

# Occupational Disease Surveillance in Manitoba – Final report

## Executive summary

### Funding

This project is supported by a grant from the Research and Workplace Innovation Program of The Workers Compensation Board of Manitoba.



### Study team

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### Overview of the project

Disease surveillance is the ongoing, systematic collection, analysis, and interpretation of health-related data for the planning, implementation, and evaluation of public health practice. In particular, occupational disease surveillance can help to identify and monitor trends in work-related diseases and risk factors, which in turn can help to identify priority populations for primary prevention. However, an occupational disease surveillance system in Manitoba does not currently exist.

The overall purpose of this project was to develop an occupational disease surveillance system for Manitoba by drawing on existing workers' compensation and administrative health data sources. The methods used build on those piloted in Alberta and Ontario, and fully developed in Ontario. In particular, we used workers' compensation data to create a cohort of workers with their occupations and industries, linked the data to administrative health data, and then assessed the functioning of the system and its ability to detect well-known occupational diseases. Risk of select, noncancer health outcomes (asthma, contact dermatitis, Raynaud's disease, carpal tunnel syndrome, and acute myocardial infarction) were selected for study to validate the utility of such a database for future occupational disease surveillance in Manitoba and as part of an occupational disease surveillance network across Canada.

The specific objectives of the project were to:

- 1) Construct a cohort of workers in Manitoba with detailed and valid occupation and industry of employment codes from workers' compensation claims data;
- 2) Link the cohort of workers to health outcomes from select health databases (i.e. Manitoba Medical Services and Claims file, and Manitoba's Hospital Abstracts);
- 3) Calculate the risk of five diseases which maybe work related (i.e. asthma, contact dermatitis, Raynaud's disease, carpal tunnel syndrome, and acute myocardial infarction) by occupation and/or industry groups and to compare risks for known a priori high risk groups;

- 4) Document the methods and utility of the Manitoba occupational disease surveillance system, including potential linkages to other health and exposure databases, for future uses.

## **Review of work completed**

### **Objective 1: Construct a cohort of workers in Manitoba with detailed and valid occupation and industry of employment**

Accepted time-loss claims from the Workers' Compensation Board (WCB) of Manitoba were used to obtain information on workers and their occupation and industry codes. Data were obtained from January 1, 2006, to December 31, 2019. Coverage of workers by WCB during this time frame ranged from 69% to 79%; while most industries are covered, some, such as law, accounting and other professional service firms, and recreation centres, were not. In total, there were 213,892 accepted time-loss claims during this time period, of which 2,342 did not contain occupation codes (n=211,550).

### **Objective 2: Link the cohort of workers to health outcomes from select health databases**

Workers were then linked to a pseudoPHIN, a fake personal health identification number, by Manitoba Health, for confidentiality purposes. This was completed using the real PHIN, which is a unique nine-digit numeric identifier assigned to every person registered for health insurance in Manitoba, as well as name, birthdate, address and sex. The pseudoPHIN and compensation data were sent to the Manitoba Centre for Health Policy for linkage with the administrative data by pseudoPHIN.

Administrative data that were included were medical and hospital records from 1996 to 2020 (from the Medical Claims/Medical Services database, Hospital Abstracts database, Cancer registry, and Drug Program Information Network). Overall, the linkage success rate was 95.5% (n=202,029). The breakdown of workers in the cohort by 2-digit occupation is summarized in Table 1.

Table 1. MODSS cohort breakdown by 2-digit occupation

Occupation	# of workers	# of claims	Percent of people	Percent of claims	Claims per person
76 Trades helpers, construction labourers and related occupations	17354	20070	10.40%	9.50%	1.16
72 Industrial, electrical and construction trades	15392	20950	9.20%	9.90%	1.36
75 Transport and heavy equipment operation and related maintenance occupations	14511	19401	8.70%	9.20%	1.34
67 Service support and other service occupations, n.e.c.	12778	16157	7.60%	7.60%	1.26
34 Assisting occupations in support of health services	9761	15521	5.80%	7.30%	1.59
73 Maintenance and equipment operation trades	8405	10984	5.00%	5.20%	1.31
74 Other installers, repairers and servicers and material handlers	8093	10281	4.80%	4.90%	1.27
96 Labourers in processing, manufacturing and utilities	7957	9160	4.80%	4.30%	1.15
44 Care providers and educational, legal and public protection support occupations	6473	8761	3.90%	4.10%	1.35
95 Assemblers in manufacturing	6084	7144	3.60%	3.40%	1.17
63 Service supervisors and specialized service occupations	5176	5985	3.10%	2.80%	1.16
42 Paraprofessional occupations in legal, social, community and education services	5099	6394	3.10%	3.00%	1.25
94 Processing and manufacturing machine operators and related production workers	4787	5362	2.90%	2.50%	1.12
15 Distribution, tracking and scheduling co-ordination occupations	4748	6776	2.80%	3.20%	1.43
66 Sales support occupations	4391	4994	2.60%	2.40%	1.14
65 Service representatives and other customer and personal services occupations	4134	4821	2.50%	2.30%	1.17
64 Sales representatives and salespersons - wholesale and retail trade	3778	4150	2.30%	2.00%	1.1
30 Professional occupations in nursing	3330	4774	2.00%	2.30%	1.43
32 Technical occupations in health	3268	5307	2.00%	2.50%	1.62
22 Technical occupations related to natural and applied sciences	2503	2823	1.50%	1.30%	1.13
14 Office support occupations	2143	2354	1.30%	1.10%	1.1
06 Middle management occupations in retail and wholesale trade and customer services	2099	2281	1.30%	1.10%	1.09
84 Workers in natural resources, agriculture and related production	1966	2237	1.20%	1.10%	1.14
43 Occupations in front-line public protection services	1832	2823	1.10%	1.30%	1.54
12 Administrative and financial supervisors and administrative occupations	1217	1286	0.70%	0.60%	1.06
41 Professional occupations in law and social, community and government services	1158	1288	0.70%	0.60%	1.11
86 Harvesting, landscaping and natural resources labourers	1129	1194	0.70%	0.60%	1.06

82 Supervisors and technical occupations in natural resources, agriculture and related production	1028	1177	0.60%	0.60%	1.14
52 Technical occupations in art, culture, recreation and sport	923	1037	0.60%	0.50%	1.12
62 Retail sales supervisors and specialized sales occupations	809	878	0.50%	0.40%	1.09
92 Processing, manufacturing and utilities supervisors and central control operators	754	807	0.50%	0.40%	1.07
07 Middle management occupations in trades, transportation, production and utilities	728	770	0.40%	0.40%	1.06
21 Professional occupations in natural and applied sciences	559	585	0.30%	0.30%	1.05
31 Professional occupations in health (except nursing)	498	576	0.30%	0.30%	1.16
01 Specialized middle management occupations	426	434	0.30%	0.20%	1.02
04 Specialized middle management occupations	419	452	0.30%	0.20%	1.08
11 Professional occupations in business and finance	295	301	0.20%	0.10%	1.02
40 Professional occupations in education services	252	271	0.20%	0.10%	1.08
08 Middle management occupations in trades, transportation, production and utilities	222	240	0.10%	0.10%	1.08
51 Professional occupations in art and culture	143	151	0.10%	0.10%	1.06
00 Senior management occupations	127	127	0.10%	0.10%	1
09 Middle management occupations in trades, transportation, production and utilities	115	117	0.10%	0.10%	1.02
03 Specialized middle management occupations	110	116	0.10%	0.10%	1.05
13 Finance, insurance and related business administrative occupations	102	108	0.10%	0.10%	1.06
05 Specialized middle management occupations	52	52	0.00%	0.00%	1
02 Specialized middle management occupations	31	31	0.00%	0.00%	1

### **Objective 3: Calculate the risk of five well-known diseases which may be work related**

The five diseases selected for study were: Raynaud's disease, asthma, contact dermatitis, carpal tunnel syndrome, and acute myocardial infarction. Case definitions (outlined below) were developed for all health outcomes; these were based off of case definitions used in the Ontario ODSS, but incorporated changes to reflect differences in cohort characteristics (e.g. sample sizes) and findings. Risks were calculated by occupation and/or industry groups. For all outcomes, workers were followed until diagnosis, emigration from Manitoba, death, or end of the follow-up period.

