ARTHRITIS COMMUNITY RESEARCH & EVALUATION UNIT (ACREU)

University Health Network

ORTHOPAEDIC SURGERY FOR INDIVIDUALS CONSULTING ORTHOPAEDIC SURGEONS IN ONTARIO, 2004-2007

Prepared by:

Mayilee Canizares
Elizabeth Badley
Crystal MacKay
Nizar Mahomed
Aileen Davis

*Address for correspondence:

Elizabeth Badley
e.badley@utoronto.ca

Arthritis Community Research & Evaluation Unit (ACREU)
Toronto Western Research Institute
399 Bathurst Street
MP-10th Floor, Suite 316
Toronto, ON M5T 2S8
Tel: (416) 603-6269
Fax: (416) 603-6288
www.acreu.ca

In collaboration with:

Institute for Clinical Evaluative Sciences

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Executive Summary

This report builds on and extends previous work presented in *Orthopaedic Surgery in Ontario in the Era of the Wait Time Strategy*[1] which showed that the number of encounters with orthopaedic surgeons in ambulatory settings far exceeded the number of procedures carried out by orthopaedic surgeons and that this varied by diagnostic groups. The objectives of the present study are to examine the proportion of individuals consulting orthopaedic surgeons in ambulatory settings who receive orthopaedic surgery, to describe sociodemographic and surgical visit factors associated with the use of orthopaedic surgery in this population, and to document geographic variation in the use of orthopaedic surgery across Local Health Integration Networks (LHIN) in the province.

- Ambulatory and hospital discharge databases were linked to examine the proportion of a cohort of individuals consulting orthopaedic surgeons in ambulatory settings (presumed eligible for orthopaedic surgery) who have orthopaedic surgery within 18 months of the initial visit.

- The study cohort was drawn from the 521,156 Ontarians who visited orthopaedic surgeons from October 1st, 2004 to September 30th, 2005. Individuals who had surgery without a prior ambulatory visit, and those who had orthopaedic surgery within six months prior to their initial ambulatory visit (where this was likely to be a post-surgical follow-up visit) were excluded. The final cohort consisted of 486,378 individuals, 93% of the total number of individuals who consulted with orthopaedic surgeons in ambulatory settings in the study year.

- Overall the age and gender pattern of individuals with at least one visit to orthopaedic surgeons were similar to those in our previous report. This is not surprising as our cohort represents over 90% of all individuals with orthopaedic encounters in Ontario in 2005. Approximately two fifths of visits to orthopaedic surgeons were for arthritis and related disorders, with a similar proportion visiting for trauma and related conditions.

- Only a small proportion of individuals consulting orthopaedic surgeons had orthopaedic surgery during the 18 months follow-up period. The proportion ranged from 14.2% (surgery was attributed to a prior ambulatory visit because of a similar diagnostic code) to 22.7% (any surgery)[1]. The proportion varied according to the diagnostic groupings studied; between 18.5% and 24.1% of those with bone disorders (mainly foot and ankle surgery), between 18.6% and 29.2% of those with joint derangement (mainly arthroscopic surgery), and between 28.2% and 34.7% of those with osteoarthritis (predominantly total joint replacement surgery).

- The proportion of individuals having surgery (attributed to a prior ambulatory visit) within 18 months of the initial ambulatory visit to orthopaedic surgeons varied with age according to diagnostic groups. Middle aged women were more likely to have surgery for bone disorders, younger men surgery for a joint derangement, and older individuals had surgery for osteoarthritis.

[1] Two methods were used to estimate the proportion of individuals having orthopaedic surgery. The first one was stringent where the surgery was attributed to a prior ambulatory visit based on the diagnostic group (both the ambulatory visit and the surgery had to have similar diagnostic group). The second one was liberal where the surgery was not attributed to a prior ambulatory visit.

- Neighbourhood income quintile of residence was related to the proportion of individuals having orthopaedic surgery during follow-up for osteoarthritis and joint derangement. The proportion of individuals having surgery was higher for those living in neighbourhoods in the highest income quintile as compared to those in the lowest income quintile (28.8% vs. 26.8% for osteoarthritis and 20.7% vs. 16.4% for joint derangement). For the remaining conditions studied no differences were seen.

- Less than one in ten Ontarians (8%) visiting orthopaedic surgeons consulted two or more orthopaedic surgeons. Those consulting two or more surgeons were more likely to have surgery during the follow-up period for every diagnostic group studied.

- For every condition studied, the time from the initial ambulatory visit in the study period to orthopaedic surgery was shorter for day surgeries than for elective surgeries carried out on an inpatient basis. Overall, the median time to surgery was 97 days ranging from 1 day for trauma and related conditions to 120 days for arthritis and related conditions. Within the arthritis group, the shortest median wait time was 79 days, for surgery for joint derangement and the longest wait time was 147 days for surgery for osteoarthritis.

- Greater variation across LHINs was seen in the number per 100,000 population of individuals having ambulatory orthopaedic visits for the conditions studied than in the proportion of individuals having orthopaedic surgery for the corresponding conditions.

- This study used a defined cohort of individuals in Ontario visiting orthopaedic surgeons in 2005, who were presumably eligible for orthopaedic surgery, and followed them from 18 months from their initial visit to orthopaedic surgeons within that year. The findings show that only between 14.2% and 22.7% received surgery within 18 months of their initial visit. The relatively low proportion of patients getting surgery raises issues about the organization of care for musculoskeletal conditions, especially when there are pressures on waiting times for elective procedures such as total joint replacement surgery. These analyses point to the important role that orthopaedic surgeons play in the management of musculoskeletal disorders in general. It also raises questions about alternative models of care to enhance efficiency in the health care system, to optimise the availability of orthopaedic surgeons for needed surgery, and to ensure the best possible care for individuals with musculoskeletal conditions.

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1.0 Introduction

Previous reports from the Arthritis Community Research and Evaluation Unit (ACREU) have considered the role of orthopaedic surgery for individuals with arthritis as well as the workload of orthopaedic surgeons related to acute trauma (such as fractures, dislocations and tendon repair), repair of damage from injury and musculoskeletal deformities (such as corrective foot and ankle surgery), spinal conditions, and other orthopaedic surgery related to other conditions such as musculoskeletal cancers [1;2]. The present report builds on and extends ACREU's previous work *Orthopaedic Surgery in Ontario in the Era of the Wait Time Strategy*[1].

This 2007 report provided a snapshot of the work carried out by orthopaedic surgeons in 2005/06 and demonstrated that the number of encounters with patients in ambulatory settings far exceeded the number of procedures carried out. Juxtaposing data for ambulatory encounters with those for surgery, the data suggested that less than one in three individuals seeing an orthopaedic surgeon get orthopaedic surgery. This is in line with the survey of Ontario Orthopaedic Surgeons which showed that only a third of time was spent in the operating room[3;4]. It is also consistent with findings from the UK, which have shown that, in some surgeon's practices, less than 30% of patients referred to orthopaedic surgeons are candidates for surgery on their initial consultation[5]. While there were indications from this report that the proportion of patients getting surgery varied depending on the underlying condition, it was not known what proportion of patients seen by surgeons eventually had surgery. Analyses of linked data for a number of years would be necessary to establish this.

This research examined this issue by linking data on ambulatory and hospital orthopaedic service utilization to identify and follow a cohort of individuals visiting orthopaedic surgeons, presumed to be candidates for surgery.

1.1 Objectives

a. To examine the proportion of individuals consulting orthopaedic surgeons in ambulatory settings who receive orthopaedic surgery;
b. To describe sociodemographic and surgical visit factors associated with the use of orthopaedic surgery in this population; and
c. To document geographic variation in the use of orthopaedic surgery across LHINs in the province.

1.2 Interpretative Cautions

This working report is a descriptive analysis of some of the factors that influence individuals getting orthopaedic surgery in Ontario. Conclusions about the appropriateness of current utilization patterns should be made with caution. This is a descriptive analysis meant to assist in identifying areas where further exploration is needed.

2.0 Methodology

2.1 Study Population

Ontario residents who had ambulatory encounters with orthopaedic surgeons between October 1st, 2004 and September 30th, 2005 (index year) were eligible for inclusion in the study cohort. Entry into the cohort was the date of the initial ambulatory visit to orthopaedic surgeons in the index year. Individuals with orthopaedic surgical procedures within six months previous to the initial ambulatory visit in the index year were not eligible, as visits to surgeons by these individuals were likely follow-up visits related to the previous surgery. Those individuals for whom the first encounter with orthopaedic surgeons in the index year occurred in hospital settings for surgery were also excluded. The follow-up period was fixed at 18 months from the date of entry into the cohort.

2.2 Data Sources

Administrative data from the Ontario Health Insurance Plan (OHIP) database, from the Discharge Abstract Database (DAD) and from the National Ambulatory Care Reporting System (NACRS) database provided by the Canadian Institute of Health Information (CIHI) for the fiscal years 2004/05 to 2006/07 (April 2004 to March 2007) were used to identify individuals accessing orthopaedic services in Ontario.

Linkages of OHIP database and DAD/NACRS databases were conducted based on patient's unique identifier and diagnosis of interest (Refer to Appendix I for a description of the diagnostic groups of interest). For each person and diagnosis, the initial encounter with orthopaedic surgeons in the index year was identified. If the initial encounter was in a hospital setting, for orthopaedic surgery, the person was excluded from subsequent analysis. For those with the first encounter in an ambulatory setting, the DAD/NACRS databases were searched retrospectively back six months from the date of the initial visit to identify previous orthopaedic surgeries. Orthopaedic surgeries were defined based on the presence of a surgical procedure code (Canadian Classification of Health Intervention (CCI) code in the musculoskeletal chapter) recorded in the hospital databases (Refer to Appendix I for a description of the surgical groups). If previous surgeries were found the individual was excluded from the study. The eligible individuals were then followed-up for 18 months from the first ambulatory visit in the index year. DAD/NACRS records were searched for the presence of an orthopaedic surgery. The OHIP database was linked to the Ontario's Persons Registered Database (RPDB) to derive age and sex for each person in the cohort.

2.3 Variable Definitions

The main outcome was the occurrence of an orthopaedic surgery within 18 months of the initial ambulatory visit to orthopaedic surgeons in the index year. The time to any orthopaedic surgery was calculated, as the number of days between the date of the initial ambulatory visit to orthopaedic surgeons and the date of orthopaedic surgery.

