

# **Focus on Tomorrow**

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## **Does Surgical Setting or Wait-time Incentive Improve Return to Work Following Knee Surgery among Injured Workers**

November 2009

Principal Investigator/Applicant  
Mieke Koehoorn

RS2006-OG14



WORKING TO MAKE A DIFFERENCE

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**Final Report to WorkSafeBC**

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# Table of Contents

<b>TABLE OF CONTENTS.....</b>	<b>3</b>
<b>1 MAIN RESEARCH FINDINGS (BULLETED POINTS).....</b>	<b>4</b>
<b>2 EXECUTIVE SUMMARY .....</b>	<b>5</b>
<b>3 RESEARCH PROBLEM/CONTEXT .....</b>	<b>7</b>
3.1 INTRODUCTION .....	7
3.2 BURDEN OF MUSCULOSKELETAL DISORDERS .....	7
3.3 KEY RESEARCH QUESTIONS.....	8
3.4 BACKGROUND.....	9
<b>3.4.1 Research on Private versus Public Health Care .....</b>	<b>9</b>
<b>3.4.2 Research on Wait Time for Musculoskeletal Surgeries .....</b>	<b>10</b>
<b>3.4.3 Research on Work Disability (Workers' Compensation) Outcomes .....</b>	<b>11</b>
<b>3.4.4 Covariates for Work-related Disability Outcomes.....</b>	<b>12</b>
<b>4 METHODS.....</b>	<b>13</b>
4.1 WORKERS' COMPENSATION STUDY SAMPLE .....	13
4.2 DATA SOURCES .....	13
<b>4.2.1 Workers' Compensation Data .....</b>	<b>13</b>
4.3 OUTCOMES.....	14
4.4 KEY EXPLANATORY VARIABLES.....	15
4.5 COVARIATES .....	16
4.6 ANALYSES.....	17
<b>4.6.1 Descriptive Analysis.....</b>	<b>17</b>
<b>4.6.2 Multivariable Analysis.....</b>	<b>17</b>
4.7 ETHICAL APPROVAL AND DATA SOURCE ACCESS.....	18
<b>5 RESULTS .....</b>	<b>19</b>
5.1 STUDY SAMPLE.....	19
5.2 DESCRIPTIVE CHARACTERISTICS.....	20
5.3 STUDY OUTCOMES.....	23
<b>6 DISCUSSION.....</b>	<b>27</b>
6.1 STRENGTHS AND LIMITATIONS .....	30
<b>7 IMPLICATIONS FOR FUTURE RESEARCH.....</b>	<b>31</b>
<b>8 POLICY AND PREVENTION.....</b>	<b>32</b>
8.1 POLICY/PREVENTION IMPLICATIONS .....	32
8.2 RELEVANT USER GROUPS .....	32
8.3 POLICY-RELATED INTERACTIONS.....	33
<b>9 DISSEMINATION &amp; KNOWLEDGE TRANSFER.....</b>	<b>33</b>
<b>10 ACKNOWLEDGEMENTS.....</b>	<b>45</b>
<b>11 REFERENCES .....</b>	<b>46</b>

## **1 MAIN RESEARCH FINDINGS (BULLETED POINTS)**

- Among the study sample of injured workers undergoing knee meniscectomy or meniscal repair surgery, a workers' compensation-paid incentive fee to expedite the surgery reduced the wait-time between last surgical consult and surgery date. The median wait time, adjusted for age, gender, wage and health authority, was 22 and 24 calendar days among injured workers undergoing expedited surgeries (in public hospitals and private clinics respectively), compared to 37 calendar days among injured workers undergoing non-expedited surgeries in public hospitals (or a difference of approximately 2 work weeks).
- Among the same study sample, the adjusted, median time to return-to-work from surgery was 58 and 60 days for knee surgeries in a public hospital (non-expedited and expedited respectively), compared to 66 days for expedited knee surgeries in a private clinic (or a difference of approximately 1 work week).
- The overall pattern of findings described above remained the same after comparing different sub-groups of the study sample distribution (i.e. different quintiles of the distribution of wait time days and return-to-work days). The expedited groups consistently had shorter surgery wait times for individuals in the 50<sup>th</sup> and 75<sup>th</sup> percentiles of the wait-time distribution; and the public non-expedited group consistently had shorter return-to-work times from surgery across individuals in the 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> percentiles although these differences were not statistically significant at conventional levels.

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## **2 EXECUTIVE SUMMARY**

Introduction: In an effort to reduce surgery wait time and disability time for injured workers, WorkSafeBC (the Workers' Compensation Board of British Columbia) pays higher fees for surgeries in private clinics as well as fees for surgeries performed within 21 days of surgical consult regardless of private or public setting. The purpose of this project was to investigate the effect of expedited status (yes versus no) and surgical setting (private clinic versus public hospital) on surgery wait time (defined as last surgical consult date to surgery date) and return-to-work time (defined as surgery date to first return-to-work date within the year).

Methods: A study sample of 1,380 injured workers with an accepted time-loss claim for a knee injury who underwent meniscectomy day surgery (surgery that does not require an overnight stay at the hospital or clinic) between 2001 and 2005 were identified from WorkSafeBC data and included in the analysis. The study sample included three groups: expedited, private clinic surgeries (n=574); expedited, public hospital surgeries (n=568); and non-expedited, public hospital surgeries (n=238). Descriptive statistics investigated differences in baseline characteristics and median differences in surgery wait time and return-to-work time, by surgical setting and expedited status. Quantile regression, adjusted for clustering at the level of the surgeon with 1000 bootstrap replications, investigated differences in the median surgery wait days and return-to-work days for the 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> percentiles of the distribution, adjusted for socio-demographic, occupational and co-morbidity variables.

Results: The three study groups defined by surgical setting and expedited status did not differ statistically by mean age at time of surgery, mean wage at time of injury, percentage women, or pre-existing co-morbidities. The median, adjusted surgery wait was 22 and 24 calendar days for expedited

public and private surgeries respectively, compared to 37 days for non-expedited public surgeries. The median, adjusted return-to-work time was 58 and 60 calendar days for public surgeries (non-expedited and expedited respectively), compared to 66 days for expedited private surgeries. In the quantile regression analysis, the median difference in surgery wait time was 12.5 and 14 days less for the expedited surgeries (private and public respectively) compared to the non-expedited surgeries among individuals in the 50<sup>th</sup> percentile of the distribution. The median difference in return-to-work time was 4 and 6 days more for expedited surgeries (public and private respectively) compared to the non-expedited public surgeries for individuals in the 50<sup>th</sup> percentile of the distribution.

Conclusion: The expedited fee paid by WorkSafeBC reduced the surgery wait time among injured workers undergoing meniscal knee surgery regardless of surgical setting, although the difference in surgery wait time was not as large as anticipated with a difference of approximately 2 work weeks between the expedited and non-expedited groups. Following surgery, there was no statistical difference in return-to-work time by expedited status or clinic setting, but the public non-expedited group tended to return earlier by about 1 work week. A reduction in total disability time for injured workers has relevance for quality of life measures, but the difference in surgery wait time does not appear to affect the return-to-work or recovery window following surgery. This present study was an epidemiological investigation of the effect of surgical setting and incentive payment on wait times and return to work outcomes. Future research should focus on whether providing incentive fees to surgeons and funding surgeries in private clinics represents good economic value to WorkSafeBC compared to funding non-expedited surgeries in public hospitals. Further, the added cost of surgeries performed in private clinics given equal or more favourable outcomes for surgeries performed in public hospitals also warrants future cost benefit analyses.

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### **3 RESEARCH PROBLEM/CONTEXT**

#### **3.1 Introduction**

In an effort to decrease wait time and disability time, workers' compensation systems in Canada pay additional surgical fees to reduce wait time (e.g. expedited fees) and pay (higher fees) for surgeries performed in private clinics. In British Columbia, WorkSafeBC (the Workers' Compensation Board of British Columbia) began paying for surgeries for work-related musculoskeletal injuries in private clinics effective 1996 and providing payments for expedited surgical care effective 2001. Expedited is defined in BC as surgeries performed within 21 days of approval for surgery and where a higher fee is paid for hospital and surgeon services by the workers' compensation system. In 2004 for example, WorkSafeBC paid \$3,865 for an expedited knee surgery performed in a private clinic compared to \$1,150 for a non-expedited knee procedure in a public hospital, representing a three-fold increase in facility, surgical and anaesthetists' fees. The expedited financial incentive and the use of private clinics were established to reduce wait time, thereby reducing claim duration and total claim costs. The purpose of this study was to investigate the effect of expedited status (yes versus no) and surgical setting (private clinic versus public hospital) on surgery wait time and return-to-work time outcomes among a sample of injured workers.

#### **3.2 Burden of Musculoskeletal Disorders**

The current project focuses on a sample of injured workers with an accepted time loss claim for a knee injury and who underwent knee meniscectomy or meniscal repair surgery. Musculoskeletal disorders are more common than any other long-term health problem. Nearly 30% of Canadians report having musculoskeletal disorders (e.g. arthritis, rheumatism, osteoporosis, osteoarthritis) (1, 2). Conditions affecting the musculoskeletal system are often chronic and recurrent, although non-life-threatening, resulting in long-term disability over the life course and placing great demands on the health care system (3). In particular, knee and hip arthrosis are among the most common degenerative joint



diseases, and surgical procedures for these joints have risen steadily in Canada during the past decade (4).

Nested within the preceding statistics are work-related injuries. Work-related musculoskeletal injuries are the most common type of workplace injury across provincial jurisdictions in Canada. In British Columbia (BC) from 2000 to 2004, musculoskeletal injuries (e.g. knee strains, back strains) accounted for more than 55% of all lost time claims, work disability days, and disability costs (5). Among all work injuries that proceed to surgical intervention, knee procedures are the most common. The prevalence of musculoskeletal disorders including work-related injuries, and the demand for equitable and timely access to surgical procedures to alleviate pain and disability will continue to rise given the aging workforce in Canada.

### **3.3 Key Research Questions**

In a study sample of injured workers who undergo day surgery (defined as outpatient surgery that does not require an overnight stay) for knee meniscectomy or meniscal repair:

1. Is the surgical setting (private clinic versus public hospital) associated with differences in surgery wait-time (time from surgical consult to surgery date) or return-to-work after surgery (surgery date to first return-to-work date in the year), after adjustment for covariates?
2. Is the expedited status of the surgery (incentive fee to perform surgery within 21 days of last surgical consult) associated with differences in surgery wait-time or return-to-work, after adjustment for covariates?