Cox proportional hazards ratio modelling was used to ascertain risk by occupation, industry, and sex. In this modelling approach, the risk of the health outcome in one occupation or industry group was compared to the risk in all remaining workers in the cohort. Hazard ratios (HRs) and 95% confidence intervals (CIs) were calculated for each occupation and industry group, adjusted for age, and sex. Sex-stratified analyses were reported for the groups that met the reporting threshold of more than five cases (as set by the MCHP). Cells that would allow the calculation of a cell with less than six individuals were also redacted. Where a large proportion of workers' compensation claims for a given health outcome were not captured by the case definition, additional analyses were conducted. For example, for contact dermatitis and carpal tunnel syndrome, sensitivity analyses were conducted in which the case definition was amended to include or exclude all WCB claims. Analysis of these findings gives an indication of which occupations or industries have elevated health outcome risk, and which occupations or industries may be under-recognized for a given health outcome, respectively. All analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

The risk of disease for all five outcomes were calculated, except for Raynaud's disease. In addition, the risk of select cancers within this cohort was explored.

### **Objective 4: Document the methods and utility of MODSS**

Study results have been documented in published or drafted manuscripts. The results for acute myocardial infarction were published in the American Journal of Industrial Medicine (Kraut A, Peters CE, Rydz E, Walld R. Acute myocardial infarctions identified in the Manitoba Occupational Disease Surveillance System: A linkage of worker's compensation and provincial health data. Am J Ind Med. 2023 Aug;66(8):679-686.).

The results of the carpal tunnel syndrome analysis were also published in the American Journal of Industrial Medicine (Kraut A, Rydz E, Walld R, Demers PA, Peters CE. Carpal tunnel syndrome among Manitoba workers: Results from the Manitoba Occupational Disease Surveillance System Am J Ind Med. 2024 Aug;67(3):243-260.0. The Contact dermatitis manuscript was submitted to the Journal of Contact Dermatitis and is currently in a revision stage. The manuscript for the results of the asthma were submitted to a journal in early January.

The methods and results of the carpal tunnel syndrome and asthma analyses have also been presented at the 2022 and 2023 Occupational and Environmental Medical Association of Canada conference (Appendices 1 and 2).

Finally, we developed a knowledge mobilization advisory committee meeting to mobilize the results of this study among key stakeholders. This committee comprised members from:

- Manitoba Federation of Labour - Occupational Health Centre (Carly Nicholson)
- Manitoba Federation of Labour (Rick Rennie)
- Workplace Safety and Health (Norman Tran)
- SafeWork Manitoba (Michael Boileau)
- Made Safe (Nathan Rasmussen)
- RPM Safety (Aaron Dolyniuk)

Regular meetings were held throughout the study (see Appendix 3 for slides presented to the group). In addition, a knowledge mobilization plan for future implementation, which will further document and mobilize the methods and results of this study among key stakeholders, was drafted and subsequently reviewed, discussed, and amended through consultation with the advisory committee (Appendix 4).

## Results and evaluation

### Raynaud's disease

Multiple case definitions were considered for Raynaud's disease, given unexpectedly high rates observed by occupation and industry groups. ICD-9 and ICD-10 codes used are explained in Table 2. The case definitions explored were as follows:

- 1) ICD-9 443 from the medical claims, as well as ICD-9 443.0 and ICD-10 I73 from the hospital claims.
- 2) 2+ medical services claims (ICD-9 443), excluding those that have a hospital claim for ICD-9 443.1 to 443.9 or ICD-10 I731, I738 or I739 (these codes describe peripheral vascular diseases other than Raynaud's disease); or 1+ hospital claim (ICD-10 I730 or ICD-9 443.0)
- 3) 1+ claim of ICD-9 443.0 (hospital or medical), with a second diagnosis of ICD-9 443.
- 4) 2+ claims of ICD-9 443.0 (hospital or medical).

*Table 2. Breakdown of ICD-9 and ICD-10 codes related to Raynaud's syndrome*

ICD-9 codes		ICD-10 codes	
443	Other peripheral vascular disease	I173	Other peripheral vascular disease
443.0	Raynaud's syndrome	I73.0	Raynaud's syndrome
443.1	Thromboangitis obliterans	I73.1	Thromboangitis obliterans
443.2	Other arterial dissection	I73.8	Other specified peripheral vascular diseases
443.8	Other specified peripheral vascular diseases		
443.9	Peripheral vascular disease, unspecified	I73.9	Peripheral vascular disease, unspecified

Although the case definition became increasingly specific, rates by occupational and industry groups remained unexpectedly high, particularly among occupations typically held by women (e.g. education and health related occupations). For example, for the first definition (rate results by 2-digit occupation in Appendix 5, Table 1), the overall rate of Raynaud's disease was approximately 3.2%, with senior management occupations having the highest rate of Raynaud's syndrome (6.6%). A signal in high-risk occupations was not observed (e.g. in mines, the rate was relatively lower compared to other groups, at 4.1%). When we examined a subset of data (2018 onwards), for which more detailed ICD codes were available, 90% of ICD-9 443 codes were not Raynaud's syndrome (ICD-9 443.0). When considering case

definition #2, we found that most cases were identified through 2 medical claims of ICD-9 443, with hospital claims not being very useful in weeding out false positives (only 52 cases).

With more specific case definitions (e.g. case definitions #3 and 4, Appendix 5 Tables 2 and 3, respectively), the sample size became inadequate for appropriate analysis ( $n < 150$ ) and still, there was low specificity for Raynaud's disease. For example, for definition 3, retail salespersons had the highest rates (0.27%) followed by professional occupations in nursing (0.25%), compared to automotive service technicians (0.20%), where we might expect to see higher rates.

These results indicated that Raynaud's disease was not being adequately captured, and that we may be observing other peripheral vascular disease, not secondary cases of Raynaud's disease, and with relatively low rates in jobs typically associated with Raynaud's disease. Given the unusual distribution and rates of Raynaud's disease by occupation and industry and small sample sizes, we were not confident in the ability to adequately detect secondary Raynaud's disease using the available data, and further analyses to calculate the risk of Raynaud's disease were not pursued.

## **Asthma**

The case definition used for asthma, was:

- At least two medical or hospital claims for asthma (International Classification of Diseases, Ninth Revision, ICD-9, 493) within a 12-month period
- Within the two years preceding to three years following cohort entry
- With a 3-year washout period to identify new-onset asthma from pre-existing asthma.

Accepted compensation claims for asthma were not used to ascertain new-onset asthma; however, workers with accepted asthma claims that met the case definition were included in the analyses. Compared to the Ontario ODSS, the case definition was expanded to consider cases two years prior to three years following cohort entry in order to account for a smaller sample size in Manitoba.

Where a worker had multiple accepted time-loss compensation claims, the cohort was restricted to workers' first compensation claim. The cohort was further restricted to those aged 15 years and older, and to those that had full administrative health data coverage and availability to capture the follow-up and washout periods. The final asthma cohort contained 142,588 person-occupation combinations. Risk results are presented in Appendix 6, tables 1-2. In summary, increased asthma risk was observed among workers with known exposure to potential asthmagens, including male veterinary and animal health technologists and technicians (HR 3.97, 95% CI 1.78-8.86), male fish processing workers (HR 3.40, 95% CI 1.53-7.57), and male machining tool operators (HR 2.91, 95% CI 1.72-4.92). Increases were also observed for occupations with unknown or suspected allergens, including gas station attendants, drivers, mail/postal and related workers, public works and maintenance labourers, mine labourers and crane operators, and some indoor worker groups. Decreased risks were observed among nurses and residential and commercial installer and servicers. Findings provide asthma risk estimates for workers by occupation and industry, which can be used to prioritize and target future research and surveillance efforts.

## **Acute myocardial infarction**

Workers were eligible for inclusion in this study if their WCB claim listed an occupation, their claim could be linked to health data, they had an accepted non-acute myocardial infarction (AMI) compensation time loss claim and were free of a recent (<1 year) AMI diagnosis at the start of disease follow-up.

AMI cases were identified as the most responsible diagnosis in the hospitalization file (ICD-9 410 or ICD-10 I20). Cases were included if they occurred after the WCB record injury date until end of coverage, either through moving out of the province, age 65, death, or the end of the study period (March 1, 2020).

The final AMI cohort contained 1,880 incident AMIs amongst 150,022 occupations (rate=1.25%). Risk results are presented in Appendix 7, tables 1-2. Specific industries and occupations had higher or lower AMI rates. Care providers and educational, legal and public protection support occupations had a lower hazard ratio (0.64 95%CI 0.44-0.92) compared to the overall cohort. Female chefs and cooks, and male butchers and bakers had elevated AMI hazard ratios. Both male and female transport and heavy equipment operators and related maintenance occupations had increased hazard ratios (1.48 95%CI 1.30-1.67). Often male and female workers employed in the same occupations had the congruent AMI risks, but this was not always the case. For AMI, the cohort was able to identify a number of occupations with elevated risks in Manitoba, most notably in transportation. Identifying work areas with increased risk of AMIs could lead to targeted educational efforts and/or potential workplace modifications to lower this risk.