Variables that were used to examine variation in the proportion of individuals undergoing surgery included; diagnostic group, type of surgery, age, sex, neighbourhood income quintile, and number of orthopaedic surgeons consulted.

Type of orthopaedic surgery: Orthopaedic surgical procedures were classified according to the admission category variable in DAD and NACRS. Three groups were formed; non-elective surgery, elective surgery on an inpatient basis, and day surgeries.

Diagnostic groups: Hospital discharge and ambulatory visit databases use different classification systems for diagnosis (ICD10 and ICD9 based, respectively). Diagnosis codes in the ambulatory visit database were classified into one of the following groups: *arthritis and related conditions* (osteoarthritis, joint derangement, and other arthritis), *trauma and related conditions* (fractures and dislocations, sprains and strains, and other trauma), and *bone and joint conditions* (spine, bone, and other bone and joint). Diagnoses in hospital discharge databases associated with surgery were also allocated to similar groups.

Number of orthopaedic surgeons consulted: The number of orthopaedic surgeons consulted by each patient for a particular diagnosis of interest was calculated using the unique physician identifier.

Individual demographic characteristics: Sex, age, and neighbourhood income quintile. Neighbourhood income quintile was obtained for each census tract from census data based on patient's residential postal code.

2.4 Statistical analysis

Descriptive analyses were conducted to estimate the proportion of individuals who had orthopaedic surgery in the cohort. As the diagnostic coding systems used by physicians in OHIP (a subset of ICD 9 codes) and recorded in the CIHI databases at the time of surgery (full range of ICD 10 codes) were different, the proportion of individuals who received surgery for a given diagnosis was calculated in two different ways.

First we used stringent criteria where the diagnostic group recorded at the surgical encounter had to correspond to the diagnostic group recorded at a prior ambulatory visit. This method gives the most assurance that the surgery was related to the reason for the ambulatory visit. However, only 62.3% of the cohort members who received surgery were accounted for when this definition was used. This is referred to as *surgery attributed to a prior ambulatory visit*.

Second, a more liberal and inclusive method was used to identify individuals with surgery in the cohort. In this case, the surgical encounter could have any diagnostic group recorded. This way a maximum estimation of the proportion of individuals consulting orthopaedic surgeons and having surgery is obtained. However, this method may overestimate the proportion having surgery as cases with surgery unrelated to the visit are not excluded.

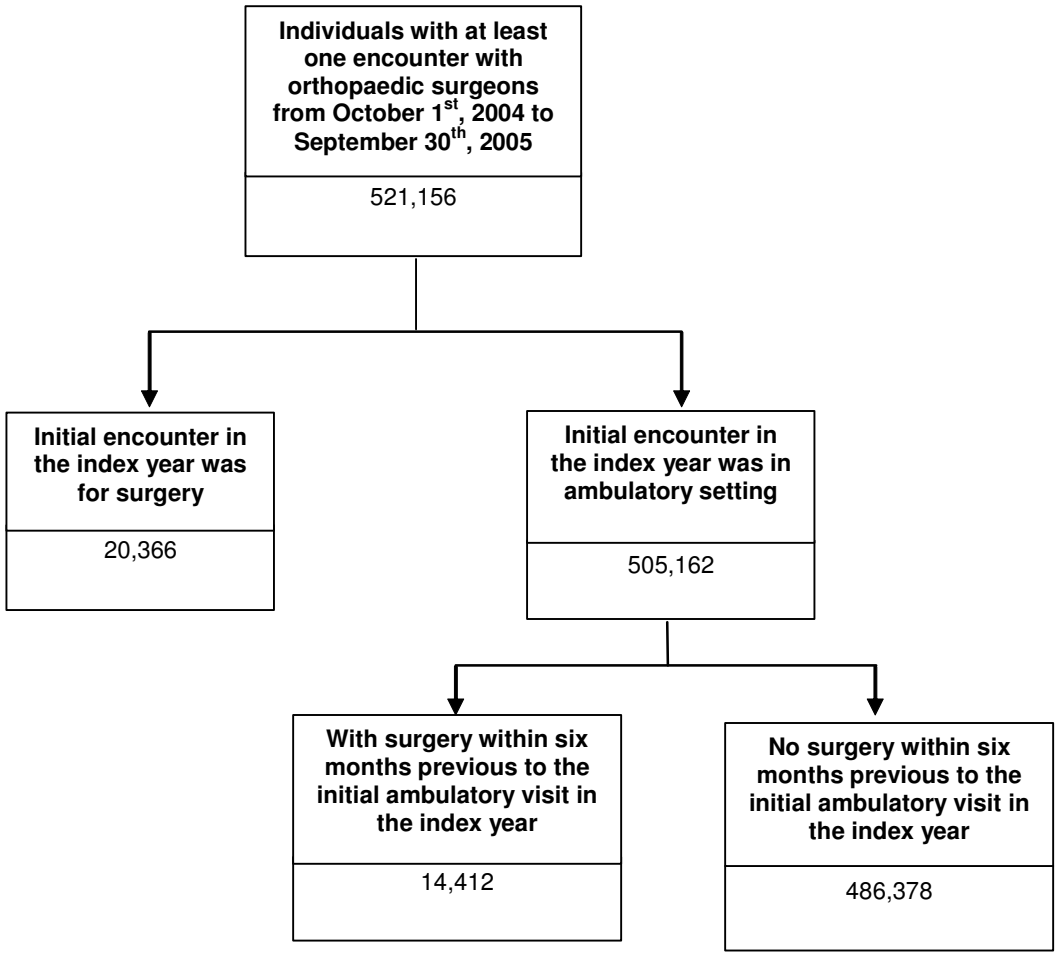
Crude as well as age and sex standardised rates were calculated for the number of individuals consulting orthopaedic surgeons for each LHIN. Cell sizes less than five are not reported due to reasons pertaining to confidentiality. Statistical Analysis Systems (SAS) Version 9.1 was used for all analyses.

3.0 Results

3.1 Study Population

The cohort for this study comprises 486 thousand Ontarians (38 per 1,000 population), who initially visited orthopaedic surgeons in the index year (October 1st, 2004 to September 30th, 2005) and who had not had any orthopaedic surgery in the six months before the initial consultation. Therefore the presumed reason for the visit relates to the potential need for surgery. Figure 1 illustrates how the cohort was identified. Out of the over half million Ontarians who made ambulatory visits to orthopaedic surgeons in the index year, 3.9% (20,366) were excluded as the first encounter with orthopaedic surgeons in the study period was an orthopaedic surgery. In addition 14,412 (2.8%) were excluded since they had orthopaedic surgery within six months previous to the initial visit in the period. The final cohort included 486,378 individuals (93.3% of all individuals who visited orthopaedic surgeons in the index year).

Figure 1: Distribution of individuals with encounters with orthopaedic surgeons from October 1st, 2004 to September 30th, 2005.



Data Sources: OHIP, DAD, NACRS, RPDB

3.2 Characteristics of the Cohort

The characteristics of the individuals included and excluded in the cohort are presented in Table 1. Of those that were excluded for having orthopaedic surgery within six months previous to the first ambulatory visit in the study period, over half visited for arthritis and related conditions and almost 40% visited for trauma and related diagnosis. Trauma and related conditions was the most common reason (66.3%) for visiting orthopaedic surgeons among those that were excluded when the first encounter with orthopaedic surgeons in the index year was for surgery. This group also included some patients for whom the ambulatory visit(s) prior to surgery was before the study period.

Table 1: Characteristics of individuals (included and excluded from the study) consulting orthopaedic surgeons between October 1st, 2004 and September 30th, 2005, Ontario.

	Included		**Excluded**			
	(Visit to orthopaedic surgeons in the index year† in ambulatory setting, with no surgery within six months of the initial ambulatory visit)		With orthopaedic surgery within six months of the initial ambulatory visit in the index year†		First encounter with orthopaedic surgeons in the index year† was for orthopaedic surgery	
	Number	%	Number	%	Number	%
All	486,378	100.0	14,412	100.0	20,366	100.0
Sex						
Women	252,954	52.0	8,050	55.9	11,280	55.4
Men	233,424	48.0	6,362	44.1	9,086	44.6
Age groups						
0-24	101,694	20.9	1,915	13.3	3,361	16.5
25-44	98,051	20.2	2,307	16.0	3,179	15.6
45-64	161,397	33.2	4,430	30.7	5,607	27.5
65+	125,236	25.7	5,760	40.0	8,219	40.4
Diagnostic groups						
Arthritis and related	201,505	41.4	7,895	54.8	5,748	28.2
Bone and joint	85,705	17.8	1,030	7.1	1,070	5.3
Trauma and related	224,696	46.1	5,544	38.5	13,500	66.3

Data Sources: OHIP, DAD, NACRS, RPDB
Note: Numbers do not add up total since individuals may have visits for more than one condition.
† Index Year: October 1st , 2004 – September 30th , 2005

Slightly more than half of the cohort members were women (52%) and about 40% were younger than 45 years. Of the 486 thousand individuals of the cohort, 202 thousand made at least one visit to orthopaedic surgeons for arthritis and related conditions (41.6%), 224 thousand visited orthopaedic surgeons for trauma and related conditions (46.1%) and 87 thousand consulted orthopaedic surgeons for bone and joint conditions (17.9%). Further details of the conditions associated with ambulatory visits to orthopaedic surgeons are shown in Table 2. On average, individuals made two ambulatory visits to orthopaedic surgeons in the index year for every condition group studied. The number of individuals potentially eligible for surgery visiting orthopaedic surgeons (i.e., the person visit rate) was 38.4 per 1,000 population.

