreasing patients' QOL (Tuominen et al., 2007). Tuominen and colleagues reported in their study of health-related QOL in 893 patients waiting for TH replacement surgery that 73% of patients had co-morbidities with a mean of two co-morbidities per patient. QOL was significantly worse for those patients with co-morbidities ( $p < .001$ ). Participants in this current study reported a similar mean number of co-morbidities (1.9, *SD* 1.5) with a range between 0 - 11. An area for future investigation could be examining the association between the co-morbidities, QOL, and FS of TH/TK replacement patients.

There were relatively few reported complications in the current study. The most frequently reported complication was infection (deep or superficial) that was treated with antibiotics (either oral or intravenous). It is not known exactly how many of the infections were deep or superficial or the route of the antibiotics. Even though it was the most common complication, only 6.3% (55 patients) in Dataset 2 ( $n = 890$ ) reported this complication. Severity of the infection is not known. When the comment section of the results was reviewed 30 patients said that they were treated in a hospital, 6 were seen in a physician's office, 4 were treated in a clinic, and 2 were seen in an emergency

department. Although where the patient was treated may provide us with an idea of the route of antibiotics and severity of infection, only one patient specifically identified that they received intravenous antibiotics and one patient explicitly identified their infection as superficial. When this complication was examined by procedure within the same dataset, only 3.4% (or 13) TH patients had this complication while 8.4% (or 42) of TK patients reported it.

The complications were slightly different in Dataset 3 (n =102). For the TH replacement patients the most common complication was dislocation (1.8%) and blood clots in the lungs (1.8%) while for TK replacement patients infection treated with antibiotics, was the most prevalent complication (4.4%).

Lower infection rates were identified in the literature although the reported rates varied depending on the severity of the infection and whether the patient had TH or TK replacement surgery. In the study by Phillips et al. (2003) the prevalence of deep infections was 0.2% of 58,521 TH patients while a more general overall infection rate in 472 TK patients was reported as 3.0% by Fan, Hung, and Fung (2008). Phillips et al. reported slightly different rates of dislocation and pulmonary embolism in their TH replacement patients (3.9% and 0.9% respectively). The patients in this current study had few complications although the severity of the reported complications was unknown. Data on the type of prophylaxis was also not available. Regardless, either the preventive regimes were very effective or there was a lack of reporting by the patients.

### *The Symptom Experience.*

The symptom experience focuses on the presence and response to the symptoms. Besides being asked about the incidence of certain co-morbidities, patients were also

asked to identify areas where they had pain. In the total sample ( $N = 1,228$ ), 46.9% of patients reported that they had hypertension. It is not surprising that 45.6% of the patients also confirmed that OA or degenerative arthritis other than in their hip or knee was present. Back pain was another co-morbidity commonly listed by 38.2% of the patients. Similar results were seen in the three datasets. These are not surprising results given the age of the patient population.

When patients were asked specifically about pain, the presence of pain was most frequently reported in their hips, knees, and lower back. This was true for the total sample and each of the three individual datasets. Given the impact of arthritic hips and knees and their effect on patients' body alignment and gait these were not unusual findings. These results are supported by Ben-Galim et al. (2007) who identified that OA of the hip can not only lead to abnormal gait and spinal mal-alignment but it is related to lower back pain. Bejek, Paróczai, Illyés, and Kiss (2006) agree and add that OA of the knee also results in abnormal movement in the pelvic and lower extremity joints that leads to lower back pain. The goals of TH replacement surgery are to alleviate pain and to return the normal biomechanics of the joint although unfortunately this is not always accompanied by normal gait (Foucher, Hurwitz, & Wimmer, 2007).

#### *Symptom Management Strategies.*

The symptom management strategies dimension asks pertinent questions about the interventions. The two most prominent questions that are addressed in this study are the 'what' and the 'when'—specifically the TH/TK replacement surgery and the wait for surgery. While the wait for surgery ranged from 0 - 162 weeks in the total sample ( $N = 1,228$ ), the mean wait was 48.4 weeks ( $SD 29.1$ ). Only 11.1% of the delays for TH/TK

surgery were the patients' choice and their reasons for the delays were not reported. When these 11.1% patients were removed from the total sample the mean wait time decreased by 2.3 weeks. It is not known how many of these patients would be classified as either non-urgent or urgent. There are differing recommendations in the literature regarding the timeliness of TH/TK replacement surgery. The WTA (2005) advocates that non-urgent surgery should be performed within 24 weeks of specialist consultation while the WCWL (2005) project reports that the most urgent cases should be done in 4 weeks with the less urgent in 12 weeks. In the total sample of this study only 0.7% of patients had their surgery within 4 weeks, 8.1% had their surgery within 12 weeks, and 26.2 % of patient had their surgery within 24 weeks. The vast majority of the patients (71.4%) did *not* have their surgery performed within even the longest recommended wait time of 26 weeks, which is the Canadian benchmark for TH/TK replacement surgery according to the WTA (2007) and the CIHR (2007). Unfortunately, the patients in this study waited far too long for their joint replacement surgery.

Most of the patients in the study had unilateral TH/TK replacement surgery performed as only 4.0% or 49 patients from the total sample ( $N = 1,228$ ) had bilateral joint surgery performed. The number of bilateral joint surgeries that were performed varied slightly from one dataset to another. The least number of bilateral joints were performed in Dataset 2 (0.7%; 6 patients) while Dataset 1 had the most patients who had bilateral surgery (10.0%; 44 patients). According to the CJRR report (CIHI, 2006) 0.5% or 97 of their patients had bilateral TH replacement surgery and 3.1% or 890 of their patients had bilateral TK replacement surgery. The findings of this study were similar for patients who had either unilateral or bilateral joint replacements performed. Other

researchers have reported similar indistinguishable unilateral or bilateral surgical outcomes in TH patients (Berend et al., 2005) or joint replacement patients (Hashmi, Barlas, Mann & Howell, 2007).