## **Carpal tunnel syndrome**

Within the cohort, CTS cases were identified if the worker had:

- At least two medical claims for Mononeuropathy in the upper limbs (ICD-9 354) in a 12-month period (called the medical claims-based definition) **or** one surgical claim for median nerve release tariff code 5235 (called the surgical procedure definition),
- Within the two years preceding or three years following cohort entry,
- With a 3-year washout to identify cases was used to distinguish new cases of the disorder from preexisting ones.

Workers with accepted time-loss claims for CTS were included as cases.

After eliminating claims where an individual had two or more claims for the same occupation, CTS diagnoses prior to the study period, or incomplete health coverage, and where their age was < 15 years, the final cohort contained 143,001 unique person-occupation. In order to explore whether occupation- and industry-related associations persisted after excluding accepted work-related cases, the analysis was repeated excluding cases of CTS that were accepted by the WCB either as the claim that entered the individual into the cohort or a subsequent claim within the study period window for both the medical claims-based definition and the surgical procedure definition.

Results are presented in Appendix 8, tables 1-2.



**In summary** 4302 individuals (3.0%) met the CTS definition. The risk of developing CTS varied with occupation. Job titles with ergonomic risk factors had higher risks than those with lower exposures. This finding remained after eliminating time-loss compensated WCB cases suggesting that all cases of CTS in high risk jobs are not identified in WCB statistics. Female workers in some job titles had excess CTS cases compared to male workers within the same job title.

### **Contact dermatitis**

From cohort entry (i.e. compensation claim date of injury), workers were followed to identify incident cases of contact dermatitis. Contact dermatitis cases were defined for a worker as having:

- At least two medical or hospital claims for “Contact dermatitis and other eczema” (International Classification of Diseases, Ninth Revision, ICD-9, 692), **or** one claim each of ICD-9 692 (contact dermatitis) and ICD-9 691 (Atopic dermatitis and related conditions) within a 12-month period,
- Within the two years preceding to three years following cohort entry, and
- A 3-year washout period to identify new-onset contact dermatitis from pre-existing cases

The case definition was based on one used by the Ontario ODSS (16) for dermatitis, more generally, with some differences; the follow-up period was expanded from three years following cohort entry, as used in the Ontario ODSS, to two years prior to three years following cohort entry, given the smaller sample size in Manitoba, and workers had to have at least one medical or hospital claim for ICD-9 692 (contact dermatitis) to increase specificity for contact dermatitis.

When including compensation claims (Appendix 9, tables 1-2), we found an increased risk of new onset contact dermatitis among some occupations and industries with known skin irritants and allergens. These occupations and industries included heavy metal working, food handlers, fish processing labourers, motor vehicle assemblers, and metal working operators. An increased risk was also observed in occupations and industries without known exposures related to contact dermatitis, such as production logistics co-ordinators, probation and parole officers and related, community and social service workers, and public works and maintenance labourers. Several groups known to be at a high risk of contact dermatitis, such as nurses, cleaners, and mechanics, did not find elevated risks within this cohort, although others, such as construction workers, saw a decreased risk.

### **Cancers**

Exploratory analysis of selected cancer diagnoses in the Manitoba Occupational Disease Surveillance System (MODSS). Results are presented in Appendix 10, tables 1 and 2. Five cancer sites, in addition to all invasive cancers (ICD-9 140-208), were considered: Mesothelioma (ICD-9 163.9); Female breast cancer (ICD-9 174); Leukemia (ICD-9 204-208); Lymphoma (ICD-9 200-203); Bladder (ICD-9 188).

Workers were eligible for inclusion in this study if their WCB claim listed an occupation, their claim could be linked to health data, and were free of a recent (<1 year) cancer diagnosis at the start of disease follow-up. For mesothelioma cases, we eliminated the recent cancer diagnosis requirement as for many of the mesothelioma cases, the mesothelioma diagnosis was the reason they were entered into the cohort.

Due to the relatively small number of cancers identified, few occupations or industries were found to have elevated hazard ratios. Most specific occupations had under 6 cases so hazard ratios could not be reported as per MCHP protocol (Table 1). For bladder cancer, the trade industry and the subsectors of automotive related and heavy metal working had elevated hazard ratios (Table 2). For breast cancer in women, the industrial subsection of business services has an elevated hazard ratio. For leukemia, the industrial group of public administration and two NOC codes, NOC 44 Care providers and educational, legal and public protection support occupations and NOC 7612 Other trades helpers and labourers had elevated hazard ratios. Among lung cancer cases, construction and transportation industries and the industrial subsector of trucking had elevated hazard ratios. The healthcare industry and the aircraft manufacturing and repair industrial subsector had elevated lymphoma hazard ratios. Mesothelioma is strongly associated with asbestos exposure. The railway industrial subsectors along with some construction trades had elevated risks.

## Evaluation

- The construction of a cohort of workers in Manitoba with detailed and valid occupation and industry of employment codes from workers' compensation claims data, who were then linked with administrative health data, was feasible.
- MODSS was not able to assess risk of Raynaud's disease among Manitoba workers due to a lack of specificity in available ICD codes for Raynaud's disease.
- For the four, other, health outcomes examined (asthma, acute myocardial infarction, contact dermatitis, and carpal tunnel syndrome), MODSS was able to assess the risk by occupation and industry (adequate sample size, follow-up).
- MODSS identified increased risk among some occupations and/or industries that are well known to be at elevated risk for the different health outcomes.
- MODSS was also able to identify some occupations and industries with elevated risk, not commonly observed elsewhere. These may be occupations/industries with under-recognized occupational disease.
- For some occupations and industries with well-known risk, weak or no associations were observed. This may be worth pursuing to investigate further to see what this may be, and to better evaluate the functioning of the system.
- The current data set had limited power to investigate the association between occupational title and cancer.
- The methods and utility of the Manitoba occupational disease surveillance system were adequately documented through peer-reviewed publications (published, or in preparation) and presentations at conferences.
- Results will continue to be mobilized using a knowledge mobilization plan that was developed by the research team and reviewed by the advisory committee.