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### **3.4 Background**

#### **3.4.1 Research on Private versus Public Health Care**

Studies comparing health outcomes for private versus public health care services indicate that setting matters, although the majority of studies focus on mortality and are within the context of the American health care system. Canadian researchers (6) conducted a systematic review of published studies that compared mortality rates of for-profit and non-profit hospitals. Based on pooled results, both adult and infant patients had higher mortality rates (2% and 10% respectively) in for-profit hospitals. Research out of Manitoba found that residents of for-profit nursing homes had higher rates of hospitalization for dehydration, pneumonia, falls and fractures compared to non-profit homes (7). More recent work by co-investigator McGrail and colleagues (8) also found higher hospitalization outcomes among residents of private long-term care facilities compared to public facilities, after adjusting for level of care (9). The authors of these studies hypothesize that for-profit facilities tend to lower staff complements compared to non-profit facilities, leading to poorer health outcomes for patients.

Studies comparing surgical outcomes between private versus public settings are limited and only one was found for day surgeries and one for musculoskeletal procedures. The study of day surgeries reported shorter wait times for cataract procedures performed in private clinics compared to a public hospital, but no difference between the two patient groups in visual acuity or incidence of complications post-operatively (10). The study of hip replacement procedures in the United Kingdom reported worse disability outcomes in the public patient group compared to the private patient group at two follow-up points within one year post surgery, but the public patients had worse pain and disability measures pre-operatively (11). In summary, the evidence suggests that type of service delivery setting matters, but more research is warranted within the Canadian context and in the areas of musculoskeletal disorders and day surgeries.

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### 3.4.2 Research on Wait Time for Musculoskeletal Surgeries

Researchers in the areas of health services and policy research and musculoskeletal health recently examined evidence on wait times for musculoskeletal procedures (knee and hip) and concluded that individuals waiting more than 12 months may have poorer surgical outcomes (12). Research on the effect of wait time on *work-related outcomes* for elective orthopaedic surgeries in Norway (13) showed improved odds of returning to work post surgery for shorter wait times. Compared to those treated within one month, the odds ratios for not returning to work during the first year post surgery was 9.2 for those who waited more than a year for surgery, 6.2 for those waiting 9 to 12 months, and 4.9 for those waiting for 6 to 9 months. The evidence suggests that 12 months is a critical window for improved health outcomes associated with musculoskeletal surgeries, and some evidence suggests improvements in *work* outcomes with a shorter wait time even within this 12 month window.

The definition and measurement of wait time can vary considerably across studies (14, 15). In most cases, wait times are created retrospectively from administrative databases containing medical and hospital records. Administrative records do not usually contain the date a patient decides to undergo surgery, is booked for surgery or is placed on a waiting list. As such, many researchers in the field of musculoskeletal surgeries have assumed that the last pre-surgical visit is when both the patient and physician decide to proceed with surgery, and this date is used to represent the start of wait time (16, 17). A study comparing wait list data with physician records revealed that most patients waiting for knee replacement (67%) or hip replacement (68%) were placed on the waiting list after their last pre-surgical visit (14). Shortt et al (18) compared the date of the last pre-surgical visit for more than 31,000 elective surgeries performed in Ontario with the “decision to treat” date in the patient’s chart. For orthopedic procedures, the decision date and last visit date were almost always the same (91%), although differences were noted for specific procedures such as disc surgeries (mean difference of 4 days) and hip

arthroplasty (mean difference of 14 days). In summary, the preoperative visit date closest to surgery is valid as a wait list measurement for knee procedures.

### **3.4.3 Research on Work Disability (Workers' Compensation) Outcomes**

Return-to-work (RTW) is a common outcome measure in occupational, workers' compensation and musculoskeletal research (e.g. 19) including work by the investigators (20). Krause and colleagues (21) examined eleven different administrative definitions of RTW and applied each to a cohort of 850 low back injury cases extracted from workers compensation claims data in California. The estimated mean duration of work disability ranged from 75 days using time to first RTW date to 337 for total compensated days (multiple or re-opened claims over time). Total compensated days were considered to be a reasonable measure of disability, primarily because it takes into account multiple episodes of disability which is typical of musculoskeletal morbidity.

Many studies investigating work-related outcomes use administrative claim data (e.g. claim closure) to obtain estimates of disability days or RTW time after injury (22). Work by Côté (co-investigator) has successfully demonstrated that time to claim closure is associated with improvements in health for musculoskeletal conditions (23). Others contend that claim closure and RTW, although associated with significant improvements in health, are not an indication of being fully recovered from a musculoskeletal injury (24, 25). However, RTW and claim closure have significant importance for employers, compensation systems, health care systems and employees. Hogg-Johnson and Cole state, "...return-to-work and compensation costs are important outcomes for employers and compensation boards. Health care practitioners are interested in RTW as a clinical outcome and injured workers are interested in reintegration into work." (20). For this study, we are able to investigate the first RTW date as recorded in the clinical files of the workers' compensation data.

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#### **3.4.4 Covariates for Work-related Disability Outcomes**

Given access and linkage of multiple datasets, and based on Krause's framework (21), the current analysis of surgery wait time and return-to-work time was adjusted for socio-demographic characteristics (age at time of surgery, gender, wage at time of injury, occupation of employment at time of injury); health system characteristics (health region of surgery defined as one of 5 geographic health regions responsible for the administration of health services, and surgeon (anonymous study identifier); and clinical characteristics/co-morbidity (previous same knee claim, previous same knee surgery, osteoarthritis, or other joint pathologies (anterior cruciate ligament, medial collateral ligament, and posterior collateral ligament)).

In summary for the Background Section, the existing evidence suggests that there is a need to investigate the effect of surgical care setting and wait time on health outcomes for work-related musculoskeletal day surgeries with a focus on knee procedures, and that access to existing linked data provide a valid source of variables to measure wait time, return-to-work or disability days, controlling for known covariates for disability and return-to-work outcomes.

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## 4 METHODS

### 4.1 *Workers' Compensation Study Sample*

Using a retrospective study design, we identified the cohort of individuals in the WorkSafeBC surgical/clinical/rehabilitation database with a surgical procedure coded for knee meniscectomy or knee meniscal repair between January 2001 and December 2005 (allowing one year of follow-up for all subjects given data through to 2006). Individuals that also had an anterior cruciate ligament repair at the same time were excluded, and individuals had to be claim or injury free for at least one year prior to the injury that led to the knee surgery. This group represents individuals aged 15-64 years with a time-loss claim (accepted short-term disability requiring at least one full day away from work) who underwent a day surgery procedure for a meniscal repair or meniscectomy only between 2001 to 2005. The study sample was restricted to knee meniscectomy or meniscal repair, which were the most frequent surgical procedure in the population, and restricted to day-procedures (less than 24-hour total stay) as the only type of surgical procedure that is done in private clinics for comparison purposes. Individuals whose surgery included anterior cruciate ligament (ACL) repair, as a complicated co-morbidity at the time of surgery, were excluded from the study cohort. Due to the intensive manual abstraction process to collect the study data, a random sample of expedited surgeries, both private and public, were selected for inclusion in the study. All public non-expedited surgeries were included in the analysis. See Appendix 1 for a detailed description of the study cohort and sample selection criteria.

### 4.2 *Data sources*

#### 4.2.1 *Workers' Compensation Data*

WorkSafeBC data were used to identify the study cohort, as well as expedited status and surgical setting, wait-time and return-to-work outcomes, and study covariates. Data were extracted from the

claim records, surgical/clinical/rehabilitation records and medical benefits payment records, and linked by unique claim identifier at the individual level for the 2001 to 2006 period (allowing for a minimum of one year of post surgical follow-up for all cohort members); and for the period 1991 to 2006 for the claim records (allowing up to fifteen years of prior data to identify previous work-related injuries and a minimum of one year of follow-up for surgical outcomes related to return-to-work). The claim record provided data on age at time of surgery, gender, wage at time of injury, occupation and industry of employment at time of injury, and injury characteristics. Two full-time kinesiology-trained data extraction technicians reviewed the surgical/clinical/rehabilitation records (scanned electronic documents equivalent to a patient chart) to abstract data and construct the outcome variables on surgery wait time and return-to-work time, health authority of surgical setting, and co-morbidity covariates, and to identify surgical care setting and expedited status based on a combination of care facility codes and benefits payment codes in the medical benefits payment records. A random sample (10%) of the extract was reviewed for validity and accuracy by members of the research team, and internally by WorkSafeBC representatives. An additional sample (10%) of all records was randomly selected for dual-extraction by both data technicians for reliability assessment. For the entire study cohort, all key variables related to the study outcomes (last surgical consult, surgery date and return-to-work date) were entirely dual-extracted to ensure valid and accurate outcome measures.

### **4.3 Outcomes**

The WorkSafeBC surgical/clinical/rehabilitation database contains scanned, electronic versions of all medical information pertaining to a claim. These data were used to define the study outcomes using surgical consultation date, surgery date, and first return-to-work date (Figure 1 below), as follows:

1. Surgery wait-time was measured in calendar days (continuous) from last pre-surgical consult to surgery date as recorded in the WorkSafeBC surgical/clinical/rehabilitation records.
2. Time to return-to-work from surgery was measured in calendar days and defined as surgery date to first return-to-work date within 365 days following surgery, as recorded in the WorkSafeBC surgical/clinical/rehabilitation records. There were 237 individuals without a return-to-work date or a date greater than 365 days from surgery. These individuals were assigned 365 days as their study outcome.

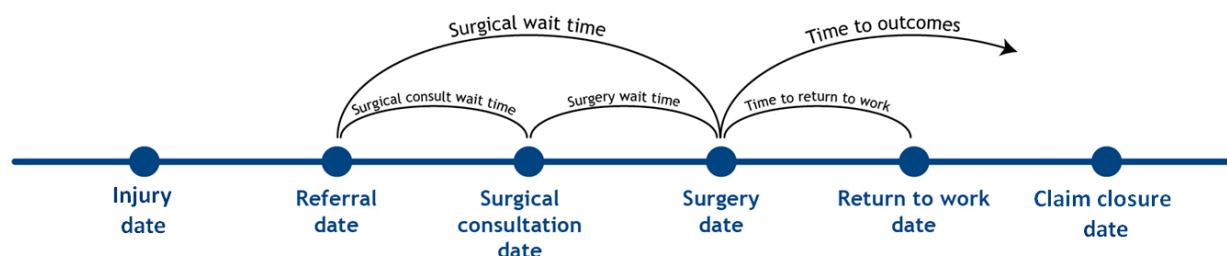


Figure 1: Surgery Wait Time and Return-to-Work from Surgery time – two study outcomes for analysis of expedited status and surgical setting among injured workers undergoing knee surgery, 2001-2005.

#### 4.4 Key Explanatory Variables

Using a combination of surgical facility codes and surgeon fee codes in the surgical/clinical records and the surgical billing records, the key explanatory variable was defined as a) private clinic, expedited surgery; b) public hospital, expedited surgery; or c) public hospital, non-expedited surgery. Private clinic, non-expedited surgeries are not included in the analysis as private clinics (generally) only perform expedited surgeries.