#### *Outcomes.*

The outcomes dimension refers to the symptom status or the resulting situation. The foci or outcomes of this study were QOL and FS of TH/TK replacement patients before and after their surgery. The relationship between the QOL and FS was also examined. Whether a significant change in the QOL and FS was observed or not, was dependent on time points of the observations.

When SF-12 scores (QOL) were compared from 12 months before surgery to 1 month before surgery there were, on average, no significant differences in scores observed between these time points. However, when the scores were compared from 1 month before surgery to 12 months following surgery there were positive significant clinical changes based on SF-12 scores, and these differences varied somewhat by surgery type.

In order to put the results in context, expert opinions were sought regarding clinical significant changes in SF-12 and OHS/OKS and mean SF-12 scores in the Canadian population. Cheang (M. Cheang, personal communication, February 28, 2007) recommends that a significant clinical difference for the MCS and PCS in the SF-12 is 2.7 points. Dawson (J. Dawson, personal communication, February 28, 2007) identifies that clinically significant changes in the OHS/OKS are 2.6 points and 2.65 points respectively. Information was used from the Canadian normative data for the SF-36 (Hopman et al., 2000) to establish cut-off points for the SF-12 scores. Therefore the score



range for average health for the MCS is 53.4 to 54.0 and for the PCS is 46.8 to 47.6. A score less than this range indicates below average health and a score above this range would indicate above average health.

In Dataset 1, based on these parameters, with respect to QOL, the MCS and PCS scores did not show any clinically significant differences between the 12 months prior to surgery and 1 month prior to surgery measurement points. However, in Dataset 2, there were positive clinically significant changes in the physical component of QOL from 1 month prior to surgery to 12 months following surgery with a change in score by 12.3 points. The change in the mental component of QOL for the 1 month prior to surgery to 12 months following surgery was not clinically significant as there was a change in score by only 2.4 points. (*Note.* Means and *SD* for the above MCS and PCS measurements are found in Table 12.)

In Dataset 2 ( $n = 890$ ), the SF-12 scores were also analyzed separately for TH and TK replacement patients. The MCS scores for TH replacement patients showed a positive clinically significant change from the 1 month prior to surgery to the 12 months following surgery with a change in score of 4.3 points but there was not a clinically significant change for the TK patients during the same time frame (change score was 1.1 points). The PCS scores in Dataset 2 ( $n = 890$ ) for this same time period were clinically significant and changed positively for TH/TK replacement patients, when analyzed together over time. When analyzed separately, there were also positive clinically significant changes for both TH and TK replacement patients. The change in scores for TH and TK patients were 14.5 points and 10.7 points respectively. (*Note.* Means and *SD* for the above MCS and PCS measurements are found in Table 13).

When the OHS/OKS were compared from 1 month before surgery to 12 months following surgery there were positive significant clinical changes or functional improvements for the patients. The OHS/OKS improved by 19.4 points. (*Note.* The lower the OHS/OKS, the less perceived difficulty with function and pain). In Dataset 2, there were improvements in the OHS of 22.8 (42.5 to 19.7) and in the OKS of 16.6 (41.3 to 21.9). In other words, there were clinically significant improvements in FS for both the TH/TK replacements.

In summary, patients in this study who had below average mental and below average physical health scores on the SF-12 at 12 months prior to surgery tended to have below average mental health and below average physical health scores at 1 month prior to surgery. There was also a tendency for patients who had below average mental and below average physical health at 1 month preoperatively to have below average mental and below average physical health 12 months following their surgery. Patients who had poor OHS/OKS at 1 month prior to surgery tended to have better OHS/OKS 12 months following surgery. More specifically, in TH replacement patients the mean FS scores from 1 month prior to surgery to 12 months following surgery improved by 22.8 points and for the TH/TK group the scores improved by 19.4 points. These results are supported by several orthopaedic researchers (Fortin et al., 1999; Fortin et al., 2002; Holtzman et al., 2002; Lingard et al., 2004; Röder et al., 2007) who found that preoperative scores predicted postoperative scores.

Based on the above results, there were some clinically significant improvements in patient outcomes (QOL and FS) as identified in this study and measured by the SF-12 and the OHS/OKS respectively. The SF-12 measured clinical improvements in regards to

patients' general and emotional health plus difficulty with activities associated with daily living, work, and social interactions. The OHS/OKS measured outcomes specifically for TH/TK replacement patients, based on pain and difficulty with activities of daily living.

*Research Question 1: What is the impact of the preoperative wait on quality of life and functional status during the wait?*

The SF-12 and the OHS/OKS were used to evaluate QOL and FS in TH/TK patients before their surgery. To answer this first question, data were collected at 12 months prior to surgery (SF-12) and 1 month prior to surgery (SF-12 and OHS/OKS) (Dataset 1, n = 440).

Based on SF-12 scores (QOL) and using the cut-off points from the Canadian normative data for the SF-36 (normal range MCS: 53.4 – 54.0 and PCS: 46.8 – 47.6; Hopman et al., 2000) most patients in Dataset 1, had below average mental health at 12 months prior to surgery. Patients who had below average mental health scores (49.5) on the SF-12 at 12 months prior to surgery were more likely to have below average mental health scores (50.5) at 1 month before surgery. These results echo the findings of Derrett et al., (1999) who found no evidence that QOL worsened during the wait for surgery.