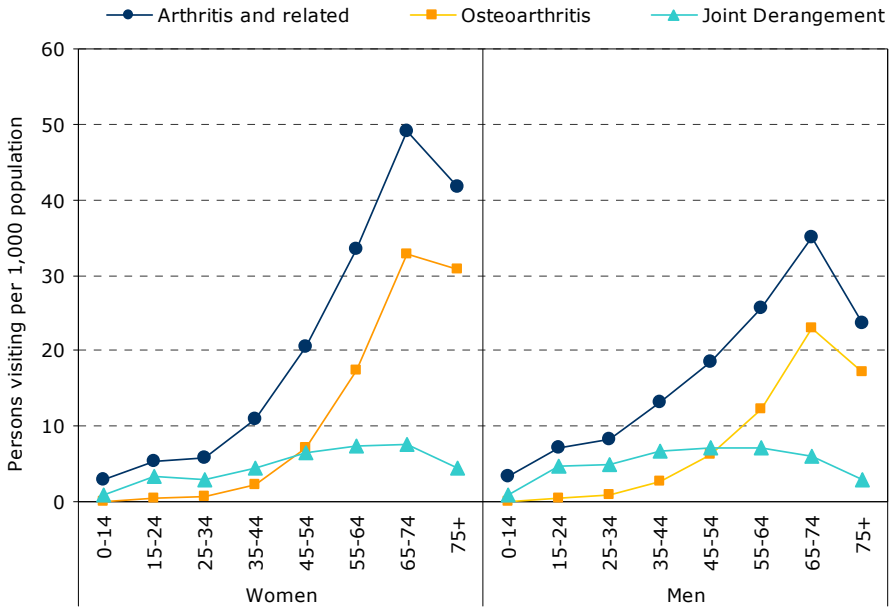
Table 2: Individuals with ambulatory visits to orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, Ontario.

	Number (%) of individuals (thousands)	Number of visits (thousands)	Mean number of visits per person	Individuals visiting per 1,000 population
Arthritis and related	**202 (41.6)**	**367**	**1.8**	**15.9**
Osteoarthritis	87	161	1.9	6.8
Joint derangement	57	97	1.7	4.5
Other arthritis	64	105	1.6	5.1
Bone and Joint	**86 (17.9)**	**140**	**1.6**	**6.9**
Spine	31	49	1.6	2.5
Bone	14	23	1.6	1.1
Other bone and joint	41	68	1.7	3.2
Trauma and related	**225 (46.1)**	**465**	**2.1**	**17.7**
Fractures and dislocations	111	247	2.2	8.8
Sprains and strains	108	198	1.8	8.5
Other trauma	11	20	1.8	0.9
All conditions	**486 (100.0)**	**1,023**	**2.1**	**38.4**

Data Sources: OHIP, DAD, NACRS, RPDB

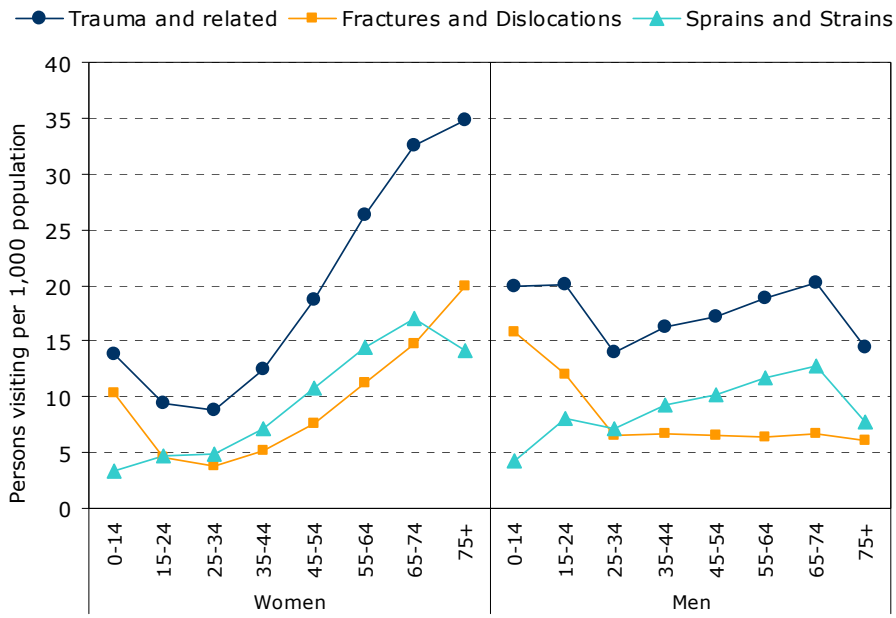
Figure 2 displays the rate per 1,000 population of individuals visiting orthopaedic surgeons for arthritis and related conditions by gender and age group. The visit rate for all arthritis and related conditions and osteoarthritis increased with age for both men and women, with a decrease in the highest age group. The rate for women visiting orthopaedic surgeons for these conditions was higher than the rate of men for those 55 years or older. The opposite situation was seen for those 44 years or younger. The rate for women visiting orthopaedic surgeons for joint derangement increased with age to the 55-64 years age group and declined in the highest age group. The corresponding visit rate for men increased with age to the 45-54 years age group and declined in the age group of 65-74 years. The rate was higher for women 65 years or older and for men 54 years or younger.

Figure 2: Number of men and women per 1,000 population visiting orthopaedic surgeons for arthritis and related conditions, osteoarthritis, and joint derangement, from October 1st, 2004 to September 30th, 2005, Ontario.



Data Sources: OHIP, DAD, NACRS, RPDB

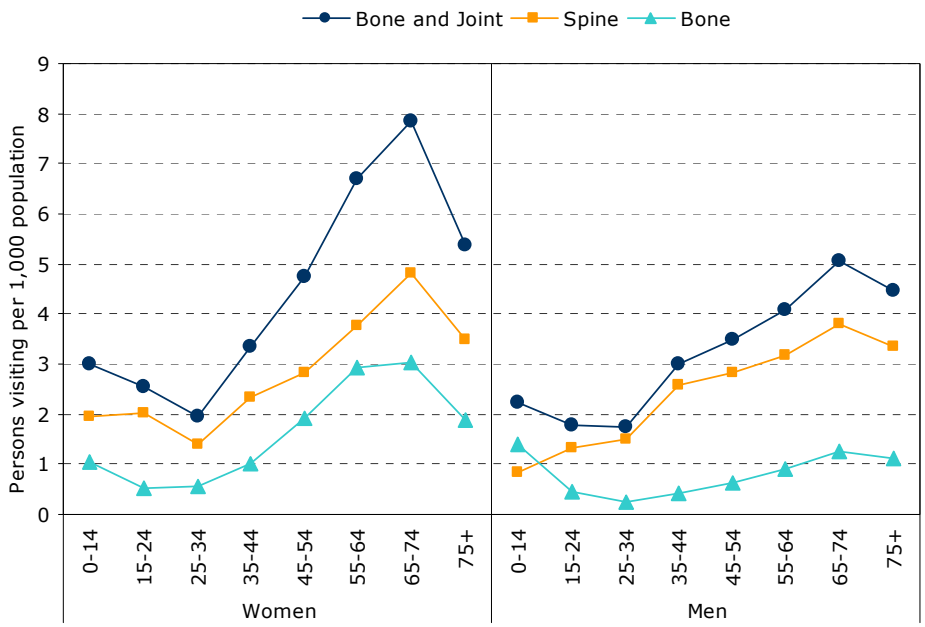
Figure 3: Number of men and women per 1,000 population visiting orthopaedic surgeons for trauma and related conditions, fractures and dislocations, and sprains and strains, from October 1st, 2004 to September 30th, Ontario.



Data Sources: OHIP, DAD, NACRS, RPDB

The number of men and women per 1,000 population visiting orthopaedic surgeons for trauma and related conditions is presented in Figure 3. The rate for women visiting orthopaedic surgeons for fractures and dislocations declined with increasing age to the 25-34 years age group and increased from age 35-44 years onwards. The rate for men visiting orthopaedic surgeons for this condition declined with increasing age to the 25-34 years age group; however rates for men did not change with increasing age for those 35 years or older. Rates were higher for men 44 years or younger and for women 45 years or older. The rate for men visiting orthopaedic surgeons for sprains and strains was higher for those 44 years or younger than the rate for women in the corresponding age group. The opposite situation was seen for those 55 years or older. The rate increased with age to the of 65-74 years age group and declined in the highest age group, for both men and women.

Figure 4: Number of men and women per 1,000 population visiting orthopaedic surgeons for bone and joint conditions, spine, and bone disorders, from October 1st, 2004 to September 30th, 2005, Ontario.



Data Sources: OHIP, DAD, NACRS, RPDB

The rates per 1,000 population for individuals visiting orthopaedic surgeons for bone and joint conditions, spine, and bone disorders are presented in Figure 4. Rates for bone and joint conditions and spine were higher for women than men, 45 years or older. Between the ages of 25 to 74 years, rates for these conditions increased with increasing age and declined in the highest age group, for both men and women. The rate for women visiting orthopaedic surgeons for bone disorders was higher than the rate for men in every age group with the exception of the lowest age group.

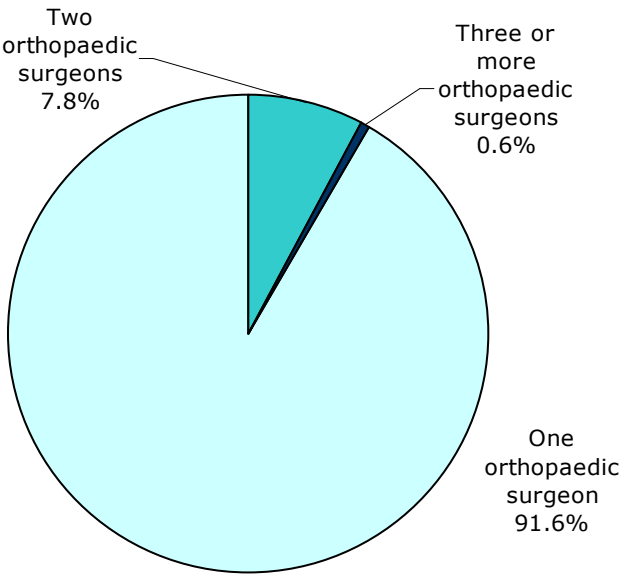
Overall, 22.9% of individuals who made an orthopaedic surgeon visit for any condition resided in neighbourhoods with high income quintile as opposed to 16.6% in the lowest category of neighbourhood income quintile (Table 3). Similar patterns were seen for all conditions studied.

Table 3: Percent distribution of neighbourhood income quintile by diagnostic groups among individuals with ambulatory visits to orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, Ontario.