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## 4.5 Covariates

The combined WorkSafeBC data provided the following covariates:

### *Individual or Socio-demographic Characteristics:*

- Age at time of Surgery (analyzed by 4 categorical variables) and Gender; Wage (pre-claim wage at time of injury); Occupation of employment at time of injury (Standard Occupational Classification (SOC)).

### *Health System or Organizational Characteristics:*

- Geographic codes for Health Authority (entered as Vancouver Coastal, Vancouver Island, Interior, Fraser, and Northern health authorities) for surgery location; Surgeon (anonymous study identifier).

### *Clinical Characteristics:*

- The following co-morbidity measures were captured in the WorkSafeBC surgical/clinical/rehabilitation records and offered in the adjusted analyses: Osteoarthritis and Other Joint Pathologies (e.g. Intra-articular Joint Co-pathologies including osteophytosis; Other Knee Tears including anterior cruciate ligament, medial collateral ligament, and posterior collateral ligament).
- Previous Claim (the risk of a compensation claim is associated with a prior history, claim data available back to 1991); and Previous Surgery as indicated in the WorkSafeBC surgical/clinical records (entered as yes/no).

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## **4.6 Analyses**

### **4.6.1 Descriptive Analysis**

Data preparation and analysis was completed using SAS 9.1 (SAS Institute, Cary, NC) and Stata 10.0 (StataCorp, College Station, TX). We compared the baseline characteristics (e.g. socio-demographic, occupation, clinical characteristics) of the three study sub-groups (private expedited, public expedited, public non-expedited) using descriptive statistics. Median days (with interquartile ranges) were calculated for the outcome measures defined by surgery wait time (last pre-surgical consult to surgery date) and time to return-to-work following surgery (surgery date to first return-to-work) for the three study sub-groups, adjusted for covariates.

### **4.6.2 Multivariable Analysis**

Quantile regression was used to investigate differences in median days for surgery wait-time and return-to-work outcomes associated with the surgical care setting and expedited status categorical variable, adjusting for covariates and confounders. Quantile regression (26) is useful for examining skewed distributions as well as outcomes that may be censored as it allows for a robust analysis of the entire observed distribution of outcomes. In this study, differences in median days for surgery wait time and return-to-work time were investigated for individuals in the 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> percentiles of the distribution for each outcome, using the public non-expedited group as the reference category for each comparison. For the final multivariable models adjusted for covariates, we computed the regression coefficient (interpreted as the days difference in wait-time or time to return-to-work, compared with the reference category for each variable) and 95% confidence intervals for the primary explanatory variables and covariates. Standard errors were adjusted for clustering at the level of surgeon using bootstrap re-sampling methods. The covariates of age, gender, wage and health authority were retained in all models as known factors or confounders for the outcomes. Occupation and co-morbidity variables were

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retained in the final model for the return-to-work outcome, but were excluded from the final model for the surgery wait time as the 95% CI for these estimates included '0'.

#### **4.7    *Ethical Approval and Data Source Access***

Ethical approval for the research project was obtained from the Behavioural Research Ethics Board at UBC (Certificate # H06-80221). The abstraction of data for the creation of the research database was completed on-site at WorkSafeBC under a data access agreement between the University of British Columbia and WorkSafeBC governing the conditions and use of the data for research purposes (27). The research database was released to the investigators with personal identifiers removed from the database and replaced with anonymous study identifiers.

## 5 RESULTS

### 5.1 Study Sample

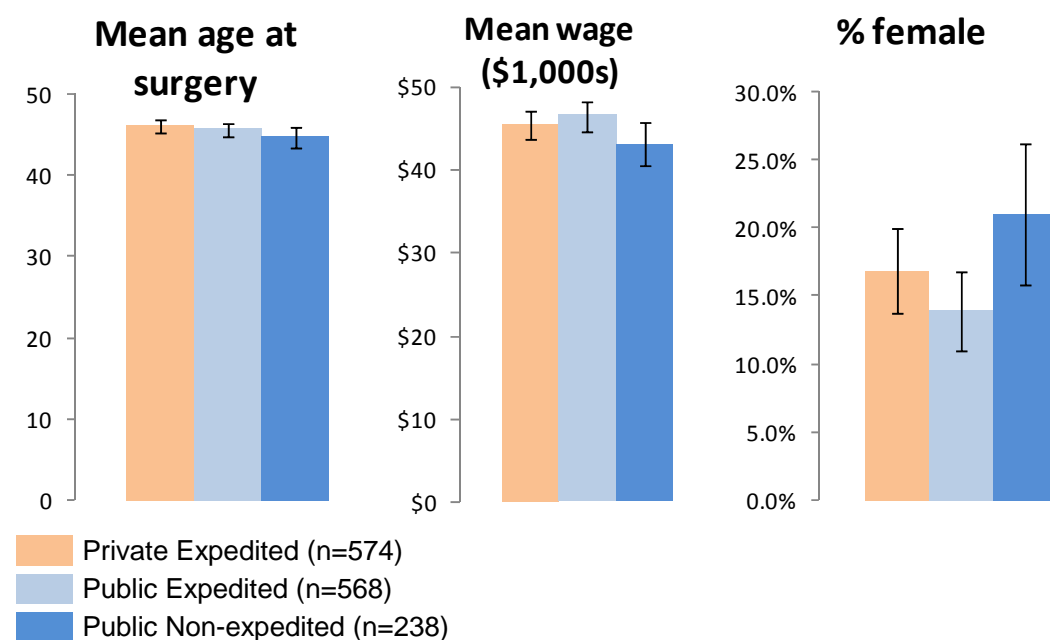
A total of 4,089 unique knee meniscectomies or knee meniscal repairs were identified in the BC workers' compensation data between 2001 and 2005, of which 3,259 were eligible for inclusion in the study with no complicating ACL repair procedure as part of the knee surgery. Of these, all public non-expedited surgeries were included in the study (n=263); a total of 25 surgeries were excluded due to missing data on the outcomes and/or covariates for a total of 238 public non-expedited surgeries. Of the remaining expedited surgeries, a random sample of 610 private expedited and 601 public expedited surgeries were abstracted; a total of 69 surgeries were excluded due to missing data on the outcomes and/or covariates for a total of 574 private expedited surgeries and 568 public expedited surgeries. See Appendix 1 for a summary of the study cohort selection process and see Figure 2 below for a summary of the final study sample.

	<b>Public Hospital</b>	<b>Private Clinic</b>
<b>Expedited</b>	568 (41.2%)	574 (41.6%)
<b>Non-expedited</b>	238 (17.2%)	n/a

Figure 2: Final Analytic Sample of Injured Workers in British Columbia with an Accepted Workers' Compensation Claim who underwent Knee Meniscectomy or Meniscal Repair by Surgical Setting and Expedited Status, 2001-2005 surgeries (Note: the expedited groups represent a stratified random sample of all expedited knee surgeries).

## 5.2 Descriptive Characteristics

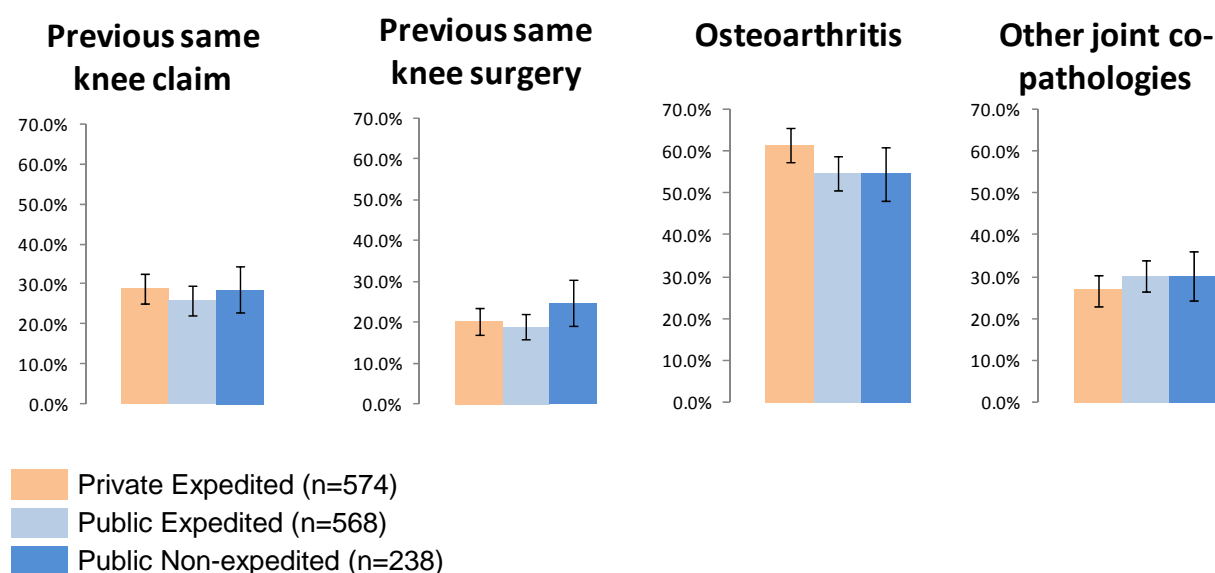
The three study groups defined by expedited status and surgical setting did not differ statistically on baseline characteristics of age at time of surgery, wage at time of injury, percent women (Figure 3 below) or co-morbidities (Figure 4 below). Of these characteristics, the greatest difference was observed for gender, with women representing 21.0% of the public non-expedited surgical group compared to 16.9% for the private expedited group and 13.9% for the public expedited group. The mean age at time of surgery ranged from 44.7 years in the public, non-expedited group to 46.1 years in the private expedited group. The mean wage at time of injury ranged from \$43,100 per annum in the public, non-expedited group to \$46,500 per annum in the public expedited group. In all three study groups, the most common occupations were transportation, construction trades and other trades. Appendix 2 provides a detailed table of descriptive statistics by study characteristics.



**Note: The error bars represent 95% confidence intervals.**

Figure 3: Baseline Characteristics of Study Cohort of Injured Workers with a Workers' Compensation Claim for Knee Surgery (Meniscectomy or Meniscal Repair), 2001-2005 by Surgical Setting and Expedited Status.

The majority of the knee meniscal surgeries involved a medial meniscus diagnosis (ranging from 71.0% in the public, non-expedited group to 74.8% in the private expedited group). Surgeries involving both a medial and a lateral meniscus diagnosis ranged from 11.3% in the public, non-expedited group to 15.7% in the private expedited group (See Appendix 2 for detailed table of clinical characteristics). History of a previous same knee claim (but not in the year prior to the study surgery) ranged from 25.9% in the public expedited group to 28.9% and 28.6% in the private expedited and public non-expedited groups respectively. The most common co-morbidity was osteoarthritis ranging from 54.6% in the public non-expedited group to 61.5% in the private expedited group.