In addition, the patients in this dataset had below average scores (28.3) on physical health 12 months prior to surgery (normal range MCS: 53.4 – 54.0 and PCS: 46.8 – 47.6; Hopman et al., 2000). These patients who had below average physical health scores on the SF-12 at 12 months prior to surgery tended to have below average physical health scores (28.9) at 1 month prior to surgery. Similar results were conveyed by Kelly et al., (2001) when they identified that the wait time did not appear to have a negative

impact on the amount of pain and FS experienced by their patients. Hirvonen et al. (2007) agree and believe that patients who waited longer for their TK replacement surgery did not have worse levels of QOL preoperatively. In contrast, Kili et al. (2003), Mahon et al., (2002) and Ostendorf, Buskens et al. (2004) report that their patients deteriorated and experienced significant clinical losses in health status while waiting for joint replacement surgery.

Using Dataset 1 (n = 440) measurements were taken with the SF-12 at 12 months prior to surgery and 1 month prior to surgery. These measurement points adequately evaluated the preoperative QOL. There was a moderate relationship between the MCS scores at 12 months prior to surgery and 1 month prior to surgery and between the PCS scores at 12 months prior to surgery and 1 month prior to surgery. It was found that most patients had below average mental health at 12 months prior to surgery and they tended to have below average mental health at 1 month prior to surgery. Patients who had below average physical health at 12 months prior to surgery tended to have below average physical health at 1 month prior to surgery.

The length of the wait for surgery had little if any relationship with either the mental or physical health scores. There was little if any relationship between the FS and the wait for surgery with only weak support that patients with poorer FS did not wait as long for surgery as those individuals with better FS.

*Research Question 2: What is the impact of the preoperative wait on quality of life and functional status following surgery?*

The SF-12 and the OHS/OKS were used to evaluate QOL and FS in TH/TK patients before and after their surgery. To answer this second question, SF-12 and OHS/OKS data were collected at 1 month prior to surgery and 12 months following surgery (Dataset 2,  $n = 890$ ). As discussed earlier, information was used from the Canadian normative data for the SF-36 (Hopman et al., 2000) to establish cut-off points for the SF-12 (normal range MCS: 53.4 – 54.0 and PCS: 46.8 – 47.6). Cut-off points were not utilized for the OHS/OKS as was discussed earlier.

It was found that patients who had below average mental health (50.8) at 1 month prior to surgery tended to have below average mental health (53.2) at 12 months following surgery. As far as their physical health, patients who had below average physical health (28.8) 1 month prior to surgery were likely to have below average physical health (41.1) at 12 months following surgery. By contrast, patients' FS scores tended to improve by 19.4 points (41.3 to 21.9) as those patients with poorer FS scores at 1 month prior to surgery tended to have higher FS scores at 12 months following their surgery.

There was a low but significant relationship between the mental health scores at 1 month prior to surgery and 12 months following surgery and physical health scores at 1 month prior to surgery and 12 months following surgery. The findings from this current research have demonstrated that preoperative health, mental health in particular, predicted postoperative health outcomes. Both Fortin et al. (1999) and Fortin et al. (2002) verified that TH/TK patients' preoperative health status predicted their postoperative health status. Röder et al. (2007) found similar results as TH patients who had poor preoperative walking capacity and hip flexion were less likely to obtain the best possible

mobility and movement outcomes postoperatively. Hajat et al. (2002), Holtzman et al. (2002), Nilsson and Lohmander (2002), Ostendorf, Buskens, et al. (2004), and Lingard et al. (2004) concluded that those patients with poorer health status scores before surgery continued to have poorer health status scores after surgery.

The influence of waiting on QOL and FS lead to mixed results. Little or no relationship existed between how long the patients waited and their mental and physical QOL scores and FS scores at 12 months following their surgery (Dataset 2, n = 890). On the contrary, some researchers have found that longer wait times were associated with poorer outcomes while others found that shorter wait times were associated with better post-surgical outcomes. Hajat et al. (2002) stated that waiting for surgery is associated with worse outcomes following surgery. Ahmand et al. (2007) concur that patients who waited the longest had the biggest negative change in their FS scores.

*Research Question 3: What is the relationship of quality of life to functional status over time?*

The SF-12 and the OHS/OKS were used to evaluate QOL and FS in TH/TK patients before and after their surgery. To answer this third question, SF-12 data was collected at 12 months prior to surgery, and SF-12 and OHS/OKS data were collected at 1 month prior to surgery, and 12 months following surgery.

No previous studies that examined the relationship of QOL to FS over time in TH/TK replacement patients could be found. This study's novel approach was to be able to examine that relationship longitudinally. With the use of the GLM also known as a repeated measures analysis of variance with covariates, adjustments were made for the

covariates of PCS, MCS, OHS/OKS, wait time, and type of procedure as applicable in the analysis. The relationship of QOL to FS over time was explored with the GLM by using two different approaches. In the first approach the relationship of QOL to FS was examined from 1 month prior to surgery to 12 months following surgery (Dataset 2,  $n = 890$ ) whereas the second approach explored the relationship of QOL to FS from 12 months prior to surgery, 1 month prior to surgery to 12 months following surgery (Dataset 3,  $n = 102$ ).

Using the first approach ( $n = 890$ ), it was determined that there was a significant increase in the mental health (mean change = 3.13,  $SD = .24$ ) of TH replacement patients from 1 month prior to surgery to 12 months following surgery. A change of 2.7 points has been identified as being clinically significant (M. Cheang, personal communication, February 28, 2007). Physical health scores and FS scores also increased significantly for both TH (mean change = 12.85,  $SD = .25$ ) and TK (mean change = 12.63,  $SD = .22$ ) replacement patients with the greatest improvement seen in TH patients where a change of 2.7 points is regarded as clinically significant (M. Cheang, personal communication, February 28, 2007). Clinically these results make sense as one would expect patients to recuperate and see improvement in their physical health and FS following surgery. Since the OHS/OKS were not collected from patients at 12 months prior to their surgery, only two collection points (1 month prior to surgery and 12 months following surgery) were involved in this analysis. The advantage to using Dataset 2 ( $n = 890$ ) was that it provided a large dataset so that the means could be adjusted for covariates and there would still be adequate numbers for analysis. Having a large dataset also added strength to the findings so that generalizations could be made to other similar patient populations. Although

Dataset 2 had 890 patients not all patients had data for all measurements, therefore the number of patients in the analysis varied depending on the available data. Even though the number of patients changed there was still an adequate number of patients to do the analysis.