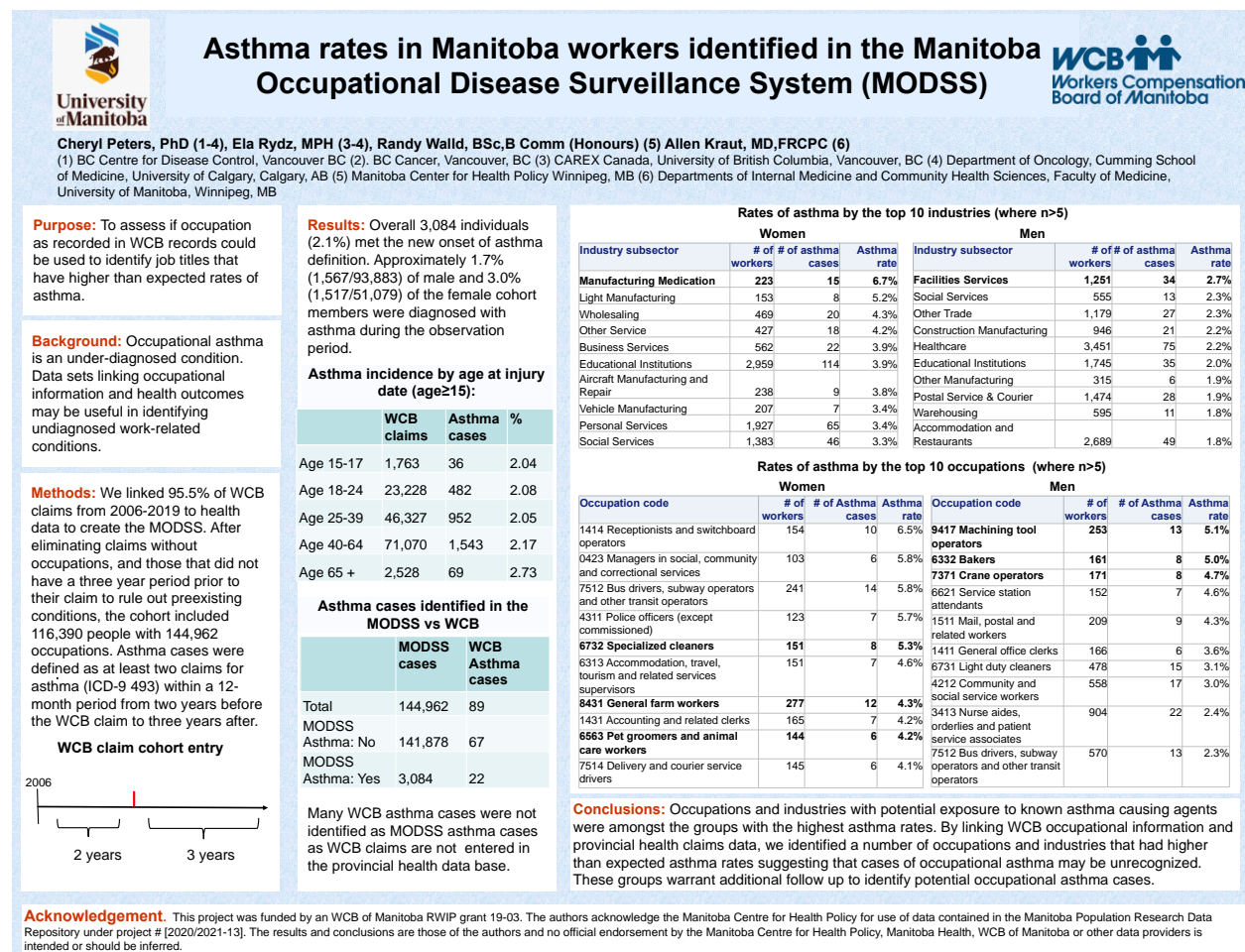
## Proposed recommendations

- Where unexpected increased risk was observed, additional research should be conducted to investigate potential reasons for this increased risk.


- Results suggest some conditions such as AMI, CTS, and CD time loss WCB claims may not identify all cases of work-related disease.
- Update MODSS in the future once we have more years of data to re-assess risk of these health outcomes among Manitoba workers, and to re-evaluate the ability of MODSS to examine longer latency diseases, like cancer.
- Collaborate with other provinces to encourage the development of ODSS's in their jurisdictions; comparison of results, and discuss potential pooling in the future, which could yield interesting and impactful results.
- Potential to expand this work to examine other health outcomes (e.g. Ontario is using their ODSS in innovative ways, e.g. to look at opioid deaths among workers).

# Appendices

## Appendix 1. OEMAC 2022 poster presentation: Asthma




## Appendix 2. OEMAC 2023 poster presentation: Carpal tunnel syndrome



### Carpal Tunnel Syndrome in Manitoba workers identified in the Manitoba Occupational Disease Surveillance System (MODSS)

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**Background:** Carpal Tunnel syndrome (CTS) is associated with high force repetitive occupational tasks and vibration along with a number of non-occupational factors. This project examines the relationship between CTS and work to; 1. identify jobs and industries with increased CTS risk by linking WCB claims with health data; 2. explore whether there is a sex difference in the risk of CTS after controlling for occupation; 3. determine whether any occupational or industry related relationships observed persist after excluding accepted CTS time loss compensation claims.

**Results:** 4302 individuals (3.0%) met the CTS definition. Approximately 2.5% (2,341/92,917) of male and 3.9% (1,961/50,084) of the female cohort members were diagnosed with CTS during the observation period. The greatest risk was in the 50-64 year old age group

**Risk of CTS among the MODSS cohort by industry.**

Industry	Number	CTS/HR (95% CI)
Healthcare	22062	702 0.74 (0.68-0.81)
Manufacturing	26523	1012 1.52 (1.41-1.63)
Aircraft Manufacturing and Repair	1085	69 1.93 (1.52-2.45)
Clothing/Textile Manufacturing	537	35 1.88 (1.35-2.62)
Meat Processing	1394	134 3.48 (2.93-4.14)
Paper & Printing	1426	73 1.69 (1.34-2.13)
Natural Resources	3513	148 1.61 (1.36-1.90)
Mining	879	60 2.50 (1.94-3.23)
Public Admin.	14778	370 0.77 (0.69-0.85)
Service	20958	585 0.84 (0.77-0.92)
Automotive Related	6035	207 1.44 (1.25-1.66)

**Carpal tunnel syndrome Hazard Ratios among the MODSS by sex and occupation** (2016 National Occupational Classification)\*

Occupation	Overall		Men		Women	
	# CTS	HR (95% CI)	# CTS	HR (95% CI)	# CTS	HR (95% CI)
3 Health occupations	15006	437 0.71 (0.64-0.79)***	2115	24 0.43 (0.29-0.64)***	12891	413 0.75 (0.67-0.83)***
421 Paraprofessional occupations in legal, social, community and education services	4466	90 0.55 (0.44-0.68)***	768	13 0.66 (0.38-1.13)	3698	77 0.53 (0.42-0.66)***
6331 Butchers, meat cutters and fishmongers	262	21 2.89 (1.88-4.44)***	199	12 2.38 (1.35-4.19)**	63	9 3.99 (2.07-7.68)***
94 Processing and manufacturing machine operators	3892	171 1.53 (1.31-1.78)***	3084	83 1.02 (0.82-1.27)	808	68 2.31 (1.81-2.95)***
95 Assemblers in manufacturing	5067	199 1.40 (1.21-1.61)***	4281	132 1.16 (0.97-1.38)	786	88 2.80 (2.26-3.47)***
96 Labourers in processing, manufacturing and utilities	6466	266 1.50 (1.32-1.69)***	4821	142 1.22 (1.03-1.44)*	1645	124 2.01 (1.68-2.41)***

**Carpal tunnel syndrome (CTS) hazard ratios (HR) in the MODSS after excluding WCB accepted cases\***

Occupation	Overall			Eliminating WCB time loss claims			% accepted time loss claims by WCB
	#	CTS #	HR (95% CI)	#	CTS #	HR (95% CI)	
Meat Processing	1394	134	3.48 (2.93-4.14)***	1320	60	2.11 (1.64-2.73)***	55
Mining	879	60	2.50 (1.94-3.23)***	844	25	1.46 (0.99-2.17)	58
7231 Machinists and machining inspectors	395	19	1.75 (1.12-2.75)*	392	16	2.07 (1.26-3.38)**	16
7312 Heavy-duty equipment mechanics	1257	66	2.10 (1.65-2.69)***	1224	33	1.49 (1.05-2.10)*	50
9462 Industrial butchers and meat cutters, poultry	441	41	3.37 (2.47-4.58)***	415	15	1.69 (1.02-2.81)*	63
952 Mechanical, electrical assemblers	2035	96	1.60 (1.31-1.96)***	1996	57	1.30 (1.00-1.70)*	41
961 Labourers in processing, manufacturing	6466	266	1.50 (1.32-1.69)***	6370	170	1.28 (1.10-1.49)**	36

\*Associations with p-values of less than 0.05, 0.01, and 0.001 were reported, signified by (\*), (\*\*), and (\*\*\*), respectively.

**Conclusions:** The risk of developing CTS varied with occupation. Job titles known to have ergonomic risk factors having higher risks and those that have lower exposures having lower risks. This pattern remained after eliminating time loss compensated WCB cases suggesting that all cases of CTS in high risk jobs are not identified in time loss WCB statistics. Female workers in some job titles had excess cases compared to male workers within the same job title.

**Methods:** We linked 95.5% of WCB claims from 2006-2019 to health data to create the MODSS. After eliminating claims without occupations, and those that did not have a three year period prior to entering the cohort to rule out preexisting conditions, the cohort included 143,001 unique person occupation combinations. CTS cases were defined as at least two claims for (ICD-9 354) within a 12-month period or a surgical claim for CTS from two years before the WCB claim to three years after. WCB accepted CTS claims not identified by the above criteria were also included.