	Individuals with ambulatory visits	**QI** (Lowest)		**QII**		**QIII**		**QIV**		**QV** (Highest)	
	Number	Number	%	Number	%	Number	%	Number	%	Number	%
Arthritis and related	**196,575**	**33,048**	**16.8**	**37,416**	**19.0**	**39,703**	**20.2**	**42,240**	**21.5**	**44,168**	**22.5**
Osteoarthritis	84,132	14,540	17.3	16,630	19.8	16,896	20.1	17,371	20.6	18,695	22.2
Joint derangement	55,948	8,576	15.3	10,154	18.1	11,403	20.4	12,620	22.6	13,195	23.6
Other arthritis	62,696	11,174	17.8	12,030	19.2	12,619	20.1	13,328	21.3	13,545	21.6
Bone and joint	**84,449**	**14,214**	**16.8**	**15,512**	**18.4**	**16,692**	**19.8**	**18,009**	**21.3**	**20,022**	**23.7**
Spine	30,495	5,610	18.4	5,916	19.4	6,150	20.2	6,276	20.6	6,543	21.5
Bone	13,981	2,289	16.4	2,517	18.0	2,813	20.1	3,009	21.5	3,353	24.0
Other bone and joint	39,975	6,284	15.7	7,076	17.7	7,598	19.0	8,745	21.9	10,272	25.7
Trauma and related	**218,074**	**38,107**	**17.5**	**40,911**	**18.8**	**42,086**	**19.3**	**45,578**	**20.9**	**51,392**	**23.6**
Fractures and dislocations	107,974	19,284	17.9	20,539	19.0	21,387	19.8	22,838	21.2	23,926	22.2
Sprains and strains	105,044	19,027	18.1	20,267	19.3	20,658	19.7	21,805	20.8	23,287	22.2
Other trauma	10,894	1,792	16.4	1,957	18.0	2,007	18.4	2,265	20.8	2,873	26.4
All conditions	**473,748**	**78,866**	**16.6**	**93,367**	**19.7**	**94,297**	**19.9**	**98,841**	**20.9**	**108,377**	**22.9**

Data Sources: OHIP, DAD, NACRS
Note: Subjects in the cohort with missing data on neighbourhood income quintile were excluded from this analysis

Figure 5: Proportion of individuals with ambulatory visits by number of orthopaedic surgeons consulted from October 1st, 2004 to September 30th, 2005, Ontario.



Data Sources: OHIP, DAD, NACRS

Getting second opinion is a widely recognized practice particularly for individuals for whom surgery has been recommended [6] . Of the 486 thousand individuals in the cohort, 91.6% consulted one orthopaedic surgeon and 8.4% consulted two or more orthopaedic surgeons (Figure 5). The distribution varied according to diagnostic groups (Table 4), individuals visiting for osteoarthritis or fractures and dislocations consulted two or more orthopaedic surgeons more frequently (over 11%).

Table 4: Proportion of individuals with ambulatory visits and number of orthopaedic surgeons consulted from October 1st, 2004 to September 30th, 2005, by diagnostic groups, Ontario.

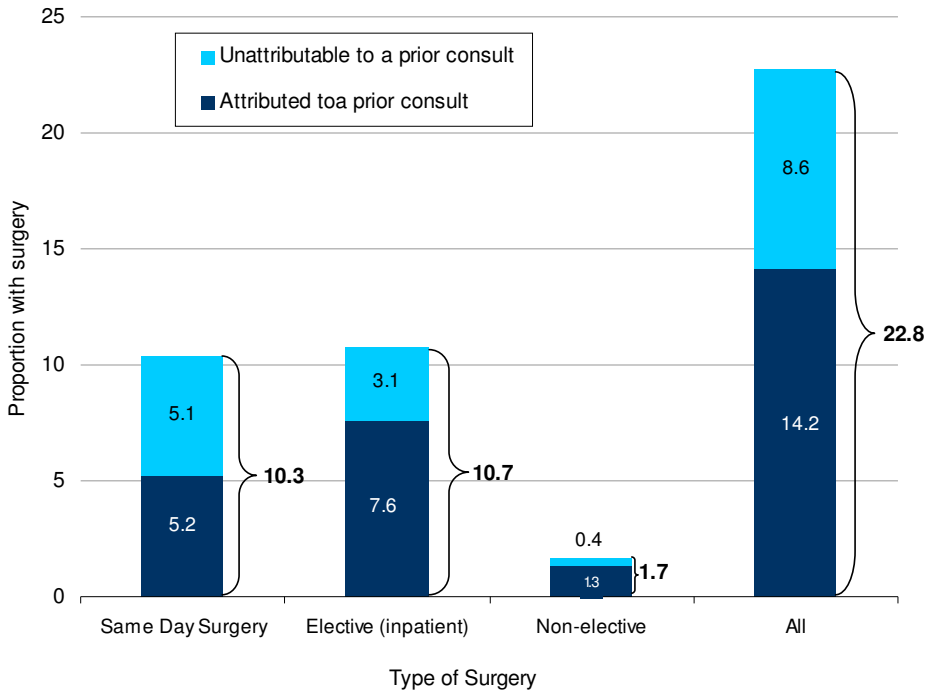
Diagnostic Group	All	One orthopaedic surgeon		Two or more orthopaedic surgeons	
	Number	Number	%	Number	%
Arthritis and related	**201,505**	**185,136**	**91.9**	**16,365**	**8.1**
Osteoarthritis	86,531	76,336	88.2	10,195	11.8
Joint derangement	57,348	54,055	94.3	3,293	5.7
Other arthritis	63,985	60,899	95.2	3,086	4.8
Bone and Joint conditions	**85,705**	81,085	**94.6**	**4,620**	**5.4**
Spine	31,257	28,625	91.6	2,632	8.4
Bone	14,348	13,756	95.9	592	4.1
Other MSK	40,870	39,460	96.6	1,410	3.4
Trauma and related	**224,696**	204,325	**90.9**	**20,371**	**9.1**
Fractures and dislocations	110,912	97,787	88.2	13,125	11.8
Sprains and strains	108,031	100,902	93.4	7,129	6.6
Other trauma	11,204	10,925	97.5	279	2.5
All conditions	**486,378**	445,593	**91.6**	**40,785**	**8.4**

Data Sources: OHIP, DAD, NACRS

3.3 Proportion of Individuals with Orthopaedic Surgery

Between 14.2% and 22.7% of individuals had surgery within 18 months of an initial consultation with orthopaedic surgeons. A total of 68,912 individuals (14.2%) had orthopaedic surgery attributed to a prior ambulatory visit and an additional 8.6% had surgery unattributable to a prior consult (Figure 6). Overall, 10.7% of individuals had an elective surgery of whom 7.6% had surgery attributed to a prior consult with the remaining 3.1% unattributable to a prior consult. In the latter cases the reported diagnosis for the ambulatory visit and for the surgery differed. Of those individuals having non-elective surgery, the majority had surgery attributed to a prior consult. In contrast, among those having day surgery similar proportions had surgery attributed (5.2%) and unattributable (5.1%) to s prior consult.

Figure 6: Proportion of individuals with orthopaedic surgery within 18 months of initial visit to orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, Ontario



Data Sources: OHIP, DAD, NACRS

The proportion of individuals having orthopaedic surgery varied across the different conditions studied (Table 5). Column A shows the findings for the proportion who had surgery attributed to a prior consult (lowest estimate) and column B shows the overall proportion having any surgery (highest estimate). Overall between 19.5% and 27.8% of individuals visiting orthopaedic surgeons for arthritis and related conditions had orthopaedic surgery. The proportion was lower for those visiting for bone and joint conditions (between 4.9% and 14.7%) or trauma and related conditions (between 3.7% and 13.6%). Within the major diagnostic groups there was variation in the proportion of individuals having orthopaedic surgery; the highest proportion (between 28.2% and 34.7%) who had surgery was found for osteoarthritis, followed by joint derangement (between 18.6% and 29.2%), bone disorders (between 18.5% and 24.1%), and fractures and dislocations (between 6.5% and 11.1%).

The difference between the highest estimate and the lowest estimate of the proportion with surgery was particularly marked for sprains and strains (0.7% attributed to a prior consult compared to 15.8% of any surgery) and for other bone and joint conditions (0% attributed to a prior consult and 14.0% of any surgery). This is likely related to the scope of codes in the two classification of diagnosis systems used. For example, the OHIP codes in the group of other bone and joint conditions include non specified codes such as pain in the leg which are unlikely to be present in the hospital data. Similarly, much of the increment in the proportion with surgery among those with visits for sprains and strains is in day surgeries; the most common codes in the hospital data were derangement of knee which is often treated by using knee arthroscopic surgery.

For simplicity, the following sections present results for the more conservative estimate; the surgery is attributed to a prior consult. In general the pattern of the proportion of individuals with surgery by age and sex was similar for both approaches.

Table 5: Proportion having orthopaedic surgery within 18 months of initial visit to orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, by diagnostic groups, Ontario.