The second approach examined the relationship of QOL to FS over three data points (12 months prior to surgery, 1 month prior to surgery, to 12 months following surgery) ( $n = 102$ ). The mental health change scores demonstrated significant improvement when the TH and TK replacement patients were examined together over all three measurement points. When physical health scores were studied there was a significant improvement but the change in scores was only statistically significant from 1 month prior to surgery to 12 months following surgery and 12 months prior to surgery to 12 months following surgery. The greatest improvement in physical health was seen in the TH replacement patients who tended to have a greater rate of change from 1 month prior to surgery to 12 months following surgery (mean change = 14.37,  $SD = .52$ ). Clinically these results make sense as one would expect to see an improvement in physical health from 1 month prior to surgery and 12 months following surgery as a consequence of the joint replacement surgery. The goals of joint replacement surgery include the significant reduction of pain and disability which in turn lead to better QOL and FS (CIHI, 2006). Although this sample size was considerably smaller ( $n = 102$ ), the strength of this second approach for this question is that these patients had longitudinal data from all of the three measurement points. These patients actually moved across the continuum.



### Limitations of the Study

Since this was a retrospective study, the major limitations were not within the control of the researcher. The foremost limitation was that the researcher did not have input into what data was collected nor the timing of its collection. A more complete picture of the patient population could have been examined if additional demographic (or person factors) information had been gathered such as: level of education, socioeconomic background, type of housing and type of employment. This demographic information would have given a more thorough description of the total sample of this study.

Additional information could have been collected in regards to the presence of additional risk factors. The identification of more risk factors would have provided further information regarding the patients' health and illness domain. Data regarding health risk factors such as patients' smoking and alcohol histories would have provided further information about patients' predisposition for various illnesses that could have effected the trajectory of their postoperative recovery.

The timing of the collection of the data refers to the drawback that the OHS/OKS were not administered to the patients at 12 months prior to surgery. The inclusion of this data would have allowed for a more inclusive examination of FS across the extreme measurement points (from 12 months before surgery to 12 months following surgery). Further analysis of the relationship between QOL and FS could have been investigated from 12 months prior to surgery, 1 month prior to surgery to 12 months following surgery.

Another limitation of the study is that at 12 months after surgery, the patients reported their postoperative complications but the information was not verified with the

patients' physicians or patients' health records. The researcher had no way to validate the complications as the data was provided to the researcher in an unidentifiable format. Given the reported significance of complications on outcomes (Rahme et al., 2008) the development of some type of validation reporting mechanism could lend greater predictive strength to future studies.

One further limitation of the study relates to the 12 months prior to surgery measurement point. It is important to remember that these individuals had been placed on a waiting list for joint replacement surgery perhaps because they were struggling with some form of impaired health already. Their impairment lead them to see an orthopaedic surgeon who in turn decided that they were suitable for surgery. It could be argued that the reason that further decline was not seen from the 12 months prior to surgery to 1 month prior to surgery measurement points was because their mental and physical health scores were already below average. This could be referred to as a 'floor effect' in the data. Other researchers have reported no ceiling and floor effects for the SF-12 (Dunbar et al., 2001) and few ceiling effects and no floor effects for the OHS (Ostendorf, Buskens et al., 2004). It is interesting to also note that these patients had a lengthy wait time that had a large *SD* so there was a lot of variability within the reported wait times. In other words, the patients were already suffering from declining mental and physical health, they had a lengthy wait for surgery, and further deterioration may not have been captured by the measurement tools. Even though there were some limitations to the current study there were many positive aspects to the research that added strength to the findings.

### Strengths of the Study

There are numerous strengths that can be identified in the current research study. The major strength is the focus on patients' perceptions. All data was self-reported with the patients using the SF-12, the OHS/OKS, a medical/musculoskeletal co-morbidity questionnaire, and based on questions asking about their complications and satisfaction with their surgery.

Another obvious strong point of this study was that this study examined QOL longitudinally. QOL and FS were examined not only over time but in relation to each other. This study's novel approach to the examination of these variables was done with the use of three approximate individual measurement points. Both QOL and FS were examined at 1 month prior to surgery and 12 months following surgery therefore their relationship to each other and a comparison with the baseline measures of the SF-12 and the OHS/OKS as well as wait time was performed. This provided the opportunity to determine the degree to which the outcomes changed over time and their influence on each other.

An extremely positive aspect of the study was that the major instruments that were chosen are standardized tools. Both the SF-12 (Luo et al., 2003) and the OHS/OKS (Suk et al., 2005) are psychometrically sound and have been used extensively with these patient populations (Dawson et al., 1996; Dawson et al., 1998; Ostendorf, Buskens et al., 2004). This enabled comparisons of the study findings to other previous research findings. The data were also easy to analyze as the SF-12 provided two summary scores (mental and physical) while the OHS/OKS each yielded one summary score.

There was a large total sample ( $N = 1,228$ ) with three measurement points that helped form the three datasets. The total sample included 528 TH patients and 700 TK patients. This provided the opportunity to compare and contrast these two patient groups along a number of study parameters. For example, differences in the rate of change in the levels of QOL and FS were investigated. There was a large amount of data which provided an adequate number of patient records in each dataset to perform the necessary statistical analysis. This allowed for adequate statistical power for the study and therefore these results can be generalized to other similar TH and TK replacement patient populations. Even though there were limitations to this study, the strengths definitely outweigh the inadequacies of the study and provide a strong foundation to the study's methodology, findings, and recommendations.