\*Bold text sectors plain text subsectors. All associations had p-values of < 0.001

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### **Appendix 3. Advisory committee meeting presentation slides**

(See attached file)

## Appendix 4. Knowledge mobilization plan

### MODSS – Draft knowledge mobilization plan

Objective	Target audiences	Proposed activities
Mobilize research findings to raise awareness of occupational disease in Manitoba	Practitioners, professionals, and government agencies, unions focused on occupational health and safety, generally and in Manitoba (Manitoba WCB, health and safety associations (e.g. MadeSafe, RPM), Manitoba Federation of Labour - Occupational Health Centre, Manitoba Federation of Labour, Workplace Safety and Health, SAFE Work Manitoba)	<b>Diffusion<sup>1</sup></b> <ul style="list-style-type: none"> <li>Summarize and share results on the CAREX Canada website</li> <li>Promote results via CAREX Canada communication channels (i.e. social media, newsletters)</li> </ul> <b>Basic Dissemination<sup>2</sup></b> <ul style="list-style-type: none"> <li>Offer a general webinar on the findings of the MODSS</li> </ul> <b>Targeted Dissemination<sup>2</sup></b> <ul style="list-style-type: none"> <li>Develop a KT committee and present findings at regular meetings</li> <li>Offer targeted webinars to specific groups, with specific details tailored to the audience (e.g. findings unique to a specific industry)</li> </ul>
Enhance capacity among key audiences that can apply the results to their prevention planning activities and resource allocation	Same as above	<b>Targeted Dissemination<sup>2</sup></b> <ul style="list-style-type: none"> <li>Where opportunities have been identified, develop tailored, accessible KT products to share the results of the research, including occupations and industries at increased risk of specific health outcomes</li> </ul> <b>Application<sup>3</sup></b> <ul style="list-style-type: none"> <li>Facilitate dialogue to inform priorities and identify possible opportunities to collaborate and/or apply the results of our research</li> </ul>
Enhance research credibility of this methodology and promote the study findings among researchers	Researchers in occupational health and safety and workers' compensation	<b>Diffusion<sup>1</sup></b> <ul style="list-style-type: none"> <li>Publish results in scientific journals (2 open access publications)</li> <li>Present at a scientific conference</li> </ul> <b>Basic Dissemination<sup>2</sup></b> <ul style="list-style-type: none"> <li>Pursue opportunities to present at the Dalla Lana School of Public Health and/or UBC School of Population and Public Health OEH seminars, which are broadly attended by OEH researchers and practitioners.</li> </ul> <b>Targeted Dissemination<sup>2</sup></b> <ul style="list-style-type: none"> <li>Share case definitions used (and sensitivity analyses conducted) with OCRC</li> </ul> <b>Application<sup>3</sup></b> <ul style="list-style-type: none"> <li>Explore research networks and new partnerships through ongoing communication and dissemination activities; where opportunities present, collaborate to encourage further development of ODSS systems across Canada, or to encourage the further use of MODSS</li> </ul>

<sup>1</sup>Diffusion refers to KT activities that support the operational efforts typical to research programs.

<sup>2</sup>Basic and Targeted Dissemination refers to activities that enhance capacity broadly, and in a targeted way, respectively.

## Appendix 5. Raynaud's disease – Rate results

*Table 1. Rates of Raynaud's disease (Case definition #1: ICD-9 443 from the medical claims, as well as ICD-9 443.0 and ICD-10 I73 from the hospital claims) by 2-digit occupation*

Occupation	# of workers	Exposure time (PYAR)	Raynaud's cases	Rate of Raynaud's	Raynaud's rate per 1000 PY
<b>00 Senior management occupations</b>	122	1,347	8	6.6%	5.94
09 Middle management occupations in trades, transportation, production and utilities	111	1,124	7	6.3%	6.23
01 Specialized middle management occupations	397	4,490	20	5.0%	4.45
14 Office support occupations	2058	24,128	101	4.9%	4.19
62 Retail sales supervisors and specialized sales occupations	766	7,726	36	4.7%	4.66
12 Administrative and financial supervisors and administrative occupations	1162	13,272	50	4.3%	3.77
75 Transport and heavy equipment operation and related maintenance occupations	13375	137,784	564	4.2%	4.09
82 Supervisors and technical occupations in natural resources, agriculture and related production	855	8,380	36	4.2%	4.3
42 Paraprofessional occupations in legal, social, community and education services	4863	52,685	197	4.1%	3.74
67 Service support and other service occupations, n.e.c.	12017	129,156	470	3.9%	3.64
44 Care providers and educational, legal and public protection support occupations	6224	66,306	242	3.9%	3.65
30 Professional occupations in nursing	3206	40,252	122	3.8%	3.03
34 Assisting occupations in support of health services	9316	103,045	344	3.7%	3.34
66 Sales support occupations	4162	43,744	153	3.7%	3.5
06 Middle management occupations in retail and wholesale trade and customer services	1988	21,667	71	3.6%	3.28
65 Service representatives and other customer and personal services occupations	3924	43,286	140	3.6%	3.23
11 Professional occupations in business and finance	282	3,315	10	3.5%	3.02



15 Distribution, tracking and scheduling co-ordination occupations	4490	46,585	159	3.5%	3.41
40 Professional occupations in education services	236	2,641	8	3.4%	3.03
64 Sales representatives and salespersons - wholesale and retail trade	3567	38,282	117	3.3%	3.06
73 Maintenance and equipment operation trades	7861	80,298	257	3.3%	3.2
92 Processing, manufacturing and utilities supervisors and central control operators	706	6,520	23	3.3%	3.53
07 Middle management occupations in trades, transportation, production and utilities	684	6,708	22	3.2%	3.28
32 Technical occupations in health	3113	36,550	94	3.0%	2.57
04 Specialized middle management occupations	404	3,836	12	3.0%	3.13
21 Professional occupations in natural and applied sciences	510	5,553	15	2.9%	2.7
31 Professional occupations in health (except nursing)	480	4,936	14	2.9%	2.84
95 Assemblers in manufacturing	5678	52,691	163	2.9%	3.09
52 Technical occupations in art, culture, recreation and sport	865	9,464	24	2.8%	2.54
96 Labourers in processing, manufacturing and utilities	7429	68,087	199	2.7%	2.92
76 Trades helpers, construction labourers and related occupations	15979	154,940	419	2.6%	2.7
41 Professional occupations in law and social, community and government services	1097	11,447	28	2.6%	2.45
63 Service supervisors and specialized service occupations	4855	51,743	120	2.5%	2.32
74 Other installers, repairers and servicers and material handlers	7538	72,368	180	2.4%	2.49
22 Technical occupations related to natural and applied sciences	2326	23,086	54	2.3%	2.34
94 Processing and manufacturing machine operators and related production workers	4506	40,109	101	2.2%	2.52
72 Industrial, electrical and construction trades	14231	152,663	299	2.1%	1.96
84 Workers in natural resources, agriculture and related production	1786	18,234	36	2.0%	1.97
43 Occupations in front-line public protection services	1730	21,558	31	1.8%	1.44
86 Harvesting, landscaping and natural resources labourers	1024	10,460	18	1.8%	1.72

*Table 3. Rates of Raynaud's disease by three digit occupation (Case definition #3: 1+ claim of ICD-9 443.0 (hospital or medical), with a second diagnosis of ICD-9 443)*

Occupation	# of workers	Exposure time (PYAR)	Raynaud's cases	Rate of Raynaud's	Raynaud's rate per 1000 PY
<b>642 Retail salespersons</b>	3343	36,009	9	0.3%	0.25
301 Professional occupations in nursing	3206	40,252	8	0.3%	0.199
662 Other sales support and related occupations	2940	30,063	6	0.2%	0.2
732 Automotive service technicians	3445	36,439	7	0.2%	0.192
441 Home care providers and educational support occupations	4965	51,150	8	0.2%	0.156
421 Paraprofessional occupations in legal, social, community and education services	4863	52,685	6	0.1%	0.114
341 Assisting occupations in support of health services	9316	103,045	11	0.1%	0.107
751 Motor vehicle and transit drivers	10201	107,400	11	0.1%	0.102
673 Cleaners	7191	77,203	7	0.1%	0.091
761 Trades helpers and labourers	13213	126,825	9	0.1%	0.071

*Table 4. Rates of Raynaud's disease by 3 digit occupation (Case definition #4: 2+ claims of ICD-9 443.0 (hospital or medical))*

Occupation	# of workers	Exposure time (PYAR)	Raynaud's cases	Rate of Raynaud's	Raynaud's rate per 1000 PY
<b>642 Retail salespersons</b>	3343	36,009	7	0.2%	0.194
341 Assisting occupations in support of health services	9316	103,045	8	0.1%	0.078
673 Cleaners	7191	77,203	6	0.1%	0.078
761 Trades helpers and labourers	13213	126,825	6	0.1%	0.047

## Appendix 6. Asthma – Hazard ratio results

*Table 1. Risk of asthma among the Manitoba Occupational Disease Surveillance System cohort, by sex and industry (where p-value<0.05)*