**Note:** The error bars represent 95% confidence intervals.

Figure 4: Co-morbidities at Baseline for Study Cohort of Injured Workers with a Workers' Compensation Claim for Knee Surgery (Meniscectomy or Meniscal Repair), 2001-2005 by Surgical Setting and Expedited Status.

Surgeries for injured workers were distributed across the five geographic health regions of the province, including surgeries performed in public and private surgical settings, and by expedited status. The volume of surgeries was greatest in the most densely populated and urban regions of the province (Vancouver Coastal, Vancouver Island and Fraser Health Authorities) and lowest in the more northern

rural and remote regions of the province (Northern and Interior Health Authorities) (Figure 5 and Appendix 2). The number and percentage of surgeries conducted in private, expedited surgeries appears to be proportional to the number of private clinics available in a region (Figure 5).

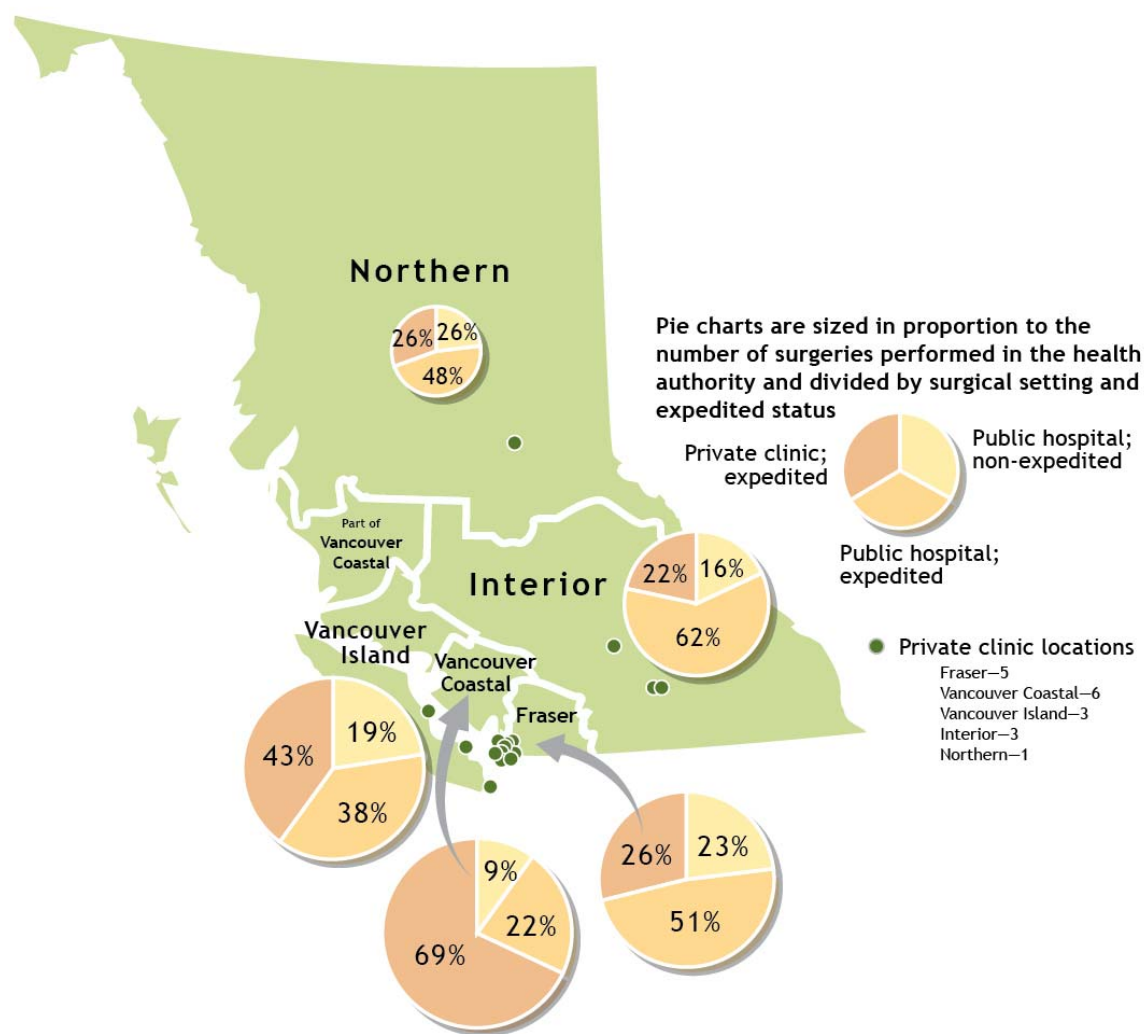


Figure 5: Geographic Distribution (defined as Health Authorities) of Study Sample of Injured Workers with a Workers' Compensation Claim for Knee Meniscectomy or Meniscal Repair Surgery, 2001-2005 by Surgical Setting and Expedited Status.

### 5.3 Study Outcomes

Among the study sample of injured workers undergoing knee meniscectomy or meniscal repair surgery, the adjusted median surgery wait time (last surgical consult to surgery date) was 22 and 24 calendar days for *expedited* surgeries in public hospitals and private clinics respectively, compared to 37 calendar days for *non-expedited* surgeries in public hospitals (Figure 6), or a difference of approximately 2 work weeks.

	Public Hospital	Private Clinic
<b>Expedited</b>	22 (12-38)	24 (13-39)
<b>Non-expedited</b>	37 (18-71)	n/a

*Adjusted for age, gender, wage and health authority.*

Figure 6: Median surgery wait time in days (last surgical consult to surgery date) with interquartile range by surgical setting and expedited status among study sample of injured workers undergoing knee meniscectomy or meniscal repair, 2001-2005 (adjusted for age, gender, wage and health authority).

The majority of the study sample returned to work within the first year, ranging from 84.2% and 84.9% among the public expedited and non-expedited groups, to 88.3% among the private expedited group. The adjusted, median time to return-to-work was 58 and 60 calendar days for non-expedited and expedited *public hospital* surgeries respectively, compared to 66 calendar days for workers with an expedited knee surgery in a *private clinic* (Figure 7), or a difference of approximately 1 work week.



	<b>Public Hospital</b>	<b>Private Clinic</b>
<b>Expedited</b>	60 (35-162)	66 (37-161)
<b>Non-expedited</b>	58 (29-164)	n/a

*Adjusted for age, gender, wage, health authority, occupation, previous surgery, and osteoarthritis.*

Figure 7: Median return-to-work time in days (surgery date to first return-to-work date) with interquartile range by surgical setting and expedited status among study sample of injured workers undergoing knee meniscectomy or meniscal repair, 2001-2005 (adjusted for age, gender, wage, health authority, occupation and co-morbidities).

In the adjusted quantile regression analysis, the median difference in surgery wait time was 12.5 and 14 less days wait for *expedited* surgeries (private and public respectively) compared to *non-expedited* surgeries among individuals in the 50<sup>th</sup> percentile of the distribution (Figure 8, *note that 0 in the graph represents 0 difference relative to the median number of days for the public, non-expedited group*). The median difference ranged from approximately 6 less days wait for individuals in the 25<sup>th</sup> percentile of the distribution to 33 and 34 less days wait for individuals in the 75<sup>th</sup> percentile of the distribution (Figure 8), compared to the public non-expedited group. Estimates of the median difference in wait time for individuals with expedited surgeries (public or private) in the 25<sup>th</sup> percentile did not differ statistically from the public non-expedited median wait time (95% CIs included a 0 difference). The final model was adjusted for age, gender, wage and health authority. Occupation and co-morbidities were not associated with surgery wait time in the final model. Appendix 3 provides a detailed table of regression results for all of the study variables.

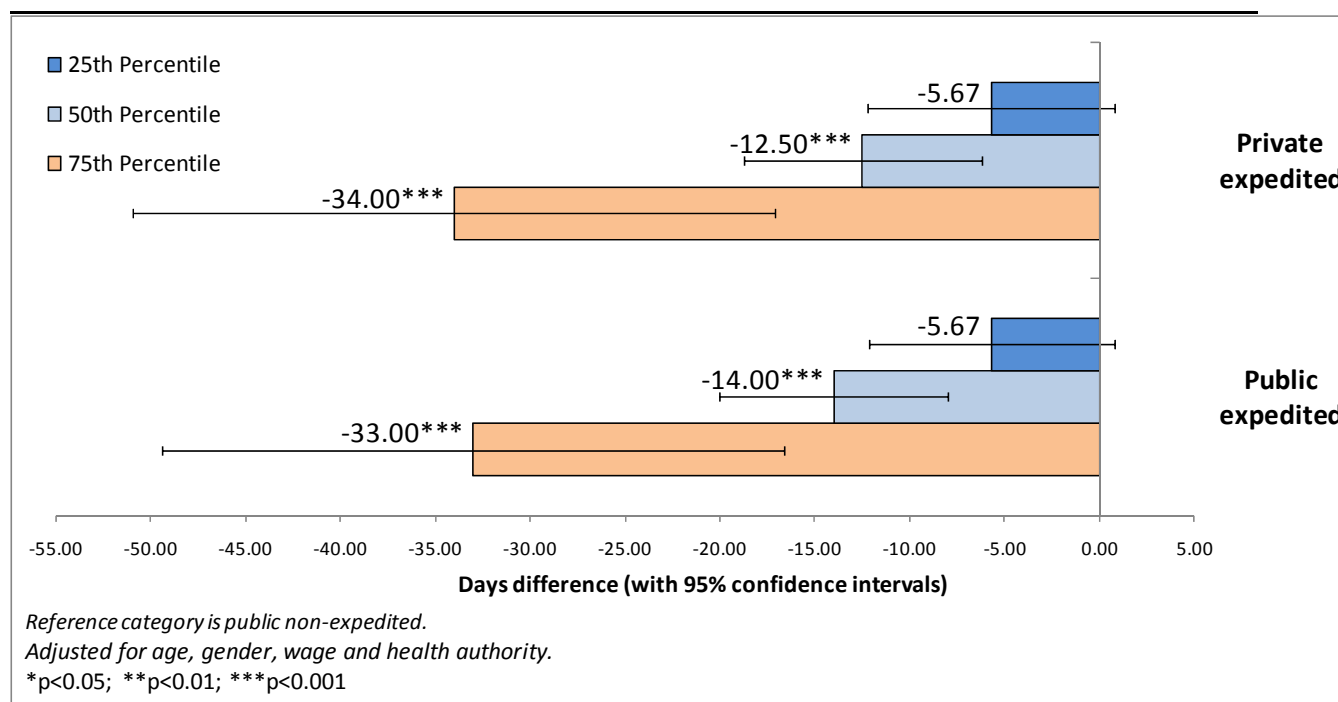


Figure 8: Quantile regression results for differences in median days (and interquartile range) for surgery wait time among injured workers undergoing knee meniscectomy or meniscal repair surgery by surgical setting and expedited status. *Note that 0 in the graph represents 0 difference relative to the median number of days for the public, non-expedited group.*

The median difference in return-to-work time from surgery within the year post surgery was 4 and 6 days more for *expedited* surgeries (public and private respectively) compared to *non-expedited* surgeries for individuals in the 50<sup>th</sup> percentile of the distribution. Differences ranged from approximately 5 to 7 days more for individuals in the 25<sup>th</sup> percentile of the distribution to approximately 2 days less to 7 days more for individuals in the 75<sup>th</sup> percentile of the distribution (Figure 9). The 95% CIs around the estimates of the median difference in return-to-work days from surgery among both private and public expedited surgeries included 0 days difference compared to the median return-to-work time from surgery for the public non-expedited group. The final models were adjusted for age, gender, wage, health authority, occupation and co-morbidities. See Appendix 3 for a detailed table of coefficients for all study variables.