#### Implications for Practice

To care for orthopaedic patients, health care professionals must be cognizant of the altered QOL and FS that the patients experience before and after their TH/TK replacement surgery. The burden of arthritis can be detrimental to many aspects of patients' lives; therefore as clinicians we can assist patients to optimize their health prior to surgery as this will ultimately affect their postoperative outcomes. It is crucial that care providers realize that differences exist between various types of lower limb arthroplasty patients. Not only do differences exist between the characteristics of these patient populations but their postoperative course and rate of improvement vary. Nurses with advanced education can play a critical role in assisting TH/TK patients as they move through their perioperative trajectory.

The implications for nursing practice centre on three major areas: assessment and intervention, shortening waitlists, and education. Firstly, if patients are noted to have below average mental and physical health-related QOL at 12 months prior to surgery, healthcare providers should be proactive and intervene. Once additional mental and physical assessment is completed, advanced practice nurses can provide the necessary assistance to help meet patients' needs. These interventions may include consults for various services such as homecare equipment, additional help in their homes, or assistance with transportation. Assessment and therapy from physiotherapists and occupational therapists assists patients by aiding with ambulation, muscle strengthening, and functional assistance with activities of daily living. Patient counselling for mental health issues and the use of community resources such as support groups for seniors also can help address mental health issues. Early identification of patients with lower mental and physical health is critical as if the trend continues their lowered mental and physical health will continue across the spectrum into their postoperative phase.

Secondly, we need to facilitate surgery for those patients especially with lower FS prior to surgery. Wait list initiatives continue to be discussed within provincial and national governments and as Canadians we need to be supportive and voice our concerns. If patients with lower FS have their surgery in a timely manner, they may have improved FS outcomes postoperatively. Resources need to be in place so that patients know who to call if their FS is worsening and a date for surgery is still unknown. Orthopaedic nurses have an important role to play with wait list initiatives.

Thirdly, this study reinforces the need for patient and health care professional education. Clinical nurse specialists can participate in educational programs for patients

and other health care professionals. If patients have misconceptions regarding what their TH/TK surgery can do for their mental and physical health we need to discuss the expected outcomes of surgery with them. Clinicians not only need to be aware of the clinical trajectory that TH/TK face as they wait for their surgery but they should be alert to patients' declining mental and physical health.

#### Recommendations for Further Research

Several recommendations can be made for further research with TH/TK replacement patients using the SMM to guide the study. Although the SMM is quite new it was an excellent choice for this research and it would be appropriate for future studies with orthopaedic patients. The use of the model domains and dimensions assisted the researcher to obtain insight into the QOL and FS of these patients.

There are numerous recommendations for future research that centre on the model domains and dimensions. For instance, potential studies could investigate the relationships between the person factors of age, gender, BMI, type of surgery, and the surgical involvement (i.e. unilateral versus bilateral). Once the political environment is investigated further, there may be justification to add it to the SMM as a type of environment. Additional relationships that could be tested include the interaction between age and the symptom experience as well as the effect of co-morbidities on outcomes. Other areas that require attention include the relationship between gender and pain plus the costs associated with symptom management for TH/TK replacement patients.

This study could also be repeated with the SF-12 and OHS/OKS administered at all three measurement points: 12 months prior to surgery, 1 month prior to surgery, and 12 months following surgery. A qualitative component to a future study could provide an

interesting aspect to the study of TH/TK replacement patients. An interview with several open-ended questions would allow patients to discuss their QOL and FS and the resulting effect on their lives.

Future research could also take another direction in that it could investigate the various aspects of care such as the indication for surgery, the type of prosthesis used, the type of surgical approach, or whether regional clinical pathways were being utilized. The relationship between these factors and patients' QOL and FS would be an excellent focus for a future study because it would demonstrate to practitioners how their patient care decisions impact patient outcomes. Additional comparisons could also be made between TH and TK replacement patients as these two patient groups are very distinct. These datasets were rich with information about TH/TK replacement patients' perceived QOL and FS and this current research has only begun to explore what *could* be studied.

### Conclusion

In returning to the three research questions that were stated at the onset of this study, the results from this study suggest that perceived general mental and physical QOL are different from perceived FS for TH/TK replacement patients. There were positive clinically significant changes in physical health from 1 month prior to surgery to 12 months following surgery however there were only positive clinically significant changes in mental health for TH patients. When FS was examined during the same time period there were clinically significant changes for both TH and TK replacement patients.

Patients who reported below average mental and physical health at 12 months prior to surgery tended to report below average mental and physical health at 1 month prior to surgery, and 12 months following surgery. Therefore, if patients were struggling

with below average mental or physical health when they were placed on the waiting list, the struggle may persist and the trend may continue across the spectrum. Mental health was a slightly stronger predictor than physical health across the three data measurement points. When patients were placed on the waiting list, they were *already* in a severely compromised state of impairment therefore the relationships between the wait and QOL and FS require further research as other factors may be influencing the wait for surgery.

When the relationship between QOL to FS was explored, TH patients had higher mental health, physical health, and FS when compared to TK patients. TH patients demonstrated the greatest increase and tended to have the greatest rate of improvement with their physical health.

This was the first study that examined the QOL and FS of TH/TK patients guided by the SMM. The use of the domains and dimensions was beneficial in framing the research and reporting the findings. It provided a longitudinal exploration of TH/TK replacement patients across the wait period and postoperatively. Insights were gained into the changes in QOL and FS throughout their surgical trajectory. This study has contributed to health outcomes research and the body of knowledge regarding the QOL and FS of TH/TK patients before and after their surgery.