	Individuals with ambulatory visits	Proportion with orthopaedic surgery								Proportion without surgery	
		All		SDS		Elective (inpatient)		Non-elective (inpatient)			
	(Number)	A	B	A	B	A	B	A	B	A	B
Arthritis and related	**201,505**	**19.5**	**27.8**	**7.2**	**12.1**	**12.1**	**14.8**	**0.2**	**0.9**	**72.2**	**80.5**
Osteoarthritis	86,531	28.2	34.7	2.1	5.0	25.8	28.6	0.3	1.1	65.3	71.8
Joint derangement	57,348	18.6	29.2	16.9	24.1	1.5	4.4	0.1	0.7	70.8	81.4
Other arthritis	63,985	6.7	15.3	4.6	10.0	1.9	4.4	0.2	0.9	84.7	93.3
Bone and joint	**85,705**	**4.9**	**14.7**	**2.4**	**6.9**	**2.4**	**6.8**	**0.1**	**0.9**	**85.3**	**95.1**
Spine	31,257	4.9	11.1	0.3	1.2	4.4	8.9	0.2	0.9	88.9	95.1
Bone	14,348	18.5	24.1	13.5	16.2	4.7	6.9	0.4	0.9	75.9	81.5
Other bone and joint	40,870	0.0	14.0	0.0	7.9	0.0	5.1	0.0	1.0	86.0	100.0
Trauma and related	**224,696**	**3.7**	**13.6**	**1.1**	**6.9**	**0.7**	**4.0**	**1.9**	**2.7**	**86.4**	**96.3**
Fractures and dislocations	110,912	6.5	11.1	1.7	4.1	1.1	2.7	3.7	4.4	88.9	93.5
Sprains and strains	108,031	0.7	15.8	0.5	9.5	0.1	5.3	0.0	1.0	84.2	99.3
Other trauma	11,204	3.7	12.0	1.4	6.4	1.1	3.6	1.2	2.0	88.0	96.3
All conditions	**486,378**	**14.2**	**22.7**	**5.2**	**10.3**	**7.6**	**10.7**	**1.3**	**1.7**	**77.3**	**85.8**

Data Sources: OHIP, DAD, NACRS

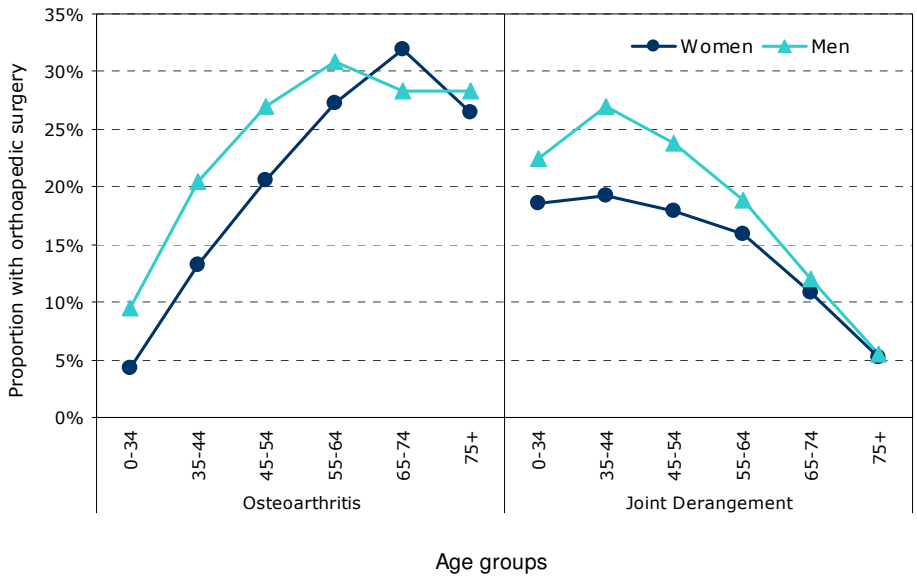
A: Attributed to the initial consult B: Any surgery

3.3.1 Variation by Age, Sex and Neighbourhood Income Quintile

Figures 7 to 9 illustrate the proportion of individuals in the cohort having surgery by gender and age for the specific diagnoses for which the proportion having surgery attributed to the initial consult was 5% or higher. The proportion of individuals visiting orthopaedic surgeons for osteoarthritis and having orthopaedic surgery for this condition (90% of these surgeries were total joint replacement) increased with age for both men and women, with a decrease in the highest age group (Figure 7).The proportion having orthopaedic surgery increased with increasing age for women to the age group of 65-74 years and for men to the age group of 55-64 years. The proportion of men having orthopaedic surgery was slightly higher in every age group, with the exception of the 65-74 years age group.

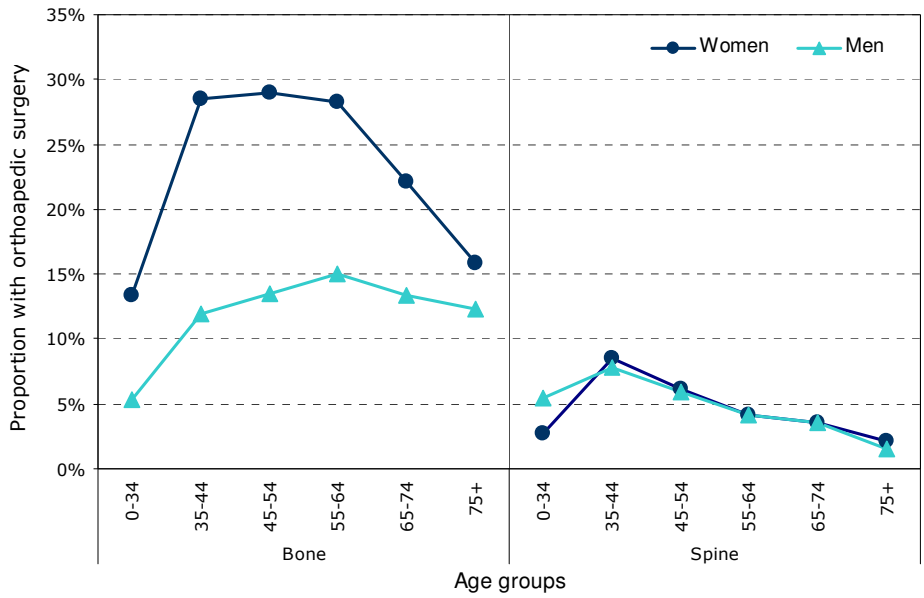
Figure 7 also displays the proportion of individuals having orthopaedic surgery for joint derangement. The proportion of individuals having an ambulatory orthopaedic visit followed by surgery for this condition (96% of these surgeries were arthroscopy) decreased with age from the 35-44 age group onwards. The proportion of men having orthopaedic surgery was higher than that for women for those 64 years or younger.

Figure 7: Proportion of individuals with orthopaedic surgery within 18 months of initial ambulatory visit to orthopaedic surgeons for osteoarthritis and joint derangement, from October 1st, 2004 to September 30th, 2005, by age and sex, Ontario



Data Sources: OHIP, DAD, NACRS, RPDB

Figure 8: Proportion of individuals with orthopaedic surgery within 18 months of initial ambulatory visit to orthopaedic surgeons for spine and bone disorders, from October 1st, 2004 to September 30th, 2005, by age and sex, Ontario.

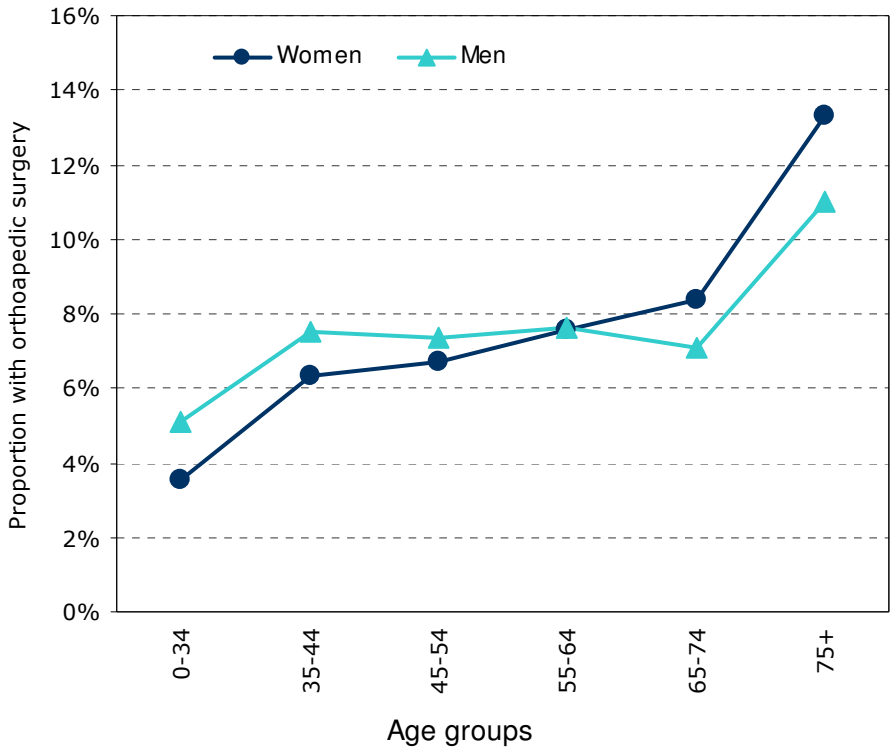


Data Sources: OHIP, DAD, NACRS, RPDB

A markedly higher proportion of women than men had surgery for bone disorders for every age group (Figure 8). The relatively high proportion of women having surgery between the ages of 35 to 64 years (about 28% of women with visits to orthopaedic surgeons) was mainly associated with foot and ankle surgery.

Only a minority of individuals visiting orthopaedic surgeons for spine disorders had surgery. Although in most age groups the person visit rate for women for spine disorders was higher than that for men (Figure 4), no difference was found in the proportion of men or women having orthopaedic surgery. The proportion declined with increasing age for both men and women 35 years or older (Figure 8).

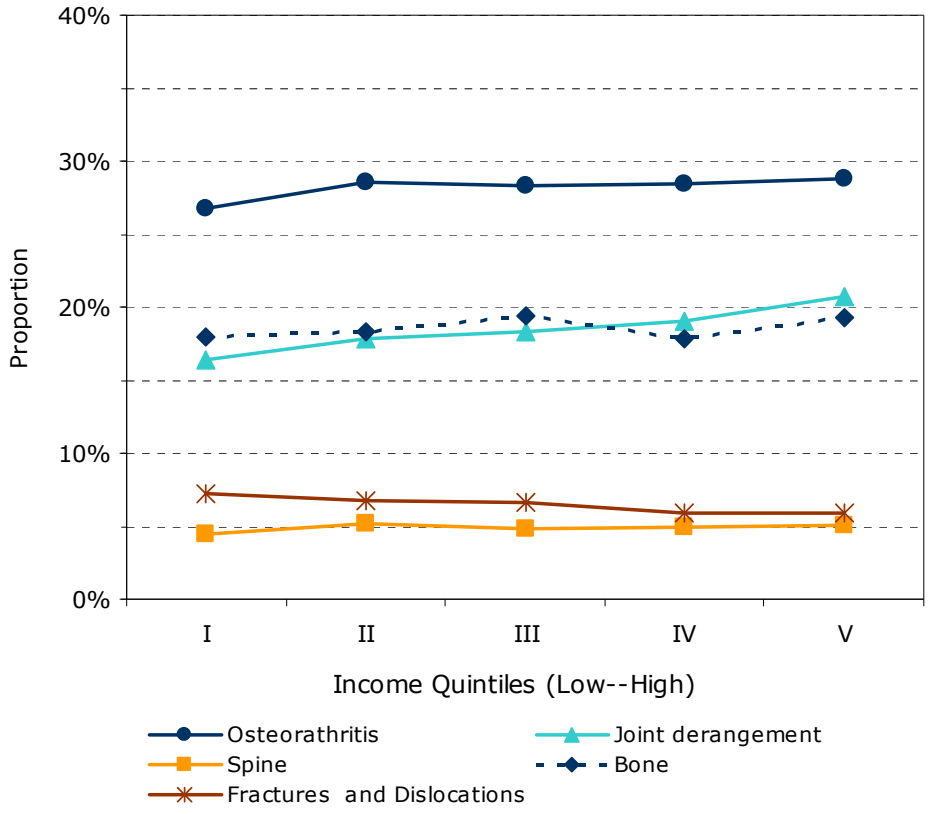
Figure 9: Proportion of individuals with orthopaedic surgery within 18 months of first ambulatory visit to orthopaedic surgeons for fractures and dislocations by age and sex, from October 1st, 2004 to September 30th, 2005, Ontario.