Industry	Overall			Males			Females		
	Number	Asthma cases	HR (95% CI)	Number	Asthma cases	HR (95% CI)	Number	Asthma cases	HR (95% CI)
<b>Construction</b>	<b>18589</b>	<b>326</b>	<b>0.86 (0.77-0.97)*</b>	<b>18032</b>	<b>311</b>	<b>0.88 (0.78-1.00)*</b>	<b>557</b>	<b>15</b>	<b>0.82 (0.49-1.36)</b>

Building Construction	15401	262	0.84 (0.74-0.96)**	14959	250	0.85 (0.75-0.98)*	442	12	0.82 (0.47-1.46)
<b>Healthcare</b>	<b>22024</b>	<b>658</b>	<b>0.96 (0.87-1.05)</b>	<b>3406</b>	<b>85</b>	<b>1.30 (1.05-1.62)*</b>	<b>18618</b>	<b>573</b>	<b>0.91 (0.83-1.01)</b>
Healthcare	22024	658	0.96 (0.87-1.05)	3406	85	1.30 (1.05-1.62)*	18618	573	0.91 (0.83-1.01)
Social Services	1894	67	1.26 (0.99-1.61)	542	17	1.66 (1.03-2.67)*	1352	50	1.16 (0.87-1.54)
<b>Manufacturing</b>	<b>26509</b>	<b>571</b>	<b>0.98 (0.90-1.08)</b>	<b>22308</b>	<b>429</b>	<b>0.96 (0.87-1.08)</b>	<b>4201</b>	<b>142</b>	<b>1.03 (0.86-1.22)</b>
Manufacturing Medication	415	16	1.47 (0.90-2.40)	.	.		218	15	2.14 (1.29-3.56)**
Plastic Manufacturing	1466	18	0.55 (0.34-0.87)*	1174	-	0.51 (0.29-0.91)*	292	-	0.63 (0.28-1.39)
<b>Natural Resources</b>	<b>3541</b>	<b>80</b>	<b>1.07 (0.85-1.33)</b>	<b>3038</b>	<b>61</b>	<b>1.04 (0.80-1.34)</b>	<b>503</b>	<b>19</b>	<b>1.15 (0.73-1.81)</b>
<b>Public Administration</b>	<b>14743</b>	<b>372</b>	<b>1.06 (0.95-1.18)</b>	<b>9692</b>	<b>198</b>	<b>1.04 (0.89-1.20)</b>	<b>5051</b>	<b>174</b>	<b>1.06 (0.91-1.25)</b>
<b>Service</b>	<b>20830</b>	<b>603</b>	<b>1.10 (1.01-1.21)*</b>	<b>8722</b>	<b>188</b>	<b>1.14 (0.98-1.33)</b>	<b>12108</b>	<b>415</b>	<b>1.07 (0.96-1.20)</b>
Educational Institutions	4609	155	1.24 (1.05-1.45)*	1717	36	1.04 (0.75-1.45)	2892	119	1.34 (1.11-1.61)**
Facilities Services	2296	58	1.00 (0.77-1.29)	1233	36	1.51 (1.09-2.10)*	1063	22	0.64 (0.42-0.97)*
Other Service	822	26	1.26 (0.86-1.86)	410	6	0.77 (0.34-1.71)	412	20	1.56 (1.01-2.43)*
<b>Trade</b>	<b>22548</b>	<b>542</b>	<b>1.02 (0.93-1.12)</b>	<b>15449</b>	<b>298</b>	<b>1.00 (0.89-1.14)</b>	<b>7099</b>	<b>244</b>	<b>1.05 (0.92-1.21)</b>
<b>Transportation</b>	<b>13793</b>	<b>282</b>	<b>0.95 (0.84-1.08)</b>	<b>11974</b>	<b>232</b>	<b>0.98 (0.85-1.12)</b>	<b>1819</b>	<b>50</b>	<b>0.83 (0.63-1.10)</b>

**Table notes:**

- Bolded font indicates major industry groups, regular font indicates industry subgroups.
- Associations with p-values of less than 0.05, 0.01, and 0.001 were reported, signified by (\*), (\*\*), and (\*\*\*), respectively.
- Dark grey cells indicate significantly increased risk, while light gray cells indicate significantly reduced risk at p < 0.05 or 95% CI not including 1

*Table 2. Risk of asthma among the Manitoba Occupational Disease Surveillance System cohort, by sex and occupation (2016 National Occupational Classification) (where p-value<0.05)*

Occupation	Overall			Males			Females		
	Number	Asthma cases	HR (95% CI)	Number	Asthma cases	HR (95% CI)	Number	Asthma cases	HR (95% CI)
<b>0 Management occupations</b>	<b>3837</b>	<b>82</b>	<b>0.85 (0.68-1.06)</b>	<b>2112</b>	<b>31</b>	<b>0.75 (0.52-1.07)</b>	<b>1725</b>	<b>51</b>	<b>0.91 (0.69-1.21)</b>
01 Specialized middle management occupations	375	16	1.61 (0.99-2.63)	175	8	2.32 (1.16-4.65)*	200	8	1.25 (0.62-2.49)
0423 Managers in social, community and correctional services	148	8	2.04 (1.02-4.08)*	.	.		101	-	1.94 (0.87-4.33)
06 Middle management occupations in retail and wholesale trade and customer serv	1839	33	0.67 (0.48-0.94)*	793	-	0.39 (0.18-0.87)*	1046	-	0.79 (0.54-1.15)
<b>1 Business, finance and administration occupations</b>	<b>7579</b>	<b>212</b>	<b>1.07 (0.93-1.23)</b>	<b>3749</b>	<b>78</b>	<b>1.06 (0.84-1.33)</b>	<b>3830</b>	<b>134</b>	<b>1.09 (0.91-1.30)</b>
14 Office support occupations	1958	84	1.39 (1.12-1.73)**	280	10	1.83 (0.98-3.41)	1678	74	1.38 (1.09-1.75)**
141 General office workers	1470	62	1.34 (1.04-1.73)*	175	-	1.74 (0.78-3.87)	1295	-	1.34 (1.02-1.74)*
1414 Receptionists and switchboard operators	158	11	2.21 (1.22-4.00)**	.	.		150	11	2.31 (1.28-4.17)**
145 Library, correspondence and other clerks	149	8	2.03 (1.01-4.05)*	.	.		93	-	2.14 (0.96-4.77)
1454 Survey interviewers and statistical clerks	102	7	2.74 (1.31-5.75)**						
1511 Mail, postal and related workers	430	14	1.22 (0.72-2.07)	206	-	2.24 (1.17-4.31)*	.	.	
<b>2 Natural and applied sciences and related occupations</b>	<b>2643</b>	<b>44</b>	<b>0.75 (0.55-1.01)</b>	<b>2065</b>	<b>29</b>	<b>0.72 (0.50-1.03)</b>	<b>578</b>	<b>15</b>	<b>0.79 (0.47-1.31)</b>
22 Technical occupations related to natural and applied sciences	2177	34	0.71 (0.51-0.99)*	1724	22	0.65 (0.43-1.00)*	453	12	0.80 (0.46-1.42)
<b>3 Health occupations</b>	<b>14957</b>	<b>442</b>	<b>0.94 (0.85-1.05)</b>	<b>2099</b>	<b>50</b>	<b>1.23 (0.93-1.63)</b>	<b>12858</b>	<b>392</b>	<b>0.91 (0.81-1.02)</b>
30 Professional occupations in nursing	3023	75	0.78 (0.62-0.98)*	.	.		2765	70	0.77 (0.61-0.98)*
301 Professional occupations in nursing	3023	75	0.78 (0.62-0.98)*	.	.		2765	70	0.77 (0.61-0.98)*