Chapter one provided a statement of the problem that included background information on the health problem, the orthopaedic health care climate, and current wait time initiatives. The significance of the clinical problem and the gap in knowledge was also discussed. The domains and dimensions of the SMM were reviewed as well as the appropriateness of the SMM for the study. The chapter concluded with definitions of the study variables and the assumptions of the study. The second chapter concentrated on a



review of the current literature by focusing on the symptom experience or arthritis, health status, the wait for surgery, and outcomes of QOL and FS. The third chapter provided an overview of the research design that included the sample, setting, sampling procedures, and study procedures. The chapter concluded with a detailed review of the SF-12 and OHS/OKS. Chapter four referred to the data analysis regarding the sample characteristics and the three research questions. Chapter five has concluded with a discussion of the theoretical framework, the study's major findings in relation to previous relevant research, the strengths and limitations of the study, implications for practice, and recommendations for further research.

Yearly, many individuals undergo TH/TK replacement surgery to improve their QOL and FS and fortunately the wait for surgery is steadily decreasing with median waits at 20 weeks (Manitoba Health, 2008a) and 26 weeks for TH/TK respectively as of May 2008 (Manitoba Health, 2008b). This study provided an exploration of QOL and FS of TH/TK replacement patients. Findings support that FS is significantly impaired across the wait for surgery. Furthermore, early interventions, including those targeting patients with mental and physical health concerns may enhance patient QOL and their preoperative trajectory.

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## Appendix A. Patient Information Sheet and Consent Form

**WRHA**Winnipeg Regional  
Health Authority    Office régional de la  
santé de Winnipeg**Joint Replacement Registry****PATIENT INFORMATION SHEET AND CONSENT FORM****What is the Joint Replacement Registry (JRR)?**

You can help your orthopaedic surgeon improve the quality of hip and knee replacement surgeries in Manitoba. The Winnipeg Regional Health Authority (WRHA) has launched a registry to capture information on hip and knee replacement surgery. This effort is supported by the orthopaedic surgeons in Manitoba.

The main purpose of the registry is to help orthopaedic surgeons in Manitoba gather information about joint replacement surgeries in order to improve patient outcomes. Specifically, the registry will provide information on particular implants, the most appropriate surgical methods for these surgeries, long-term outcomes and how adverse events might be minimized.

Final Version Dec 14, 2004

**You Can Help Provide Important Information**

We hope that you agree to participate in the Registry by signing the attached patient consent form. If you agree, information such as the type of implant used, the hospital in which the surgery was done and any treatments used to prevent infection or other types of complications will be collected and sent to the registry. We will also be forwarding your name, date of birth, sex, provincial health care number, patient chart number, admission and discharge dates to the Registry. This information is important in case your surgeon needs to contact you in the future as a result of the knowledge gained through the Registry and so we can link your surgery data with your hospital stay data. The time from your decision to proceed with surgery to the actual date it is performed is also very significant. Therefore these dates will be sent to the WRHA Joint Replacement Registry as well.

Additionally, we will ask you to complete health questionnaires before the operation and afterwards, on a yearly basis. Your answers to these questionnaires will be stored in the WRHA registry, and will provide information on the effectiveness of joint replacement surgery.

### **Quality Improvement and Research**

For quality improvement, research and statistical purposes, the type of implant, surgical technique and identifying information that is collected through the WRHA Registry will also be sent to the Canadian Joint Replacement Registry at the Canadian Institute for Health Information. This information may also be linked to other data sources in Manitoba, the Canadian Institute for Health Information, Statistics Canada, and Health Canada.

In addition to providing quality reports on joint replacement surgeries, the WRHA and Canadian Joint Replacement Registry data may be used in publications in scholarly journals or presentations at professional meetings. Names, addresses, or other identifiers will not be revealed in publications or presentations and patient's confidentiality will be protected. All the information in the Registries will be maintained in a secure setting that can only be accessed by

authorized members of the WRHA Joint Replacement Registry and the Canadian Institute for Health Information. You may keep this information sheet for your records. Your choice to participate in these registries will not affect the treatment you receive. You may revoke this consent at any time by contacting the Orthopaedic Coordinator.

If you have any questions about these Joint Replacement Registries, please call the Orthopaedic Coordinator at 1-866-849-3517.

### **About the Canadian Institute for Health Information (CIHI)**

The Canadian Institute for Health Information is an independent national, not-for-profit organization responsible for coordinating the development and maintenance of a comprehensive and integrated approach to health information. To this end, CIHI provides accurate and timely information that is needed to establish sound health policies, manage the Canadian health system effectively and create public awareness of the factors affecting good health. CIHI was established in 1994 by Canada's health ministers.

### **About Statistics Canada**

Statistics Canada is authorized under the Statistics Act to collect, compile, analyse, abstract and publish statistics related to the health and well-being of Canadians. The Health Statistics Division's primary objective is to provide statistical information and analysis about the health of the population, determinants of health, and the scope and utilization of Canada's health care sector.



Winnipeg Regional Health Authority  
Office régional de la santé de Winnipeg

### JOINT REPLACEMENT REGISTRY CONSENT FORM SIGNATURE PAGE

I have read this form and/or have had it explained to me by my orthopaedic surgeon or his/her delegate. I understand the reasons for the WRHA and Canadian Joint Replacement Registries and what they hope to achieve in terms of quality improvement and research into hip and knee replacement surgery as described in the information sheet.