Data Sources: OHIP, DAD, NACRS, RPDB

A low proportion of individuals visiting orthopaedic surgeons for fractures and dislocations had surgery (Figure 9). The proportion of men having surgery was slightly higher than the proportion of women for those 44 years or younger and the reverse situation was seen among those 65 years or older. These findings do not include individuals who had surgery for fracture without a prior surgeon visit.

Figure 10: Proportion of individuals having orthopaedic surgery within 18 months of initial visit to orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, by selected diagnosis, Ontario.



Data Sources: OHIP, DAD, NACRS, RPDB

The proportion of individuals having orthopaedic surgery was similar across levels of neighbourhood income quintile for the conditions studied with the exception of osteoarthritis and joint derangement. For these conditions the proportion having surgery was slightly higher for individuals who lived in neighbourhoods with higher income quintile compared to those living in neighbourhoods with lowest income quintile (Figure 10).

Table 6: Proportion of individuals having orthopaedic surgery by diagnosis groupings and number of orthopaedic surgeons consulted, from October 1st, 2004 to September 30th, 2005, Ontario.

	Individuals consulting orthopaedic surgeons		Consulted one orthopaedic surgeon		Consulted two or more orthopaedic surgeons	
	All	With surgery	All	With surgery	All	With surgery
	(Number)	(%)	(Number)	(%)	(Number)	(%)
Arthritis and related	**201,505**	**19.4**	**185,136**	**18.0**	**16,365**	**35.2**
Osteoarthritis	86,531	28.2	76,403	26.6	10,195	40.4
Joint derangement	57,348	18.6	54,071	17.8	3,293	31.0
Other arthritis	63,985	6.7	60,901	6.3	3,086	13.3
Musculoskeletal (MSK)	**85,705**	**4.9**	**82,013**	**4.6**	**4,620**	**9.2**
Spine	31,257	4.9	28,627	4.5	2,632	9.2
Bone	14,348	18.5	13,760	18.1	592	28.9
Trauma and related	**224,696**	**3.7**	**203,856**	**2.5**	**20,371**	**15.9**
Fractures and dislocations	110,912	6.5	97,819	4.2	13,125	23.2
Sprains and strains	108,031	0.7	100,928	0.6	7,129	1.6
Other trauma	11,204	3.7	10,925	3.5	279	12.9
All conditions	**486,378**	**10.6**	**445,593**	**9.3**	**40,785**	**24.2**

Data Sources: OHIP, DAD, NACRS, RPDB

The proportion of individuals having orthopaedic surgery according to the number of orthopaedic surgeons consulted is displayed in Table 6. Although the number consulting more than one surgeon was small, in general, individuals who consulted more than one orthopaedic surgeon had orthopaedic surgery more frequently for every diagnostic group studied. For instance, 40.4% of individuals visiting more than one orthopaedic surgeon for osteoarthritis had orthopaedic surgery within 18 months from the initial ambulatory visit in the index year; compared to 26.6% among those who visited one orthopaedic surgeon.

3.3.2 Time from Baseline to Orthopaedic Surgery

The median time to orthopaedic surgery ranged from one day (for trauma and related conditions) to 120 days (for arthritis and related conditions) and variations were seen according to the underlying condition and the type of surgery (Table 7). The median time was lower for same day surgeries than elective surgery on an inpatient basis for every diagnostic group studied.

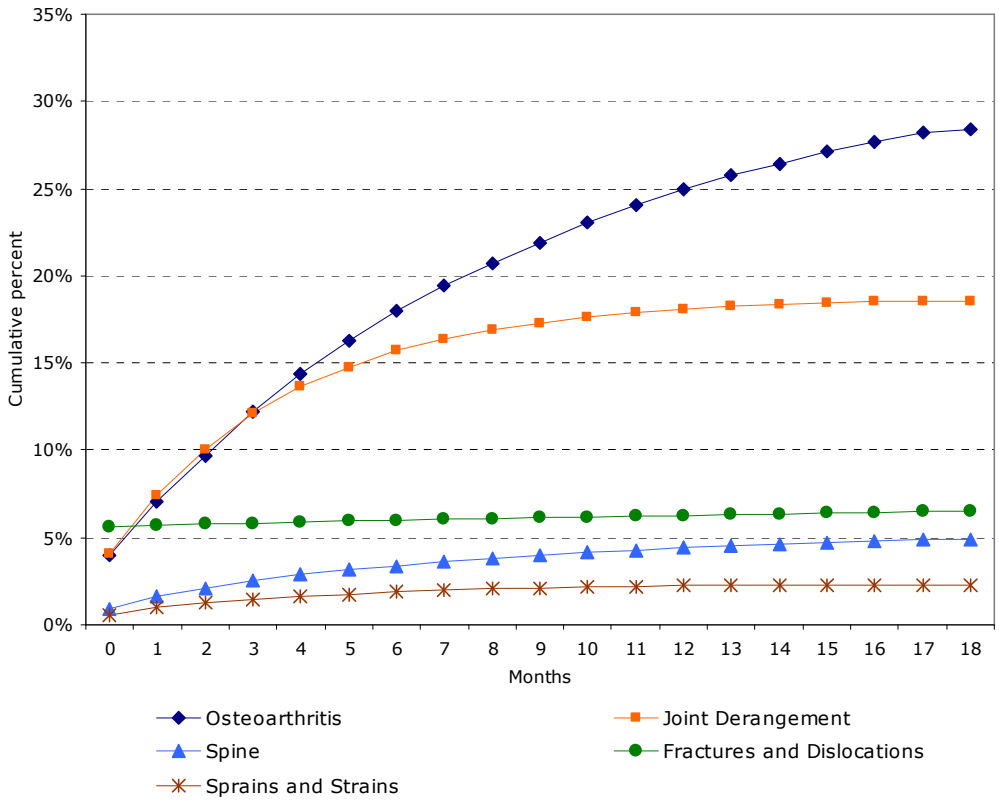
Table 7: Time (in days) from first ambulatory' visit to date of orthopaedic surgery by diagnostic groups and type of surgery, among individuals visiting orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, Ontario.

Diagnosis Group	Overall		Elective (inpatient)		SDS	
	Median	IQR*	Median	IQR*	Median	IQR*
Arthritis and related	**120**	**49-242**	**154**	**63-293**	**85**	**38-167**
Osteoarthritis	147	60-283	153	62-291	100	50-193
Joint derangement	79	35-155	115	48-224	77	34-150
Other arthritis	106	48-217	155	62-292	96	47-196
Musculoskeletal (MSK)	**114**	**50-219**	**129**	**51-262**	**109**	**55-193**
Spine	110	39-250	122	46-261	63	23-123
Bone	112	53-204	131	53-255	109	57-193
Trauma and related	**1**	**0-15**	**5**	**1-21**	**4**	**1-24**
Fractures and dislocations	1	0-7	3	0-9	2	0-7
Sprains and strains	72	29-169	138	59-214	65	28-146
Other trauma	10	0-127	64	8-180	4	0-61
All conditions	**97**	**27-218**	**141**	**51-280**	**76**	**28-158**

Data Sources: OHIP, DAD, NACRS, RPDB
* Inter-quartile range
Note: Data on non-elective surgery is not presented due to small numbers.

Figure 11 shows the cumulative proportion of individuals having orthopaedic surgery (attributed to a prior consult), within 18 months of the initial ambulatory visit in the index year, for selected diagnostic groups. The trajectory over time shows a continued increase in the proportion having surgery after 12 months only for osteoarthritis and spine conditions. However, after 18 months the curve of the trajectory had flattened suggesting that this time period had captured the majority of the surgeries that were carried out.

Figure 11: Cumulative percent curve of having orthopaedic surgery, within 18 months of initial visit to orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, by selected diagnostic groups, Ontario.



Data Sources: OHIP, DAD, NACRS, RPDB

3.3.3 Geographic Variation

This section results are given for surgeries attributable to a prior ambulatory consultation. Similar findings were obtained for all surgeries. Table 8 displays the number of individuals visiting orthopaedic surgeons and having orthopaedic surgery for osteoarthritis and joint derangement by LHIN. The variation in the number of persons per 100,000 population visiting orthopaedic surgeons for osteoarthritis and in the number of persons per 100,000 population having surgery was relatively low (extremal quotient 2.4 and 2.6 respectively). Waterloo Wellington LHIN had the highest proportion of individuals having orthopaedic surgery for this condition (36.9%) while Central LHIN had the lowest proportion (25.5%) followed by the North West LHIN (25.9%)

Table 8: Number of individuals per 100,000 population and proportion having orthopaedic surgery for osteoarthritis and joint derangement, within 18 months of initial ambulatory visit with orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, by Local Health Integration Networks (LHIN), Ontario.