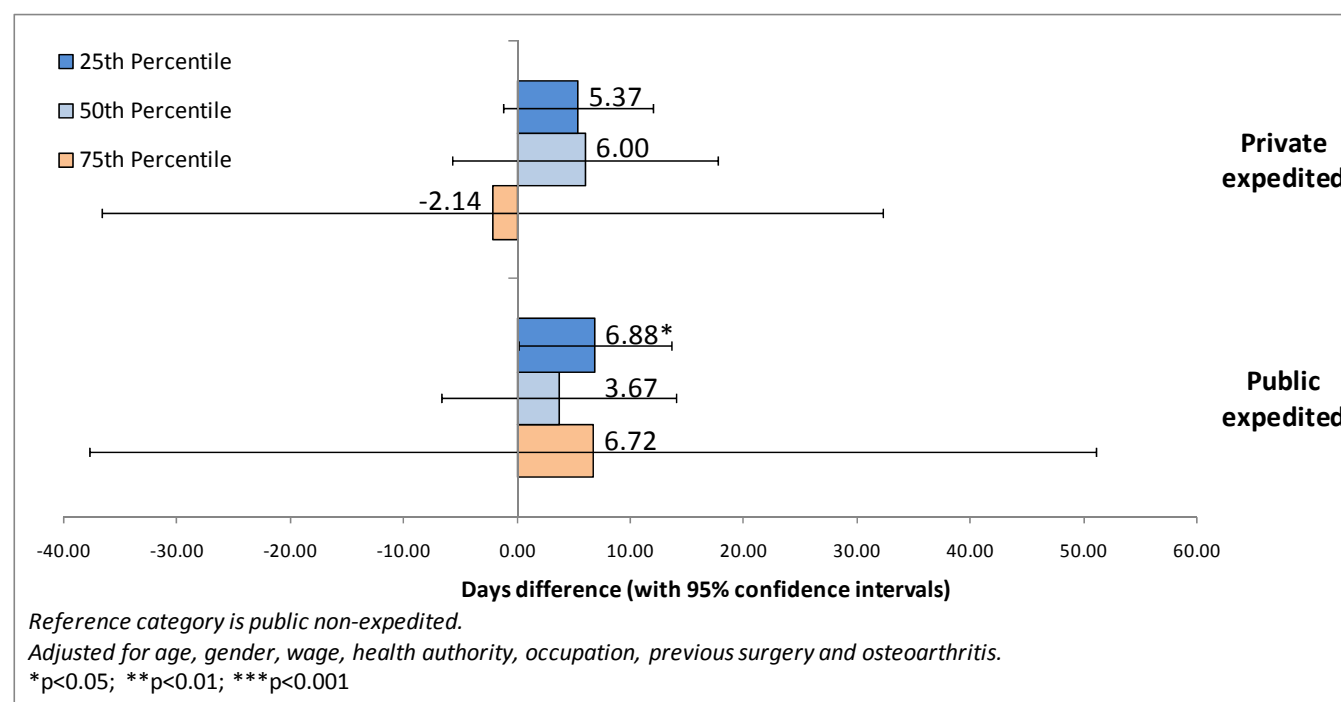


Figure 9: Quantile regression results for differences in median days (and interquartile range) for return-to-work time from surgery among injured workers undergoing knee meniscectomy or meniscal repair surgery by surgical setting and expedited status. *Note that 0 in the graph represents 0 difference relative to the median number of days for the public, non-expedited group.*

The final quantile regression models estimates were bootstrapped using 1,000 replications re-sampled at the level of the surgeon. This was done to account for the potential clustering of results among patients/injured workers within the same surgeon and provide more reasonable estimates of the variability around the regression coefficients. The increased variability of the 95% CIs around the regression coefficients in the bootstrapped analysis accounted for clustering of outcomes by surgeon.

## 6 DISCUSSION

The expedited fees paid by WorkSafeBC reduced the surgery wait time among a study sample of injured workers undergoing knee meniscectomy or meniscal repair as part of an accepted time loss claim. Among surgeries that were expedited, there was no statistical difference in surgery wait time by public versus private hospital setting. Despite differences in the median difference across different segments of the distribution of surgery wait days, the overall median difference was about two working weeks less for expedited surgeries in the study sample. This difference is perhaps not as large as expected between the expedited and non-expedited groups owing to a relatively overall short surgery wait time. This short wait time may be specific to the definition used in this study with wait time representing the period between last surgical consult and surgery date. However, this time window is the critical time window of importance to this study. The workers' compensation policy around expedited fees is designed to target and reduce this specific wait time window only.

Interestingly, the median surgery wait time for expedited surgeries exceeded the 21 day criteria at 22 and 24 days for public and private surgical settings respectively. The 21 day criteria to receive the expedited fee is by definition from surgical *approval date*, a date that was not consistently recorded in the clinical data files at WorkSafeBC, to surgery date. We relied on last surgical consult date, a date

consistently recorded in the clinical data files, as a proxy for surgery approval date, and this may explain a one or two day difference between the criteria and what we observed. However, this does not explain away the 50% of the distribution that had an expedited surgery wait time greater than 21 days including an upper interquartile value of 38 days. An investigation of surgeons and surgical facilities receiving the expedited fee according to the 21 day wait time criteria is warranted by WorkSafeBC.

Return-to-work time following surgery did not differ statistically by expedited status or by surgical setting among injured workers undergoing meniscectomy or meniscal repair surgery in our study sample. Overall, the median difference was approximately one working week, with individuals in the non-expedited, public hospital group consistently having the shortest time to return-to-work. Despite a wide distribution (1 to 365 days), the time to return-to-work did not differ statistically for individuals in the 25<sup>th</sup>, (those returning to work within a month), 50<sup>th</sup> (those returning to work within 1-2 months) or 75<sup>th</sup> percentiles (those returning to work within 2 to 6 months of surgery) of the distribution. It is hypothesized that regardless of the prior wait time, the surgery is a new starting point at which the playing field is evened for individuals in terms of their physical health and rehabilitation and subsequent return-to-work. This is similar to a prior study of day surgeries for cataracts reporting shorter wait time in private clinics compared to private hospital, but no difference between the two patient groups in terms of health outcomes following surgery (10). One prior study of musculoskeletal surgeries in the UK reported worse disability outcomes in the public patient group compared to the private patient group following hip replacement, but the public patients had worse pain and disability measures pre-operatively (11). In the current study, the public non-expedited group tended to have more co-morbidities at the time of surgery with the exception of osteoarthritis (higher in the private expedited group). It was thought that surgical cases complicated by pre-existing co-morbidities would be directed to public hospital in the current study in the event that complications necessitated a stay longer than 24

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hours (in a private clinic, an individual would need to be transferred to a public hospital if the stay was greater than a day). Despite this, the public, non-expedited group tended to do better overall in terms of time to return-to-work. , The authors of the few studies that compare private to public care settings hypothesize that private (for-profit) facilities tend to lower staff complements compared to non-profit facilities, leading to poorer health outcomes for patients (7-9).

Studies on surgery wait-times suggest improved outcomes, including return-to-work, for shorter wait time under 12 months (13). The study wait time definition in the current study was well within this 12 month window for all study groups, and differences of two weeks within a relatively short wait time window were not likely to elucidate differences in return-to-work outcomes, as seen in the final models. A preliminary investigation of the total time from injury date to surgery date indicates a longer trajectory overall among individuals in the public non-expedited group (median of 152 days) compared to the expedited groups (109 days in the public expedited group and 119 days in the private expedited group). Despite the public non-expedited group having a longer overall wait for surgery, they still had the shorter (albeit not statistically significant) overall return-to-work time from surgery. Future work will investigate other outcomes such as complications following surgery, type of return-to-work (partial, full, different occupation) and re-injury.

In summary a difference of approximately two working weeks less in surgery wait time associated with the expedited fee program may have meaningful clinical and quality of life implications for injured workers, and based on time to first return-to-work as measured in this study does not appear to be harmful to injured workers. However, the cost-benefit of this workers' compensation policy warrants future analysis, as do additional outcomes such as surgical complications and re-injury/lost-time. In addition, minimal differences in expedited surgical wait time by private clinic versus public hospital, and small differences in return-to-work outcomes (one work week) favouring the public, non-

expedited group, suggest an evaluation of the additional cost of using private clinics for workers' compensation clinics.

## **6.1     *Strengths and Limitations***

The use of administrative databases for research purposes presents a trade-off between the desirability of population-based large datasets and the validity of the data/measures. Any lack of specificity in the outcome and covariate definitions should have a predictable effect on risk estimates with a bias towards the null. The major limitation of studies relying on administrative data is residual confounding from unmeasured confounders or covariates. While it is not possible to fully adjust for all factors related to our outcomes given a multifactorial model and a reliance on retrospective administrative data, this project represents a substantial research undertaking with unprecedented access to linked (but privacy protected) data at the individual level, including the equivalent of access to detailed and comprehensive clinical patient records (WorkSafeBC surgical/clinical/rehabilitation data), and the ability to measure a rich set of covariates across multiple domains known to impact both work disability and surgical outcomes (sociodemographic, clinical, occupation, and health system characteristics. Again, to our knowledge, this study represents the most comprehensive set of covariates for an investigation of health outcomes by private versus public health care settings, and by wait time incentive. Some residual confounding may still remain. Confounding in this case can bias results in either direction. Given minimal differences in the study sample by surgical setting and expedited status at baseline (in particular disability lag, co-morbidity, sociodemographic factors, and the adjustment for known confounders including clustering within individuals by surgeon, then the resulting residual bias on the comparisons should be minimized and not large enough to lead to misleading conclusions about the effect of care setting or expedited status.