3012 Registered nurses and registered psychiatric nurses	2983	74	0.78 (0.61-0.98)*	.	.		2730	69	0.77 (0.60-0.98)*
32 Technical occupations in health	2924	74	0.85 (0.67-1.07)	733	18	1.28 (0.80-2.03)	2191	56	0.76 (0.58-1.00)*
321 Medical technologists and technicians (except dental health)	818	30	1.25 (0.87-1.80)	187	10	2.81 (1.51-5.24)**	631	20	0.97 (0.63-1.51)
3213 Veterinary and animal health technologists and technicians	213	9	1.53 (0.80-2.95)	78	-	3.97 (1.78-8.86)***	.	.	
3219 Other medical technologists and technicians (except dental health)	85	6	2.52 (1.13-5.61)*						
323 Other technical occupations in health care	2085	43	0.68 (0.51-0.93)*	538	8	0.77 (0.38-1.54)	1547	35	0.67 (0.48-0.94)*
3233 Licensed practical nurses	1286	26	0.61 (0.42-0.90)*	.	.		1197	-	0.62 (0.42-0.92)*
<b>4 Occupations in education, law and social, community and government services</b>	<b>13098</b>	<b>428</b>	<b>1.20 (1.08-1.33)***</b>	<b>4098</b>	<b>91</b>	<b>1.16 (0.94-1.43)</b>	<b>9000</b>	<b>337</b>	<b>1.21 (1.07-1.36)**</b>
42 Paraprofessional occupations in legal, social, community and education service	4433	156	1.18 (1.00-1.39)*	771	22	1.49 (0.98-2.27)	3662	134	1.13 (0.94-1.35)
421 Paraprofessional occupations in legal, social, community and education service	4433	156	1.18 (1.00-1.39)*	771	22	1.49 (0.98-2.27)	3662	134	1.13 (0.94-1.35)
4212 Community and social service workers	2421	81	1.14 (0.91-1.42)	554	18	1.71 (1.08-2.72)*	1867	63	1.03 (0.80-1.32)
44 Care providers and educational, legal and public protection support occupations	5747	201	1.25 (1.08-1.44)**	1428	30	1.11 (0.77-1.59)	4319	171	1.29 (1.10-1.51)**
441 Home care providers and educational support occupations	4540	171	1.29 (1.10-1.51)**	631	15	1.30 (0.78-2.15)	3909	156	1.31 (1.11-1.54)**
4412 Home support workers, housekeepers and related occupations	2888	107	1.27 (1.05-1.55)*	429	10	1.30 (0.70-2.42)	2459	97	1.28 (1.05-1.58)*
4413 Elementary and secondary school teacher assistants	1635	63	1.27 (0.99-1.64)	.	.		1433	58	1.30 (1.00-1.69)*
<b>5 Occupations in art, culture, recreation and sport</b>	<b>917</b>	<b>16</b>	<b>0.65 (0.40-1.07)</b>	.	.		<b>534</b>	<b>12</b>	<b>0.69 (0.39-1.21)</b>
<b>6 Sales and service occupations</b>	<b>26245</b>	<b>728</b>	<b>1.05 (0.97-1.15)</b>	<b>11806</b>	<b>262</b>	<b>1.18 (1.04-1.35)*</b>	<b>14439</b>	<b>466</b>	<b>0.97 (0.87-1.08)</b>
633 Butchers and bakers	699	21	1.16 (0.75-1.78)	355	13	1.89 (1.10-3.26)*	344	8	0.70 (0.35-1.41)

6332 Bakers	438	13	1.05 (0.61-1.81)	157	-	2.62 (1.31-5.24)**	.	.	
6621 Service station attendants	213	10	2.03 (1.09-3.78)*	151	-	2.81 (1.40-5.62)**	.	.	
6731 Light duty cleaners	2542	68	0.88 (0.69-1.12)	473	16	1.72 (1.05-2.81)*	2069	52	0.77 (0.58-1.02)
6733 Janitors, caretakers and building superintendents	3093	87	1.24 (1.00-1.54)*	2333	56	1.20 (0.92-1.56)	760	31	1.29 (0.90-1.84)
<b>7 Trades, transport and equipment operators and related occupations</b>	<b>53969</b>	<b>1029</b>	<b>0.89 (0.81-0.96)**</b>	<b>50867</b>	<b>929</b>	<b>0.87 (0.80-0.96)**</b>	<b>3102</b>	<b>100</b>	<b>0.97 (0.79-1.19)</b>
72 Industrial, electrical and construction trades	13052	206	0.77 (0.66-0.89)***	12623	195	0.77 (0.66-0.89)***	429	11	0.76 (0.42-1.38)
723 Machining, metal forming, shaping and erecting trades	3971	63	0.78 (0.60-1.00)*	3833	60	0.79 (0.61-1.02)	.	.	
7371 Crane operators	171	8	2.45 (1.22-4.90)*	170	8	2.45 (1.23-4.92)*	.	.	
744 Other installers, repairers and servicers	1996	22	0.55 (0.36-0.84)**	1943	21	0.56 (0.36-0.85)**	.	.	
7441 Residential and commercial installers and servicers	1190	13	0.56 (0.32-0.96)*	1174	13	0.58 (0.33-1.00)*	.	.	
7511 Transport truck drivers	6214	125	1.01 (0.84-1.21)	-	-	1.02 (0.85-1.23)	.	.	1.88 (1.11-3.18)*
7512 Bus drivers, subway operators and other transit operators	797	27	1.49 (1.02-2.18)*	560	13	1.20 (0.69-2.07)	237	14	1.79 (0.89-3.58)
753 Other transport equipment operators and related maintenance workers	1100	12	0.54 (0.31-0.96)*	1048	-	0.45 (0.23-0.86)*	.	.	
7621 Public works and maintenance labourers	2280	56	1.16 (0.89-1.51)	2002	52	1.32 (1.00-1.74)*	.	.	
<b>8 Natural resources, agriculture and related production occupations</b>	<b>3246</b>	<b>79</b>	<b>1.14 (0.91-1.43)</b>	<b>2711</b>	<b>56</b>	<b>1.08 (0.83-1.41)</b>	<b>535</b>	<b>23</b>	<b>1.31 (0.87-1.98)</b>
8614 Mine labourers	111	6	2.79 (1.25-6.20)*						
<b>9 Occupations in manufacturing and utilities</b>	<b>16097</b>	<b>375</b>	<b>1.04 (0.94-1.16)</b>	<b>12741</b>	<b>273</b>	<b>1.10 (0.97-1.25)</b>	<b>3356</b>	<b>102</b>	<b>0.92 (0.75-1.12)</b>
941 Machine operators and related workers in mineral and metal products processing	1674	46	1.40 (1.04-1.87)*	1610	43	1.38 (1.02-1.87)*	.	.	
9417 Machining tool operators	256	14	2.84 (1.68-4.80)***	250	14	2.91 (1.72-4.92)***	.	.	

96 Labourers in processing, manufacturing and utilities	6457	170	1.15 (0.98-1.34)	4804	118	1.28 (1.06-1.54)*	1653	52	0.95 (0.72-1.25)
961 Labourers in processing, manufacturing and utilities	6457	170	1.15 (0.98-1.34)	4804	118	1.28 (1.06-1.54)*	1653	52	0.95 (0.72-1.25)
9618 Labourers in fish processing	181	8	1.66 (0.83-3.32)	89	-	3.40 (1.53-7.57)**	.	.	.
9619 Other labourers in processing, manufacturing and utilities	3095	86	1.24 (1.00-1.54)*	2425	58	1.23 (0.95-1.60)	670	28	1.27 (0.87-1.84)

**Table notes:**

- Bolded font indicates broad occupational groups; regular font indicates occupation subgroups.
- Associations with p-values of less than 0.05, 0.01, and 0.001 were reported, signified by (\*), (\*\*), and (\*\*\*), respectively.
- Dark grey cells indicate significantly increased risk, while light gray cells indicate significantly reduced risk at p < 0.05 or 95% CI not including 1.0.

## Appendix 7. Acute myocardial infarction results

Table 1. Acute Myocardial Infarction Hazard ratios by industry sector/subsector for individuals between age 15 and 64