I agree to allow the following information to be submitted to the WRHA Joint Replacement Registry (JRR) at the time of surgery: my name, address, sex, date of birth, provincial health care number, patient chart number, date of surgery, how long I waited for surgery, which joint was replaced, the type of implant used, information on my general health, information about my procedure and treatments used to prevent complications, and information from the questionnaires. I understand that the WRHA JRR will contact me after my surgery to ask me about my progress and to send me questionnaires to complete and return. I also understand that I may withdraw my permission at any time as outlined in the information sheet.

I understand that most of this information will also be given to the Canadian Joint Replacement Registry (CJRR) that is managed by the Canadian Institute of Health Information. I also understand that I may withdraw my permission at any time as outlined in the information sheet.

Patient Last Name (Please Print)

Patient First Name (Please Print)

Patient Signature \_\_\_\_\_

 / 
  / 
 

D D / M M / Y Y Y Y

**JOINT REPLACEMENT REGISTRY**

## Appendix B. SF-12



Winnipeg Regional  
Health Authority    Office régional de la  
santé de Winnipeg

## WRHA Joint Replacement Registry

Your Health and Well-Being

Today's Date

Day    Month    Year

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. *Thank you for completing this survey!*

For each of the following questions, please mark an ☒ in the one box that best describes your answer.

1. In general, would you say your health is:

Excellent	Very good	Good	Fair	Poor
▼	▼	▼	▼	▼
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

2. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
	▼	▼	▼

a. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf..... ☐ 1 ..... ☐ 2 ..... ☐ 3

b. Climbing several flights of stairs..... ☐ 1 ..... ☐ 2 ..... ☐ 3



3. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
• <u>Accomplished less</u> than you would like .....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
• Were limited in the <u>kind</u> of work or other activities .....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

4. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
• <u>Accomplished less</u> than you would like .....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
• Did work or other activities <u>less carefully than usual</u> .....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

5. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5


6. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks...

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Have you felt calm and peaceful? .....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
b. Did you have a lot of energy? .....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
c. Have you felt downhearted and depressed? .....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

7. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

## Appendix C. Oxford-12 Hip/Oxford-12 Knee


 Winnipeg Regional Health Authority    Office régional de la santé de Winnipeg  
**WRHA**  
**Joint Replacement Registry**

**Problems with your Hip**  
During the past 4 weeks...

✓ tick one box for every question.

Today's Date  
Day    Month    Year

1. During the past 4 weeks.....  
How would you describe the pain you usually had from your hip?

☐ 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 hip?

☐ No trouble at all      ☐ Very little trouble      ☐ Moderate Trouble      ☐ Extreme Difficulty      ☐ Impossible to do so

3. During the past 4 weeks.....  
Have you had any trouble getting in and out of a car or using public transport (whichever you tend to use) because of your hip?

☐ No trouble at all      ☐ Very little trouble      ☐ Moderate Trouble      ☐ Extreme Difficulty      ☐ Impossible to do so

4. During the past 4 weeks.....  
Have you been able to put on a pair of socks, stockings or tights?

☐ Yes, Easily      ☐ With Little Difficulty      ☐ With Moderate Difficulty      ☐ With Extreme Difficulty      ☐ No, Impossible

5. During the past 4 weeks.....  
Could you do household shopping on your own?

☐ Yes, Easily      ☐ With Little Difficulty      ☐ With Moderate Difficulty      ☐ With Extreme Difficulty      ☐ No, Impossible

Version 1 June 24, 2004

<p>6. During the past 4 weeks.....</p> <p>For how long have you been able to walk before <u>pain from your hip</u> becomes severe? (with or without a cane)</p>				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No pain / More than 30 minutes	16 - 30 minutes	5 - 15 minutes	Around the house <u>only</u>	Not at all - pain severe on walking
<p>7. During the past 4 weeks.....</p> <p>Have you been able to climb a flight of stairs?</p>				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yes, Easily	With Little Difficulty	With Moderate Difficult	With Extreme Difficulty	No, Impossible
<p>8. During the past 4 weeks.....</p> <p>After a meal (sat at a table), how painful has it been for you to stand up from a chair <u>because of your hip</u>?</p>				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not at all painful	Slightly painful	Moderately painful	Very painful	Unbearable
<p>9. During the past 4 weeks.....</p> <p>Have you been limping when walking <u>because of your hip</u>?</p>				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rarely / Never	Sometimes, or just at first	Often, not just at first	Most of the time	All of the time
<p>10. During the past 4 weeks.....</p> <p>Have you had any sudden, <u>severe</u> pain - 'shooting', 'stabbing' or 'spasms' - <u>from the affected hip</u>?</p>				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No days	Only 1 or 2 days	Some days	Most days	Every day
<p>11. During the past 4 weeks.....</p> <p>How much has <u>pain from your hip</u> interfered with your usual work (including housework?)</p>				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not at all	A little bit	Moderately	Greatly	Totally
<p>12. During the past 4 weeks.....</p> <p>Have you been troubled by <u>pain from your hip</u> in bed at night?</p>				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No nights	Only 1 or 2 nights	Some nights	Most nights	Every night



Winnipeg Regional Health Authority  
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## WRHA Joint Replacement Registry

### Problems with your Knee

During the past 4 weeks...

✓ tick one box  
for every question.

Today's Date

Day Month Year

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

How would you describe the pain you usually had 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 so

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

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

☐

No trouble  
at all

☐

Very little  
trouble

☐

Moderate  
Trouble

☐

Extreme  
Difficulty

☐

Impossible  
to do so

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 cane)

☐

No pain /  
More than  
30 minutes

☐

16 - 30  
minutes

☐

5 - 15  
minutes

☐

Around the  
house only

☐

Not at all  
- pain severe  
on 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

## 7. During the past 4 weeks.....

Could you kneel down and get up again afterwards?