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## **7 IMPLICATIONS FOR FUTURE RESEARCH**

The research findings signify the completion of the first phase of our overall study objectives. Phase one included the development of the research database abstracted from WorkSafeBC data and the examination of differences in wait-time and return-to-work outcomes by surgical setting and expedited status, adjusted for covariates and confounders. The next phase of the study will link the research database with Ministry of Health Services data on hospitalizations and medical services at the individual level. This will allow for adjustment of additional covariates and confounders (including more extensive clinical/treatment/co-morbidity factors, surgeon characteristics, and hospital/surgeon volumes) and expanded outcome variables (including post-surgical complications, claim-closure outcomes, and total disability days). We will also investigate variations in disability and health outcomes by other factors, such as health authority region. This work is funded by an operating grant from the Canadian Institutes of Health Research.

The overall study represents an unprecedented and unique opportunity (given access to linkable, population-based data) to evaluate the effect of workers' compensation surgical policy on disability outcomes as a study of merit on its own, while informing the debate on private care setting under a public funding mechanism, and on wait-time incentives for musculoskeletal surgeries. A study on musculoskeletal injuries (albeit work-related knee injuries) is also relevant given the disability and health services burden associated with these injuries in an aging Canadian population. Knee surgeries including work-related knee injuries, are one of the most commonly performed orthopedic procedures in Canada.



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## **8 POLICY AND PREVENTION**

### **8.1 *Policy/Prevention Implications***

WorkSafeBC is committed to reviewing its policies on health services and compensation for work-related injury and disease, including surgeries for musculoskeletal injuries, and findings from this project have the potential to influence the design of compensation policy for the provision of health services in private clinics and payments for expedited surgery. As this study directly aligns with two of WorkSafeBC's research priorities (i.e. occupational disease, injury and health services; and compensation, disability management, and return-to-work), the research findings will provide evidence to evaluate the current medical program and treatment options for workers who require surgery for musculoskeletal work-related injury with regard to timely return-to-work.

### **8.2 *Relevant User Groups***

This project evaluates WorkSafeBC's expedited surgery program and will provide evidence on whether it has improved return-to-work and health outcomes for injured workers who undergo musculoskeletal surgery. Through the development of the surgical database, this project has provided the Health Care Services unit at WorkSafeBC with an improved understanding of the expedited program and given them access to data for monitoring purposes. This represents a significant advancement in the development and use of WorkSafeBC administrative records in program and policy evaluation.

The research findings also have a broader applicability to a range of stakeholders. Specifically, the evaluation of expedited and private clinic services is a key issue for workers' compensation groups seeking solutions to the challenges imposed on injured workers in obtaining timely and effective access to health care, and in ensuring successful return-to-work following injury. Workers' compensation systems in other jurisdictions, including Manitoba and Ontario, and the North American Workers

Compensation Research Working Group, have expressed interest in the research findings from this project. In the context of the broader debate on public versus private health care (specifically, private delivery of services under a publicly-funded mechanism), this study has the potential to inform provincial and national health agencies and stakeholders.

### **8.3 Policy-related Interactions**

This project is nested within an existing, innovative partnership between WorkSafeBC and the Centre for Health Services and Policy Research (CHSPR) at the University of British Columbia. The Partnership brings together researchers and policy-makers to address current and emerging issues of work-related health in British Columbia. Knowledge translation research (28) has identified the development of partnerships, based on regular exchange and contact, as the most effective approach in facilitating the use of research evidence and in creating a research-attuned culture among decision makers. Consistent with this approach, a joint advisory committee (comprised of WorkSafeBC and CHSPR representatives) meets on a quarterly basis, thus ensuring that senior decision makers are informed and engaged in the research process from study design to implementation of findings.

## **9 DISSEMINATION & KNOWLEDGE TRANSFER**

We have presented research findings at a number of provincial, federal, and international research and stakeholder forums, including the joint UW-UBC Occupational and Environmental Health Conference (Washington, January 2009), the Canadian Association for Health Services and Policy Research Annual Conference (Alberta, May 2009), the Canadian Association for Research on Work and Health Conference (Quebec, June 2008), and the International Symposium on Epidemiology in Occupational Health (Alberta, October 2007). We intend to further disseminate research findings by

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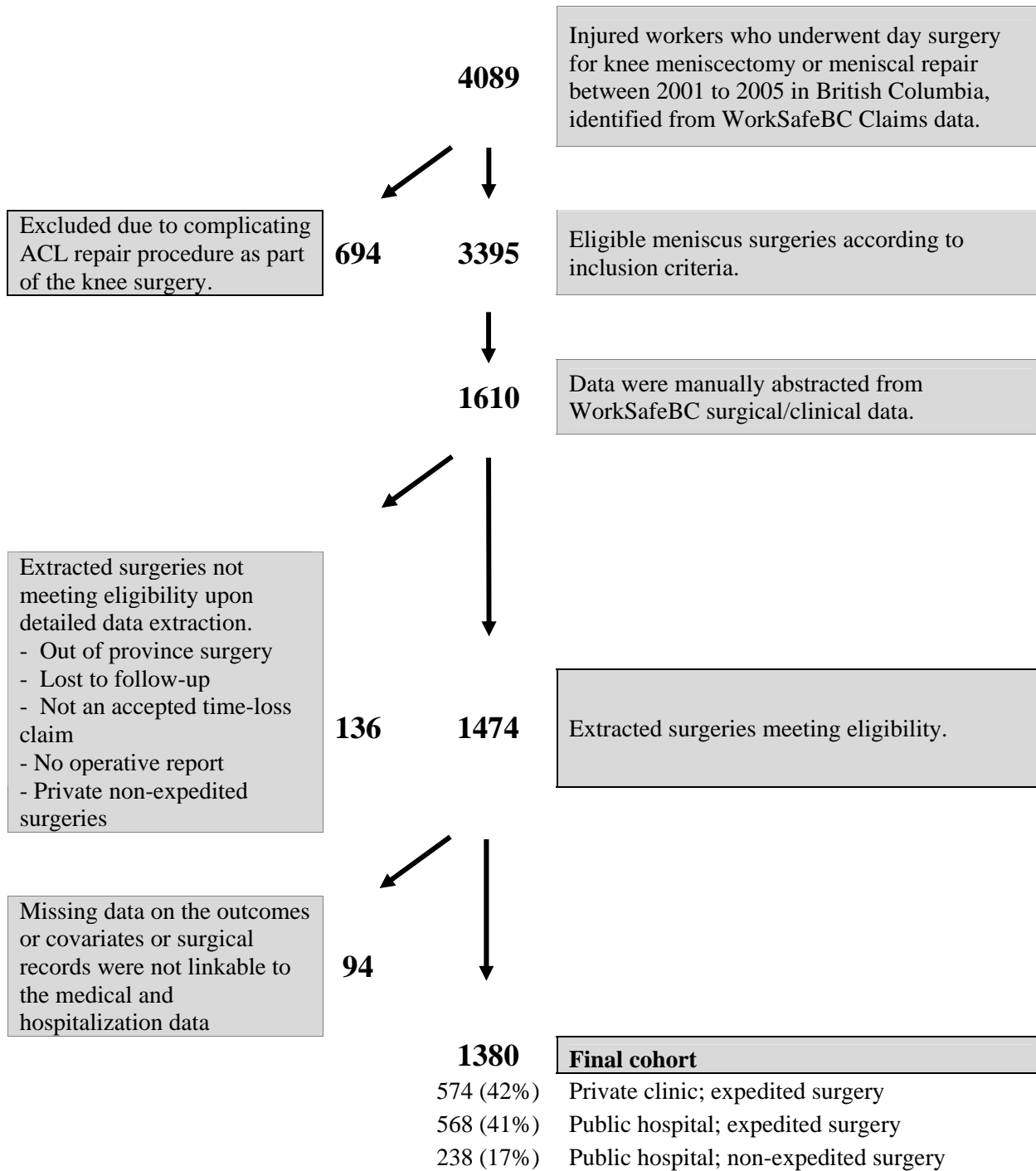
publishing two peer-reviewed papers, which are being prepared for submission. See Appendix 4 for an extensive list of dissemination activities.

Research findings will also be posted on a public website created to profile the WorkSafeBC-CHSPR Research Partnership ([www.chspr.ubc.ca/research/worksafebc](http://www.chspr.ubc.ca/research/worksafebc)). This website aims to publicize the results of the Partnership research projects to a broader audience. Further knowledge translation will be facilitated through our active collaboration with the UBC Centre for Health and Environment Research (CHER), which has dedicated research personnel and resources focusing specifically on knowledge translation in occupational health settings ([www.cher.ubc.ca](http://www.cher.ubc.ca)). In collaboration with CHER's communications specialist, we have identified a comprehensive communications strategy that will be implemented over the coming months.

## APPENDICES

### APPENDIX 1

**Figure A1-1: Selection of final study sample (n=1380) included in analyses.**



**Figure A1-2: Total number of surgeries by study year (2001 to 2005).**

	Initial cohort of eligible meniscus surgeries (n=3395).		Final cohort (n=1380).
<b>2001</b>	20% (n=666)	<b>2001</b>	21% (n=284)
<b>2002</b>	19% (n=640)	<b>2002</b>	21% (n=286)
<b>2003</b>	19% (n=653)	<b>2003</b>	20% (n=272)
<b>2004</b>	21% (n=698)	<b>2004</b>	20% (n=275)
<b>2005</b>	22% (n=738)	<b>2005</b>	19% (n=263)

*Note the consistent proportions of surgeries for each year between the initial cohort of eligible surgeries and the final study sample.*

**Figure A1-3: Breakdown of study cohort (n=1380) by surgical setting and expedited status.**

	Private clinic; Expedited surgery (n=574)	Public hospital; Expedited surgery (n=568)	Public hospital; Non- expedited surgery (n=238)
<b>Final cohort</b>	Representing a random sample of all eligible private expedited (25%) and public expedited surgeries (78%).		Representing 100% of all eligible public non-expedited surgeries.