	Osteoarthritis			**Joint derangement**		
	Individuals visiting orthopaedic surgeons per 100,000 population	Individuals who had surgery per 100,000 population	% with surgery	Individuals visiting orthopaedic surgeons per 100,000 population	Individuals who had surgery per 100,000 population	% with surgery
Erie St Clair	876.9	269.8	30.8	386.9	87.7	22.7
South West	952.0	287.7	30.2	476.0	83.6	17.6
Waterloo Wellington	624.7	230.6	36.9	354.6	98.0	27.6
Hamilton Niagara Haldimandt Brant	888.1	271.2	30.5	598.2	118.9	19.9
Central West	401.4	109.6	27.3	449.2	66.9	14.9
Mississauga Halton	484.7	127.3	26.3	469.0	84.9	18.1
Central	537.4	137.1	25.5	301.4	55.5	18.4
Toronto Central	448.1	131.1	29.3	370.5	64.5	17.4
Central East	585.4	185.3	31.7	441.2	91.2	20.7
South East	759.2	203.6	26.8	564.7	104.3	18.5
Champlain	651.6	192.8	29.6	296.7	85.5	28.8
North Simcoe	672.0	214.6	31.9	293.6	47.9	16.3
North East	767.7	233.6	30.4	344.9	68.0	19.7
North West	792.7	205.4	25.9	1,424.6	131.1	10.3
Ontario	**683.7**	**192.9**	**29.8**	**453.1**	**83.4**	**19.2**
Extremal Quotient	**2.4**	**2.6**		**4.9**	**2.7**	

Data Sources: DAD,OHIP

Table 8 also shows that there was a five-fold variation in the number of individuals per 100,000 population visiting orthopaedic surgeons for joint derangement and a three-fold variation in the

number per 100,000 population having orthopaedic surgery. The rate per 100,000 population of individuals visiting orthopaedic surgeons for the North West LHIN far exceeded the provincial rate but the proportion having orthopaedic surgery was lower than the provincial estimate (10.3% compared to 19.2%. Champlain and Waterloo Wellington LHINs had lower rates per 100,000 population of individuals visiting orthopaedic surgeons but higher proportions of individuals having orthopaedic surgery for this condition (27.6% and 28.8% respectively).

Table 9: Number of individuals per 100,000 population and proportion having orthopaedic surgery for spine and bone conditions, within 18 months of first ambulatory visit with orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, by Local Health Integration Networks (LHIN), Ontario.

	Spine			Bone		
	Individuals who visited orthopaedic surgeons per 1,000 population	Individuals who had surgery per 1,000 population	% with surgery	Individuals who visited orthopaedic surgeons per 1,000 population	Individuals who had surgery per 1,000 population	% with surgery
Erie St Clair	124.6	10.2	8.2	115.2	33.8	29.4
South West	212.5	18.6	8.7	105.9	21.3	20.1
Waterloo Wellington	146.9	13.7	9.3	93.9	16.4	17.4
Hamilton Niagara Haldimandt Brant	269.6	22.5	8.4	145.3	23.3	16.1
Central West	196.9	8.1	4.1	55.8	9.6	17.2
Mississauga Halton	219.3	9.5	4.3	77.9	17.1	22.0
Central	213.3	7.7	3.6	103.3	19.1	18.5
Toronto Central	256.1	8.8	3.5	95.9	19.1	19.9
Central East	327.2	12.3	3.7	115.5	23.0	19.9
South East	200.3	11.8	5.9	102.6	16.2	15.8
Champlain	238.6	6.8	2.9	153.9	28.9	18.8
North Simcoe	172.1	15.3	8.9	133.9	17.7	13.2
North East	205.5	10.0	4.9	85.9	19.9	23.2
North West	595.3	14.3	2.4	200.8	28.6	14.2
Ontario	**236.8**	**12.0**	**5.1**	**110.3**	**21.0**	**19.0**
Extremal Quotient	**4.8**	**3.3**		**3.5**	**3.5**	

Data Sources: DAD,OHIP

The extremal quotient for the number of individuals per 100,000 population consulting orthopaedic surgeons and the number of individuals having orthopaedic surgery was 4.8 and 3.3, respectively (Table 9). North West LHIN had the highest rate of individuals visiting orthopaedic surgeons and Erie St Clair LHIN had the lowest rate (595.3 and 124.6 per 100,000 population, respectively). North West LHIN had the lowest proportion (2.4%) of individuals having surgery followed by the Champlain LHIN (2. 9%), while Waterloo Wellington LHIN had the highest proportion of individuals having surgery for spine disorders (9.3%).
There was over a three-fold variation in the number of individuals per 100,000 population visiting orthopaedic surgeons and the number having orthopaedic surgery for bone disorders

(Table 9). Central West LHIN had the lowest rate (55.8 per 100,000 population) and North West LHIN had the highest rate (200.8 per 100,000 population). Erie St Clair LHIN had the highest proportion (29.4%) of individuals having orthopaedic surgery for this condition and North Simcoe Muskoka LHIN had the lowest proportion (13.2%).

Table 10: Number of individuals per 100,000 population and proportion of having orthopaedic surgery for fractures and dislocations and sprains and strains, within 18 months of initial ambulatory visit with orthopaedic surgeons from October 1st, 2004 to September 30th, 2005, by Local Health Integration Networks (LHIN), Ontario.

	Fractures and dislocations			**Sprains and Strains**		
	Individuals who visited orthopaedic surgeons per 1,000 population	Individuals who had surgery per 1,000 population	% with surgery	Individuals who visited orthopaedic surgeons per 1,000 population	Individuals who had surgery per 1,000 population	% with surgery
Erie St Clair	727.1	37.1	5.1	808.2	10.8	1.3
South West	783.9	74.8	9.5	567.0	3.9	0.7
Waterloo Wellington	679.8	53.8	7.9	309.6	3.2	1.0
Hamilton Niagara Haldimandt Brant	1,069.9	74.0	6.9	729.5	3.1	0.4
Central West	655.9	43.2	6.6	653.6	10.3	1.6
Mississauga Halton	742.7	32.8	4.4	611.6	6.8	1.1
Central	979.3	54.7	5.6	972.3	6.8	0.7
Toronto Central	839.1	47.0	5.6	853.4	6.1	0.7
Central East	905.4	60.4	6.7	855.4	3.2	0.4
South East	1,008.2	79.0	7.8	1,080.9	2.7	0.2
Champlain	835.0	60.6	7.3	991.1	1.5	0.2
North Simcoe	789.2	85.1	10.8	1,216.7	21.6	1.8
North East	769.3	57.7	7.5	1,035.6	6.5	0.6
North West	766.3	40.7	5.3	744.8	2.9	0.4
Ontario	**846.4**	**56.8**	**6.7**	**803.5**	**5.6**	**0.7**
Extremal Quotient	**1.6**	**2.6**		**3.9**	**14.3**	

Data Sources: DAD,OHIP

Table 10 displays the number of individuals per 100,000 population visiting orthopaedic surgeons for fractures and dislocations as well as for sprains and strains. There was little variation in the number of individuals per 100,000 population visiting orthopaedic surgeons for fractures and dislocations across LHINs (extremal quotient 1.6). North Simcoe Muskoka and South West LHINs had higher proportion of individuals having surgery for fractures and dislocations (over 9%) and Mississauga Halton LHIN had the lowest proportion (4.4%). There was higher variation in the number of individuals per 100,000 population visiting orthopaedic surgeons for sprains and strains (extremal quotient 3.9). North Simcoe Muskoka and North East LHINs had the higher rates (1,216.7 and 1,035.6 per 100,000 population respectively) while Waterloo Wellington LHIN had the lowest (309.6). Although there was a high degree of variation

in the number of individuals per 100,000 population having surgery for sprains and strains (extremal quotient 14.3) the overall proportions of surgery were low (less than 2%).

4.0 Limitations

This was a retrospective cross-sectional study based on administrative databases and not designed to identify predictive factors for orthopaedic surgery. We linked two different databases to estimate what proportion of individuals seen in ambulatory settings by orthopaedic surgeons had surgery. To create the cohort several assumptions were made. First we excluded individuals for whom an orthopaedic surgery was performed six months previous to the initial ambulatory visit, since subsequent ambulatory visits were assumed to be follow-up visits. We also excluded individuals who visited orthopaedic surgeons in the study period but the initial encounter was for surgery. A high proportion of individuals in this group were seen by orthopaedic surgeons for acute trauma. However, the characteristics of the cohort are similar to the whole group of individuals visiting orthopaedic surgeons within a year.

Ambulatory visits were estimated using physician billing data, all patients seeing physicians remunerated under alternate payment plans might not be captured, unless there is shadow billing. Therefore some of the variation in person rates may relate to area variations in the availability of provision with alternate payment plans. Also, our cohort was assembled in 2005 to allow an adequate follow up time to surgery. This was at the beginning of the implementation of the Ontario Wait Time Strategy. There may have been changes in the delivery of orthopaedic care since that time. However, evidence from trends in surgery rates suggest that the Wait Time Strategy only affected rates for total joint replacement, rates for other kinds of surgery were unaffected [1;7]. It is unlikely therefore that these changes to the health care system would have substantially affected our findings.

Linking surgeries to physician billings database is not straightforward. Both databases use different classification of diagnosis (a sub-set of ICD-9 codes for ambulatory visits data and ICD-10 for data on hospitalizations), and therefore the codes used in the two setting may not be equivalent. Also, it is well known that there are inaccuracies in codes recorded in billing data. Therefore, two definitions of individuals in the cohort receiving surgery were used. One was conservative (the surgery was attributed to *a* prior ambulatory consult) and the second one more liberal (any surgery). The former may have resulted in underestimating the proportion of individuals consulting orthopaedic surgeons who received surgery within 18 months of the initial consultation and the latter may overestimated the proportion. By restricting the linkage to individuals with corresponding diagnostic groups in both databases the results potentially omit over one-third of the surgeries carried out in the cohort. In addition, not restricting the diagnosis recorded in the surgical encounter may result in potentially including surgeries unrelated to the ambulatory visit. In future work, one way of minimizing the effect of this may be creating compatible groups of diagnosis and types of surgeries.

5.0 Discussion

This report brings together information on ambulatory and hospital orthopaedic services in Ontario in the context of enhancing services for individuals with arthritis and other musculoskeletal conditions. This study used a defined cohort of all individuals in Ontario visiting orthopaedic surgeons in 2005, who were presumably eligible for orthopaedic surgery. Individuals were followed for 18 months from their initial surgeon visit within that year. The

findings show that a relatively small proportion (22.8% with any diagnostic group and 14.2% attributed to a prior visit) of individuals consulting orthopaedic surgeons received surgery within 18 months of their initial visit. The proportion varied according to the diagnostic group, almost 30% of individuals seeing orthopaedic surgeons for osteoarthritis had surgery for this condition (where the surgery could be attributed to a prior surgeon visit) as opposed to less than 1% among those visiting for sprains and strains and other bone and joint conditions Given the flattening of the trajectory of the proportion receiving surgery over time, it is unlikely that a longer follow-up period would have substantially changed these results.