☐Yes,  
Easily☐With Little  
Difficulty☐With Moderate  
Difficult☐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 household shopping on your own?☐Yes,  
Easily☐With Little  
Difficulty☐With Moderate  
Difficult☐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  
Difficult☐With Extreme  
Difficulty☐No,  
Impossible

## Appendix D. Co-morbidities, Complications, and Satisfaction



Winnipeg Regional Health Authority  
Office régional de la santé de Winnipeg

## WRHA Joint Replacement Registry

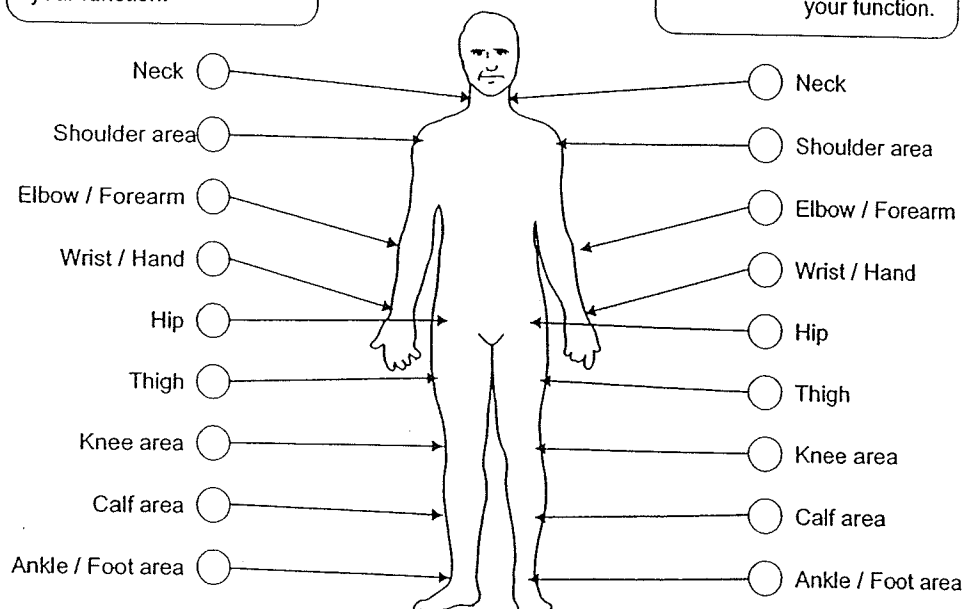
### Medical History

<b>Your Gender</b> <input type="radio"/> MALE <input type="radio"/> FEMALE	<b>What is your weight?</b> _____ POUNDS or _____ KILOGRAMS	<b>What is your height?</b> _____ FEET/INCHES or _____ CM	<b>Today's Date</b> _____ Day _____ Month _____ Year
--	---	---	---

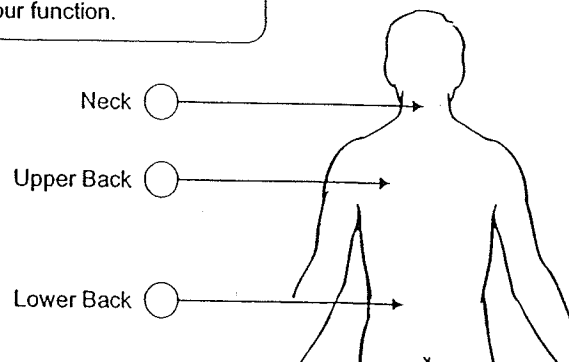
Place a check mark in the box if you have the condition.	If you have the condition, does it limit any of your activities?
Heart Disease <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
High Blood Pressure <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Lung Disease <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Diabetes <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Ulcer or Stomach Disease <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Kidney Disease <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Liver Disease <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Anemia or Other Blood Disease <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Cancer <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Depression <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Osteoarthritis or Degenerative Arthritis other than your hip or knee <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Back Pain <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Rheumatoid Arthritis <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
Other Medical Problem Please specify: _____ <input type="radio"/> YES I have this condition	<input type="radio"/> YES it limits my activities <input type="radio"/> It does NOT limit my activities
<input type="radio"/> I do not have any of the medical conditions listed above.	

For your right side please indicate those areas that bother you enough to limit your function.

For your left side please indicate those areas that bother you enough to limit your function.



For your back please indicate those areas that bother you enough to limit your function.







## W R H A Joint Replacement Registry



Winnipeg Regional  
Health Authority    Office régional de la  
santé de Winnipeg

### Annual Questions

During the past year, did you have any of the following problems with your RIGHT KNEE replacement?

Please Check One:

Dislocation of your Right Knee requiring treatment in hospital    ☐ Yes   ☐ No   ☐ Don't know

Blood clot in the calf ("DVT") requiring treatment    ☐ Yes   ☐ No   ☐ Don't know

Blood clot in the lungs requiring treatment    ☐ Yes   ☐ No   ☐ Don't know

Infection of your Right Knee requiring oral or IV antibiotics    ☐ Yes   ☐ No   ☐ Don't know

Infection of your Right Knee requiring further surgery    ☐ Yes   ☐ No   ☐ Don't know

Further surgery for problems with your Right Knee replacement    ☐ Yes   ☐ No   ☐ Don't know

If you answered yes to any of these questions, when and where did you receive treatment?

When (date):

Where (ex hospital, doctor's office):



**WRHA**  
**Joint Replacement Registry**



Winnipeg Regional Health Authority  
Office régional de la santé de Winnipeg

**Annual Questions**

All the following questions in this booklet are pertaining to this Surgery.

**What is your overall satisfaction with your RIGHT KNEE Surgery?**

\_\_\_ Very satisfied

\_\_\_ Satisfied

\_\_\_ Neutral (neither satisfied nor unsatisfied)

\_\_\_ Unsatisfied

\_\_\_ Very unsatisfied