## APPENDIX 2

**TABLE A2-1: Distribution of demographic, work, and clinical characteristics for workers with meniscal knee surgery (n=1380), by surgical setting and expedited status.**

		Private Clinic; Expedited (n=574)		Public Hospital; Expedited (n=568)		Public Hospital; Non- expedited (n=238) <sup>a</sup>	
		Obs.	% or mean (95% CI)	Obs.	% or mean (95% CI)	Obs.	% or mean (95% CI)
<b>Age</b>	Mean (years)	-	46.1 (45.3-46.9)	-	45.5 (44.7-46.3)	-	44.7 (43.5-46.0)
	15-30	42	7.3% (5.2-9.5)	43	7.6% (5.4-9.8)	18	7.6% (4.2-10.9)
	30-40	112	19.5% (16.3-22.8)	120	21.1% (17.8-24.5)	54	22.7% (17.3-28.0)
	40-50	201	35.0% (31.1-38.9)	206	36.3% (32.3-40.2)	85	35.7% (29.6-41.8)
	50-65	219	38.2% (34.2-42.1)	199	35.0% (31.1-39.0)	81	34.0% (28.0-40.1)
<b>Wage<sup>b</sup></b>	Mean (\$1,000s)	-	45.4 (43.7-47.1)	-	46.5 (44.7-48.3)	-	43.1 (40.5-45.7)
	<\$30,000	135	23.5% (20.0-27.0)	117	20.6% (17.3-23.9)	60	25.2% (19.7-30.8)
	\$30-\$40,000	109	19.0% (15.8-22.2)	111	19.5% (16.3-22.8)	51	21.4% (16.2-26.7)
	\$40-\$50,000	117	20.4% (17.1-23.7)	112	19.7% (16.4-23.0)	44	18.5% (13.5-23.5)
	\$50-\$60,000	90	15.7% (12.7-18.7)	101	17.8% (14.6-20.9)	38	16.0% (11.3-20.7)
	>\$60,000	123	21.4% (18.1-24.8)	127	22.4% (18.9-25.8)	45	18.9% (13.9-23.9)
<b>Gender</b>	Women	97	16.9% (13.8-20.0)	79	13.9% (11.1-16.8)	50	21.0% (15.8-26.2)
<b>Health Authority</b>	Van. Coastal	270	47.0% (42.9-51.1)	84	14.8% (11.9-17.7)	35	14.7% (10.2-19.2)
	Van. Island	145	25.3% (21.7-28.8)	130	22.9% (19.4-26.4)	65	27.3% (21.6-33.0)
	Interior	49	8.5% (6.2-10.8)	140	24.6% (21.1-28.2)	37	15.5% (10.9-20.2)
	Fraser	87	15.2% (12.2-18.1)	172	30.3% (26.5-34.1)	78	32.8% (26.8-38.8)
	Northern	23	4.0% (2.4-5.6)	42	7.4% (5.2-9.6)	23	9.7% (5.9-13.4)
<b>Occupation<sup>c</sup></b>	Management, admin, professional, and related	64	11.1% (8.6-13.7)	45	7.9% (5.7-10.2)	27	11.3% (7.3-15.4)
	Health	30	5.2% (3.4-7.1)	33	5.8% (3.9-7.7)	8	3.4% (1.1-5.7)
	Sales	36	6.3% (4.3-8.3)	21	3.7% (2.1-5.3)	14	5.9% (2.9-8.9)
	Service	67	11.7% (9.0-14.3)	67	11.8% (9.1-14.5)	28	11.8% (7.6-15.9)
	Construction trades	87	15.2% (12.2-18.1)	111	19.5% (16.3-22.8)	40	16.8% (12.0-21.6)
	Other trades	90	15.7% (12.7-18.7)	77	13.6% (10.7-16.4)	35	14.7% (10.2-19.2)
	Transportation, material handling	104	18.1% (15.0-21.3)	89	15.7% (12.7-18.7)	40	16.8% (12.0-21.6)
	Primary	42	7.3% (5.2-9.5)	64	11.3% (8.7-13.9)	23	9.7% (5.9-13.4)
	Processing, manufacturing	54	9.4% (7.0-11.8)	61	10.7% (8.2-13.3)	23	9.7% (5.9-13.4)

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TABLE A2-1: Continued

		Private Clinic; Expedited (n=574)		Public Hospital; Expedited (n=568)		Public Hospital; Non- expedited (n=238) <sup>a</sup>	
		Obs.	% or mean (95% CI)	Obs.	% or mean (95% CI)	Obs.	% or mean (95% CI)
<b>Clinical</b>	Previous same-knee claim	166	28.9% (25.2-32.6)	147	25.9% (22.3-29.5)	68	28.6% (22.8-34.4)
	Previous same-knee surgery	116	20.2% (16.9-23.5)	108	19.0% (15.8-22.3)	59	24.8% (19.3-30.3)
	Osteoarthritis <sup>d</sup>	353	61.5% (57.5-65.5)	311	54.8% (50.6-58.9)	130	54.6% (48.3-61.0)
	Other joint co-pathologies <sup>e</sup>	154	26.8% (23.2-30.5)	172	30.3% (26.5-34.1)	72	30.3% (24.4-36.1)
	ACL diagnosis at time of surgery	54	9.4% (7.0-11.8)	67	11.8% (9.1-14.5)	27	11.3% (7.3-15.4)
<b>Return-to-work within 365 days</b>	Yes	507	88.3% (85.7-91.0)	478	84.2% (81.1-87.2)	202	84.9% (80.3-89.5)

a. Private non-expedited surgeries were excluded from analyses due to insufficient sample size, as private clinics (generally) only perform expedited surgeries.

b. Recorded as annualized wage used to determine lost-time compensation.

c. Occupation classified according to Standard Occupational Classification (SOC) codes recorded at time of injury, in WorkSafeBC Claim file.

d. Osteoarthritis includes diagnoses of articular cartilage changes and chondromalacia, taken from the operative report.

e. Other joint co-pathologies include diagnoses of osteophytes, plicas, and knee-locking, taken from the operative report.

TABLE A2-2: Unadjusted median wait-time and time to return-to-work following meniscal knee surgery, by surgical setting and expedited status, measured in calendar days.

	Private Clinic; Expedited (n=574) Median Days (IQR)	Public Hospital; Expedited (n=568) Median Days (IQR)	Public Hospital; Non- expedited (n=238) Median Days (IQR) <sup>a</sup>
<b>Total surgery wait-time (injury date to surgery)</b>	119 (80-209)	109 (65-192)	152 (86-270)
<b>Surgery wait-time</b>	23 (14-38)	22 (13-37)	39 (19-69)
<b>Time to return-to-work</b>	58 (33-126)	55 (32-120)	50 (28-126)

a. Interquartile range.

## APPENDIX 3

**Table A3-1: Multiple quantile regression estimates for surgical wait-time, defined as last pre-operative specialist consultation to surgery date.**

		25th Percentile Coefficient [95% CI]	50th Percentile Coefficient [95% CI]	75th Percentile Coefficient [95% CI] <sup>a</sup>
<b>Surgical setting and expedited status</b>	Private clinic; expedited	-5.67 [-12.18,0.85]	-12.50 *** [-18.77,-6.23]	-34.00 *** [-50.93,-17.07]
	Public hospital; expedited	-5.67 [-12.11,0.78]	-14.00 *** [-20.00,-8.00]	-33.00 *** [-49.38,-16.62]
<b>Gender</b>	Women	-0.33 [-3.99,3.32]	2.75 [-1.26,6.76]	-1.00 [-6.71,4.71]
<b>Age</b>	30-40	-3.67 [-10.02,2.68]	-2.00 [-8.95,4.95]	1.00 [-11.07,13.07]
	40-50	1.00 [-5.70,7.70]	-0.75 [-7.60,6.10]	-2.00 [-12.58,8.58]
	50-65	0.67 [-5.71,7.05]	-0.75 [-8.01,6.51]	0.00 [-11.19,11.19]
<b>Wage<sup>b</sup></b>	\$30-\$40,000	1.00 [-3.16,5.16]	2.25 [-1.87,6.37]	-1.00 [-8.44,6.44]
	\$40-\$50,000	1.33 [-3.97,6.64]	0.00 [-4.49,4.49]	-2.00 [-9.82,5.82]
	\$50-\$60,000	0.00 [-4.21,4.21]	-0.75 [-5.38,3.88]	-5.00 [-12.45,2.45]
	>\$60,000	0.33 [-4.29,4.95]	0.25 [-3.82,4.32]	-4.00 [-11.46,3.46]
<b>Health Authority</b>	Van. Island	0.00 [-5.27,5.27]	-3.50 [-9.30,2.30]	-10.00 * [-19.19,-0.81]
	Interior	-5.00 * [-9.82,-0.18]	-4.75 [-10.11,0.61]	-11.00 * [-20.76,-1.24]
	Fraser	3.33 [-1.42,8.08]	4.50 [-1.18,10.18]	-1.00 [-10.58,8.58]
	Northern	-5.67 [-12.93,1.60]	-4.75 [-14.07,4.57]	-11.00 [-22.26,0.26]
Constant <sup>c</sup>		18.33 *** [9.84,26.83]	37.50 *** [28.91,46.09]	80.00 *** [62.03,97.97]
Observations		1380	1380	1380

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

a. Reference categories: Public non-expedited; Men; Age 15-30; Wage <\$30,000; Van. Coastal health authority.

b. 95% confidence intervals in brackets. Standard errors were obtained via bootstrap estimation based on re-sampling at the level of the surgeon (using scrambled surgeon identifier obtained from WorkSafeBC surgical/clinical data).

c. Recorded as annualized wage used to determine lost-time compensation..



**Table A3-2: Multiple quantile regression estimates for time to return-to-work from surgery, defined as surgery date to first return-to-work date.**