Our cohort excluded individuals who had had surgery in the previous six months and were therefore likely to be seeing a surgeon for follow-up. Some of these individuals also may have been visiting for an opinion as to a further surgery. We also excluded individuals who had surgery without a prior orthopaedic surgeon visit, slightly more than 20,000 individuals.

The finding that only a minority of patients seeing an orthopaedic surgeon receive surgery is compatible with findings from the US [8] and the UK [5], although differences in methodology make exact comparisons difficult. It is also in line with surveys of Ontario Orthopaedic Surgeons which show that only a third of their time was spent in the operating room [3;4;9;10]. Anecdotal accounts from surgeons suggest that a sizeable proportion of individuals referred for hip or knee arthritis are not yet ready for surgery, and neither are patients fully aware of other treatment options for the management of their arthritis, including the role of exercise, physical therapy and use of appropriate medications.

The relatively low proportion of individuals getting surgery raises issues about the organization of care for musculoskeletal conditions, especially when there are pressures on waiting times for elective procedures such as TJR surgery. The extent to which the large volume of patients who are not ultimately candidates for surgery affect waiting times for orthopaedic surgeon appointments for patients in urgent need of surgery is not known. Certainly concerns have been expressed in the context of TJR surgery about the length of waiting times from primary care referral to seeing a surgeon (the so called "wait 1")[11]. Enhancement of the capacity of primary care physicians to diagnose and treat musculoskeletal conditions is clearly important, including musculoskeletal trauma and back and other soft-tissue disorders. It is also timely given primary care reform in Ontario with the formation of primary care teams to look at other options including a wider role for other health professionals.

Overall the age and gender pattern of visits were similar to those in our previous report [1;2]. This is not surprising as our cohort represents over 90% of all individuals with orthopaedic encounters in Ontario in 2005. Approximately two fifths of visits to orthopaedic surgeons were for arthritis and related disorders, with a similar proportion visiting for trauma and related conditions. However a much higher proportion of those visiting for arthritis and related conditions had surgery (between 20% and 28%) compared to those with trauma (between 4% and 14%). The highest proportion of those receiving surgery for arthritis was of those with osteoarthritis (between 28% and 35%), which was mainly TJR surgery and between 19% and 29% of those with joint derangement mainly receiving arthroscopic surgery. There are already some initiatives in place in several orthopaedic clinics in Ontario to use physical therapists in extended roles to assist in the assessment of patients with arthritis of the hip or knee referred for potential surgery. Studies have shown that specially trained physiotherapists can assess and manage some individuals with musculoskeletal conditions while working with orthopaedic surgeons [12-14]. Alternative models of care have been discussed in ACREU working report 2006-02[15]. The use of physical therapists in these roles also has the potential to facilitate conservative management of patients not yet requiring surgery [2;11].

Variations in the overall person visit rate to orthopaedic surgeons were also found at the LHIN level, as were variations in the proportion having surgery (attributed to the initial consult) although these were somewhat less. ACREU's previous work has documented variations in the use of orthopaedic services by LHIN and suggested that some of this variation may be related to the availability of orthopaedic surgeons at the local level[1;2]. However, this is not likely to be the whole story as reflected in the slightly higher visit rates for individuals living in high income neighbourhoods. Overall it is not known to what extent variation in rates of ambulatory visits and of surgery at the level of the LHIN relates to variations in need or to other factors associated with the health care system. If evidence relating to TJR is any indication, need is not likely to be the major driver. Studies looking at access to TJR surgery in two areas with historically high and low rates of surgery have shown that need does not explain the difference, and that factors relating both to the characteristics of individuals and also to the health care system are important [17-20].

More generally the broad range of conditions seen by orthopaedic surgeons is a reflection of the major contribution of these specialists in the management of musculoskeletal conditions. Approximately a quarter of all doctors visits for musculoskeletal conditions are to specialists, with orthopaedic surgeons being the most frequently seen type of specialist [16]. However, a visit to an orthopaedic surgeon and possible subsequent surgery is only one part of the management of these disorders. Managing the health care system and planning to meet the needs of individuals with these disorders needs to be integrated in the context of community services, primary care, and rehabilitation as well as consideration of prevention and chronic disease management in general. This is also an area where there is potential for a major contribution from rehabilitation therapists working in expanded roles, especially at the interface between of primary care and specialists, to ensure timely and appropriate referrals of those who need specialist care and appropriate management of those who do not [11].

The findings in this report build on our previous reports, and provide further evidence to contribute to the development of a provincial framework for the stewardship of resource allocation and delivery of orthopaedic services and the development of strategies and priorities to meet the needs of the Ontario residents. We have suggested previously that a strategy for increasing availability of orthopaedic surgeons for TJR would be to ensure that individuals who were referred are those who are most likely to need surgery[21]. This report documents the relatively low proportion of patients seeing orthopaedic surgeons who have orthopaedic surgery, and how this varies by diagnostic groups. These analyses point to the important role that orthopaedic surgeons play in the management of musculoskeletal disorders in general and raise questions about alternative models of care to enhance efficiency in the health care system, to optimise the availability of orthopaedic surgeons for needed surgery and to ensure the best possible care for individuals with musculoskeletal conditions. Paying attention to this segment of the population is important as about 30% of all visits to physicians are for these conditions [16] and the disabling consequences of these conditions are among the most costly to society [22].

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7.0 Technical Appendix

From each of the OHIP, DAD and NACRS databases, the population accessing orthopaedic services was identified based on physician specialty. All individuals with an orthopaedic surgeon listed as a health care provider were considered as having an encounter with orthopaedic services in the time period selected.

For the analyses using the OHIP database, doctor specialty was defined according to the ICES Physician Database (IPDB), which incorporates information from the OHIP Corporate Provider Database (CPDB), the Ontario Physician Human Resource Data Centre (OPHRDC) database and the OHIP database of physician billings. The CPDB contains information about physician demographics, specialty training and certification, and practice location. This information is validated against the OPHRDC database, which verifies this information through periodic telephone interviews with all physicians practicing in Ontario. The IPDB was linked to the OHIP database to identify orthopaedic surgeons.

CIHI's databases (DAD, NACRS) collect information on up to eight health care providers for each encounter. An encounter with an orthopaedic surgeon was defined as such if a health care record has an orthopaedic surgeon or paediatric orthopaedic specialist listed as a health care provider in any of the eight health care provider fields.

Encounters with orthopaedic surgeons were further classified as being either ambulatory encounters, these are visits to orthopaedic surgeons in office or hospital outpatient department settings, or hospital encounters, which were further classified as inpatient hospitalizations, emergency department encounters, and same day surgeries. The OHIP services database was used to identify ambulatory encounters, based on physician claims that contained a fee code with a prefix of "A" or "K". Encounters with an "A" fee code in combination with an orthopaedic procedure fee code were excluded as these encounters would also be captured in the CIHI databases. All claims made by the same doctor on the same date for the same person were considered one ambulatory encounter.

Hospital encounters were identified according to the 'admission category' field in DAD and NACRS databases. Day surgeries with missing information about orthopaedic interventions received were excluded from the analysis.

In this report data from different sources were used. These data used two different classification schemes of diagnosis. OHIP used a classification system based on ICD-9 and CIHI's databases used diagnostic codes based on ICD10. We used one claim per visit per person in OHIP database and the most responsible diagnosis in the hospital databases. The following diagnostic groups were used:

- **Arthritis and related conditions:** includes osteoarthritis, rheumatoid arthritis, synovitis, ankylosing spondolytis, fibrositis, connective tissue disorders, joint derangements and other arthritis. Disseminated lupus erythematosus, scleroderma, dermatomyositis and polyarteritis were joined to form a single group of connective tissue diseases. The other arthritis and related conditions group comprised a number of relatively infrequent conditions, the majority of which relate to deformity or malfunction of joints: recurrent dislocation, ankylosis, pyogenic arthritis, and traumatic arthritis.

- **Bone and joint**: includes some disorders of the spine (e.g. lumbar strains, sciatica, scoliosis), conditions of the bone (e.g. osteomelytis, osteoporosis, osteochondritis),

conditions of the foot (e.g. corns and calluses, hallux vagus, hammer toe, ingrown nails and onychogryposis), and other MSK conditions.

- **Trauma and related conditions**: includes fractures and dislocations; strains and sprains; and other trauma (e.g. concussions, lacerations, other injuries). Fractures and dislocations of the spine are included in this category.

- **Other conditions:** includes a wide range of diseases such as benign and malignant neoplasms, conditions of the childhood and adolescence, psoriasis, bedsores, and cellulites, cerebrovascular diseases, acute poliomyelitis, obesity, and birth trauma.

Data on the type of surgical procedure were obtained from the CIHI databases. In 2002 CIHI began using the Canadian Classification of Interventions (CCI). This is a systematic classification, which codes interventions by body part and standard types of intervention (e.g. excision, fixation, repair). Procedures performed by orthopaedic surgeons were identified using data from DAD and NACRS. In CIHI's databases each in hospital encounter recorded up to 20 procedure codes in DAD and up to 10 procedure codes in NACRS. For the purpose of this analysis we classified the surgical procedures bases on the main intervention CCI code. Orthopaedic surgical procedures were classified according to Table A1.

Table A1. Description of surgical groupings used in this report

Surgical groupings	Description in CCI classification
TJR	Implantation of internal devices
Arthroscopic repairs	Repairs done arthroscopically. This includes joint repair with meniscectomy, meniscoplasty with or without concomitant debridement of meniscus.
Open repairs	Repairs using open approach. This includes joint repair with meniscectomy, meniscoplasty with or without concomitant debridement of meniscous.
Reduction with fixation	Reductions of joint with fixation device inserted into joint without fusion of joint. Codes can be found under "fixation" rubric in the CCI classification system.
Reduction without fixation	Reductions of joint only. Codes can be found under "reduction" rubric in the CCI classification system.
Other surgeries	Include amputation, fusion, excision, reattachment, removal of foreign body, etc.