		25th Percentile Coefficient [95% CI]	50th Percentile Coefficient [95% CI]	75th Percentile Coefficient [95% CI] <sup>a</sup>
<b>Surgical setting and expedited status</b>	Private clinic; expedited	5.37 [-1.22,11.95]	6.00 [-5.68,17.68]	-2.14 [-36.60,32.32]
	Public hospital; expedited	6.88 * [0.15,13.62]	3.67 [-6.63,13.97]	6.72 [-37.69,51.14]
<b>Gender</b>	Women	11.04 * [2.13,19.95]	19.00 ** [5.95,32.05]	30.64 [-9.27,70.55]
<b>Age</b>	30-40	-2.25 [-12.90,8.40]	-4.00 [-27.11,19.11]	-57.32 [-162.95,48.31]
	40-50	-2.08 [-13.12,8.97]	-5.33 [-27.28,16.61]	-51.59 [-156.30,53.13]
	50-65	0.40 [-11.15,11.96]	2.33 [-21.45,26.12]	-19.89 [-130.91,91.12]
<b>Wage<sup>b</sup></b>	\$30-\$40,000	-2.90 [-11.08,5.27]	-14.00 [-28.57,0.57]	-150.74 ** [-248.07,-53.42]
	\$40-\$50,000	-6.98 [-14.80,0.84]	-18.67 * [-34.28,-3.05]	-169.62 *** [-266.26,-72.97]
	\$50-\$60,000	-8.88 * [-16.60,-1.17]	-28.33 *** [-43.40,-13.27]	-181.60 *** [-278.47,-84.72]
	>\$60,000	-15.87 *** [-23.66,-8.07]	-30.33 *** [-45.20,-15.47]	-190.18 *** [-282.67,-97.69]
<b>Health Authority</b>	Van. Island	-9.69 * [-17.53,-1.86]	-22.00 *** [-34.56,-9.44]	-28.44 [-69.85,12.98]
	Interior	-14.12 ** [-22.77,-5.46]	-17.33 * [-33.40,-1.26]	-35.11 [-82.08,11.87]
	Fraser	-7.15 [-15.30,0.99]	-13.00 [-26.73,0.73]	-23.82 [-66.47,18.83]
	Northern	-13.46 * [-26.26,-0.67]	-14.67 [-46.10,16.76]	-26.01 [-111.82,59.80]
<b>Clinical</b>	Previous same-knee surgery	5.42 [-0.35,11.19]	15.33 ** [3.93,26.74]	55.80 [-2.33,113.93]
	Osteoarthritis <sup>d</sup>	3.98 [-0.24,8.20]	8.67 * [1.35,15.99]	5.45 [-17.26,28.15]
<b>Occupation<sup>c</sup></b>	Health	20.33 *** [8.45,32.20]	20.33 * [2.07,38.60]	30.28 [-4.23,64.78]
	Sales	-1.37 [-11.13,8.40]	-2.33 [-15.58,10.92]	-19.36 [-55.98,17.26]
	Service	15.04 ** [5.75,24.33]	22.67 ** [5.92,39.42]	34.49 [-11.55,80.53]
	Construction trades	15.46 *** [7.50,23.42]	29.00 *** [14.61,43.39]	77.72 [-3.37,158.82]
	Other trades	13.19 ** [4.75,21.63]	21.67 *** [9.60,33.73]	38.53 * [8.19,68.87]
	Transportation, material handling	19.65 *** [11.75,27.56]	28.00 *** [15.61,40.39]	49.13 ** [14.66,83.60]
	Primary	25.42 *** [14.76,36.09]	63.00 *** [32.93,93.07]	165.27 *** [67.43,263.11]
	Processing, manufacturing	14.71 ** [3.58,25.85]	29.00 *** [13.68,44.32]	75.12 * [8.98,141.25]
	Constant <sup>e</sup>	25.29 ** [9.97,40.60]	53.33 *** [22.62,84.05]	277.34 *** [154.66,400.02]
Observations		1380	1380	1380

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

a. Reference categories: Public non-expedited; Men; Age 15-30; Wage <\$30,000; Van. Coastal health authority; No previous surgery; No osteoarthritis; Management/administrative/clerical/professional & related occupations.

b. 95% confidence intervals in brackets. Standard errors were obtained via bootstrap estimation based on re-sampling at the level of the surgeon (using scrambled surgeon identifier obtained from WorkSafeBC surgical/clinical data).

c. Recorded as annualized wage used to determine lost-time compensation.

d. Occupation classified according to Standard Occupational Classification (SOC) codes recorded at time of injury, in WorkSafeBC Claim file.

e. Osteoarthritis includes diagnoses of articular cartilage changes and chondromalacia, taken from the operative report.

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**APPENDIX 4****Figure A4: List of dissemination and knowledge transfer activities.***Peer-reviewed Papers in Research Journals*

1. Koehoorn M, Fan J, Barer M, McGrail K, Hogg-Johnson S, Côté P, McLeod C. Musculoskeletal Surgery Outcomes by Surgical Setting and Expedited Status in British Columbia. In preparation to submit to Health Care Policy.
2. Fan J, McLeod C, Koehoorn M. Sociodemographic, clinical, and work characteristics associated with partial, full, or no return to work following work-related knee surgery. Submitted to the Scandinavian Journal of Work, Environment & Health.
3. Smith P, Stock S, McLeod C, Koehoorn M, Marchand A, Mustard C. Research opportunities using administrative databases and existing surveys for new knowledge in occupational health and safety in Canada, Quebec, Ontario and British Columbia. Canadian Journal of Public Health, In Press.

*Published Abstracts*

1. Koehoorn M, Bogyo T, Chhokar R, McCloskey E, McLeod CB. Descriptive epidemiology of a cohort of injured workers with knee surgery between 2001 to 2005 in British Columbia. EPICOH -19<sup>th</sup> International Symposium on Epidemiology and Occupational Health, Banff, Alberta, October 9-12, 2007. Occupational and Environmental Medicine, 2007;64(12):e42.

*Oral Presentations at Research Conferences*

1. McLeod C, Koehoorn M, Fan J, Barer M, Côté P, Hogg-Johnson S, McGrail K. Investigating outcomes for musculoskeletal surgeries among injured workers in British Columbia, Canada. Workers' Compensation Research Working Group, Boston, MA, November 5-6, 2009.
2. McLeod CB, McCloskey E. The power in partnerships. Population Data BC Spring Conference. Vancouver, BC, March 17-18, 2009.

3. McLeod CB, Fan JK, Koehoorn MW. Musculoskeletal surgeries: Outcomes by surgical setting and expedited status. 21<sup>st</sup> Annual Occupational and Environmental Health Conference, Semiahmoo, WA, January 8-9, 2009.
4. Koehoorn M, McLeod C, Fan JK, Barer M, Côté P, Hogg-Johnson S, McGrail K. Musculoskeletal Surgery Outcome by Surgical Setting and Expedited Status in British Columbia. Canadian Association for Health Services and Policy Research, 2009 Annual Conference, Calgary, Alberta, May 11-14, 2009.
5. Mustard C, Koehoorn M, McLeod C, Tompa E. Measuring the impact of policy or program reform in workers' compensation: Three case studies. 2008 Association for Workers Compensation Boards of Canada-Policy Section Conference, Vancouver, BC, October 26-27, 2008.
6. Koehoorn M, McLeod CB, Demers PA, Tamburic L, Bogyo T, McCloskey E. The WorkSafeBC-CHSPR Research Partnership: the influence of the BC Linked Health Database research results on policy. Canadian Association for Research on Work and Health Conference, Montreal, QC, June 15-17, 2008.
7. McLeod CB, Lorenz EP, Fan JK, Nath R, Koehoorn M. Meniscus surgery wait times and time-to-return-to-work by expedited and public/private status in a workers' compensation sample in British Columbia. Canadian Association for Research on Work and Health Conference, Montreal, QC, June 15-17, 2008.
8. Koehoorn M, McLeod C, Chhokar R, Bogyo T, McCloskey E. North American Workers' Compensation Research Group. Musculoskeletal surgeries among injured workers. University of California, Berkeley, CA, April 20-21, 2007.

*Poster Presentations at Research Conferences*

1. Fan JK, McLeod CB, Koehoorn M. Return-to-work following knee surgery: The role of sociodemographic, work and clinical characteristics. Population Data BC Spring Conference, Vancouver, BC, March 17-18, 2009 (2<sup>nd</sup>-place poster competition).
2. Lorenz EP, McLeod CB, Fan JK, Nath R, Koehoorn M. Meniscus surgery wait times and time to return-to-work by expedited and public/private status in a worker's compensation population between 2001 and

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2005 in British Columbia (BC). Centre for Health Services and Policy Research UBC 20<sup>th</sup> Anniversary Health Policy Conference, Vancouver, BC, March 4-5, 2008.

3. McLeod CB, Chhokar R, Lorenz EP, Bogyo T, McCloskey E, Koehoorn MW. Meniscal surgery outcomes by surgical setting and expedited status. EPICOH -19<sup>th</sup> International Symposium on Epidemiology and Occupational Health, Banff, AB, October 9-12, 2007.

#### *Presentations to Stakeholder Groups*

1. McLeod CB, Koehoorn M, Fan JK. WorkSafeBC-CHSPR Research Partnership – Results from the Surgical Outcomes Project. Presentation to the Department of Corporate Planning and the Research Secretariat, WorkSafeBC, Richmond, BC, May 1, 2009.
2. Koehoorn M. Outcomes following surgery among injured workers: Does expedited surgery or surgery setting matter? Occupational Health and Safety Agency for Healthcare in BC, Vancouver, BC, April 20, 2009.
3. McLeod CB. WorkSafeBC-CHSPR research partnership. Centre for Health Services and Policy Research UBC Internal Seminar, Vancouver, BC, December 4, 2008.
4. Fan JK. WorkSafeBC-CHSPR Research Partnership –Surgical Research Database. Presentation to the Department of Health Care Services, WorkSafeBC, Richmond, BC, July 16, 2008.
5. McLeod CB, Koehoorn M, Fan JK. WorkSafeBC-CHSPR Research Partnership – Surgical Outcomes Project Round Table. Presentation to the Departments of Health Care Services, Corporate Planning, Clinical Services, Evidence Based Practices, and the Research Secretariat, WorkSafeBC, Richmond, BC, July 2, 2008.
6. Koehoorn M. How do I love data? Let me count the ways....Using linked health data for occupational health research. BC Environmental and Occupational Health Research Network Annual Workshop, Vancouver, BC, May 2, 2008.

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7. Koehoorn M, McLeod CB. Can we using existing data to answer policy relevant questions about occupational health and safety? Research Forum – WorkSafeBC, Richmond, BC, February 22, 2008.
  8. Koehoorn M. Data, data everywhere.....using existing, linked data for occupational health research. American Industrial Hygiene Association (BC-Yukon Chapter) Meeting, Burnaby, BC, January 16, 2008.
  9. Fan JK, Nath RN, Lorenz EP, McLeod CB, Koehoorn M. Musculoskeletal surgeries: outcomes by surgical setting and expedited status. Centre for Health Services and Policy Research UBC Internal Seminar, Vancouver, BC, December 5, 2008.
  10. Koehoorn M. A Research Partnership – University of British Columbia and WorkSafeBC. Presentation to Swedish Delegation to British Columbia, Richmond, BC, November 29<sup>th</sup>, 2007.
  11. McLeod CB, Koehoorn M. WorkSafeBC-CHSPR Research Partnership – Results from the Surgical Outcomes Project. Presentation to the Research Secretariat, WorkSafeBC, Richmond, BC, October 29, 2007.
  12. Koehoorn M. Occupational health surveillance in British Columbia. Occupational Health and Safety Agency for Healthcare in British Columbia Seminar Series, Vancouver, BC, October 15, 2007.
  13. Lorenz EP, Fan JK. WorkSafeBC-CHSPR Research Partnership – Preliminary Results from the Surgical Outcomes Project. Presentation to the Departments of Health Care Services and Evidence Based Practices, WorkSafeBC, Richmond, BC, August 15, 2007.
  14. McLeod CM, Chhokar R. Impact of care setting and wait time on post-surgical health among a population of injured workers. Centre for Health Services and Policy Research UBC Internal Seminar, Vancouver, BC, May 17, 2006.

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