Industry sector	Overall				Male				Female			
	Number	AMI Cases	HR (95%CI)	P value	Number	AMI Cases	HR (95%CI)	P value	Number	AMI Cases	HR (95%CI)	P value
<b>Construction</b>	<b>19375</b>	<b>217</b>	<b>0.95 (0.82-1.10)</b>	<b>0.4767</b>	<b>18788</b>		<b>0.96 (0.83-1.10)</b>	<b>0.5464</b>	.	.	.	.
<b>Healthcare</b>	<b>23043</b>	<b>188</b>	<b>0.93 (0.79-1.10)</b>	<b>0.4039</b>	<b>3603</b>	<b>59</b>	<b>0.89 (0.68-1.15)</b>	<b>0.3584</b>	<b>19440</b>	<b>129</b>	<b>0.96 (0.77-1.21)</b>	<b>0.7405</b>
<b>Manufacturing</b>	<b>28737</b>	<b>411</b>	<b>0.85 (0.76-0.95)**</b>	<b>0.0049</b>	<b>24143</b>	<b>386</b>	<b>0.86 (0.77-0.97)*</b>	<b>0.0104</b>	<b>4594</b>	<b>25</b>	<b>0.77 (0.51-1.17)</b>	<b>0.2215</b>
Heavy Metal Working	8945	120	0.79 (0.66-0.95)*	0.0136	8589		0.79 (0.65-0.95)*	0.0125				
<b>Natural Resources</b>	<b>3794</b>	<b>63</b>	<b>1.20 (0.93-1.55)</b>	<b>0.1531</b>	<b>3246</b>		<b>1.24 (0.96-1.59)</b>	<b>0.1028</b>	.	.	.	.
<b>Public Administration</b>	<b>14976</b>	<b>214</b>	<b>0.93 (0.81-1.07)</b>	<b>0.3246</b>	<b>9814</b>	<b>175</b>	<b>0.88 (0.75-1.03)</b>	<b>0.1174</b>	<b>5162</b>	<b>39</b>	<b>1.23 (0.88-1.73)</b>	<b>0.2174</b>
<b>Service</b>	<b>22012</b>	<b>199</b>	<b>1.01 (0.87-1.17)</b>	<b>0.8900</b>	<b>9173</b>	<b>132</b>	<b>0.98 (0.82-1.18)</b>	<b>0.8654</b>	<b>12839</b>	<b>67</b>	<b>1.08 (0.83-1.42)</b>	<b>0.5668</b>
Accommodation and Restaurants	7249	53	1.39 (1.05-1.83)*	0.0200	2921	28	1.27 (0.87-1.85)	0.2107	4328	25	1.56 (1.03-2.35)*	0.0337
Educational Institutions	4641	45	0.69 (0.51-0.93)*	0.0146	1705	29	0.66 (0.46-0.96)*	0.0285	2936	16	0.76 (0.46-1.25)	0.2816
<b>Trade</b>	<b>23735</b>	<b>274</b>	<b>1.06 (0.93-1.20)</b>	<b>0.4033</b>	<b>16306</b>	<b>229</b>	<b>1.04 (0.91-1.20)</b>	<b>0.5563</b>	<b>7429</b>	<b>45</b>	<b>1.13 (0.82-1.54)</b>	<b>0.4592</b>
Wholesaling	3269	46	1.04 (0.78-1.40)	0.7823	2796	39	0.94 (0.69-1.30)	0.7250	473	7	2.40 (1.13-5.07)*	0.0222
<b>Transportation</b>	<b>14342</b>	<b>314</b>	<b>1.30 (1.15-1.47)***</b>	<b>0.0000</b>	<b>12449</b>	<b>304</b>	<b>1.33 (1.17-1.51)***</b>	<b>0.0000</b>	<b>1893</b>	<b>10</b>	<b>0.78 (0.41-1.46)</b>	<b>0.4307</b>
Warehousing	654	16	1.69 (1.03-2.76)*	0.0378	616		1.73 (1.06-2.83)*	0.0295				
Other Transportation	1217	33	1.75 (1.24-2.47)**	0.0015	1217		1.75 (1.24-2.47)**	0.0015				
Trucking	6013	170	1.59 (1.36-1.86)***	0.0000	5707		1.59 (1.36-1.87)***	0.0000				

\*Sector in bold and subsector in plain font. Table 2. Acute Myocardial Infarction Hazard ratios by NOC Occupational Categories



Table 2. Acute Myocardial Infarction Hazard ratios by NOC Occupational Categories

Occupational category	Overall				Male				Female			
	Number	AMI Cases	HR (95%CI)	P value	Number	AMI Cases	HR (95%CI)	P value	Number	AMI Cases	HR (95%CI)	P value
<b>0 Management occupations</b>	3932	41	0.89 (0.65-1.21)	0.4416	2164	33	0.89 (0.63-1.26)	0.5210	1768	8	0.85 (0.42-1.72)	0.6536
<b>1 Business, finance and administration occupations</b>	7827	80	0.79 (0.63-0.99)*	0.0366	3916	60	0.84 (0.65-1.09)	0.1873	3911	20	0.66 (0.42-1.03)	0.0697
<b>2 Natural and applied sciences and related occupations</b>	2733	31	0.81 (0.57-1.15)	0.2389	2132		0.88 (0.61-1.25)	0.4700	.	.	.	.
<b>3 Health occupations</b>	15696	126	0.98 (0.81-1.20)	0.8774	2237	30	0.79 (0.55-1.13)	0.1977	13459	96	1.09 (0.86-1.39)	0.4723
<b>4 Occupations in education, law and social, community and government services</b>	13692	85	0.73 (0.59-0.92)**	0.0062	4275	47	0.74 (0.55-0.98)*	0.0388	9417	38	0.74 (0.53-1.04)	0.0846
44 Care providers and educational, legal and public protection support occupations	6001	29	0.64 (0.44-0.92)*	0.0176	1514	16	0.81 (0.50-1.33)	0.4035	4487	13	0.51 (0.29-0.89)*	0.0169
441 Home care providers and educational support occupations	4758	18	0.55 (0.34-0.88)*	0.0124	.	.	.	.	4062		0.54 (0.31-0.95)*	0.0315
4412 Home support workers, housekeepers and related occupations	3075	10	0.51 (0.27-0.95)*	0.0341	.	.	.	.	2591		0.55 (0.27-1.12)	0.0997
<b>6 Sales and service occupations</b>	27773	278	1.04 (0.91-1.18)	0.5456	12491	183	1.00 (0.86-1.17)	0.9986	15282	95	1.15 (0.90-1.46)	0.2586
63 Service supervisors and specialized service occupations	4624	52	1.35 (1.02-1.77)*	0.0353	2369	31	1.15 (0.81-1.64)	0.4441	2255	21	1.82 (1.17-2.84)**	0.0078
631 Service supervisors	1050	14	1.31 (0.77-2.21)	0.3179	500	8	0.97 (0.48-1.95)	0.9347	550	6	2.45 (1.09-5.50)*	0.0295
632 Chefs and cooks	2669	22	1.27 (0.83-1.93)	0.2697	1409	8	0.76 (0.38-1.52)	0.4304	1260	14	2.10 (1.23-3.58)**	0.0068

6322 Cooks	2509	22	1.42 (0.93-2.16)	0.1059	1288	8	0.90 (0.45-1.79)	0.7579	1221	14	2.15 (1.26-3.68)**	0.0050
633 Butchers and bakers	769	13	1.53 (0.89-2.64)	0.1269	388		2.02 (1.17-3.49)*	0.0114	.	.		.
674 Other service support and related occupations, n.e.c.	769	13	1.32 (0.77-2.28)	0.3171	309		2.00 (1.13-3.52)*	0.0170	.	.		.
<b>7 Trades, transport and equipment operators and related occupations</b>	56468	933	1.18 (1.07-1.30)**	0.0013	53208	908	1.17 (1.05-1.29)**	0.0028	3260	25	1.38 (0.92-2.07)	0.1243
72 Industrial, electrical and construction trades	13705	163	0.79 (0.67-0.92)**	0.0036	13250		0.78 (0.66-0.92)**	0.0031	.	.		.
7335 Other small engine and equipment mechanics	89	6	2.89 (1.30-6.44)**	0.0095			2.90 (1.30-6.46)**	0.0092	.	.	.	.
75 Transport and heavy equipment operation and related maintenance occupations	12572	312	1.48 (1.30-1.67)***	0.0000	11802	300	1.45 (1.27-1.64)***	0.0000	770	12	2.48 (1.39-4.42)**	0.0020
751 Motor vehicle and transit drivers	9508	258	1.54 (1.35-1.76)***	0.0000	8857	248	1.52 (1.33-1.74)***	0.0000	651	10	2.25 (1.20-4.23)*	0.0115
7511 Transport truck drivers	6422	194	1.55 (1.34-1.81)***	0.0000	6166		1.55 (1.33-1.81)***	0.0000	.	.	.	.
7513 Taxi and limousine drivers and chauffeurs	109	8	4.07 (2.03-8.15)***	0.0001	97		3.66 (1.74-7.69)***	0.0006	.	.	.	.
<b>8 Natural resources, agriculture and related production occupations</b>	3468	43	1.04 (0.77-1.41)	0.7986	2892	41	1.04 (0.77-1.42)	0.7844	.	.		.
<b>9 Occupations in manufacturing and utilities</b>	17470	258	0.95 (0.83-1.09)	0.4652	13816	229	0.93 (0.81-1.07)	0.3159	3654	29	1.14 (0.78-1.67)	0.5069
921 Supervisors, processing and manufacturing occupations	199	7	2.87 (1.37-6.04)**	0.0053	135		3.54 (1.69-7.44)***	0.0008	.	.		.
9521 Aircraft assemblers and aircraft assembly inspectors	221	9	2.09 (1.09-4.02)*	0.0273	174		1.78 (0.85-3.74)	0.1261	.	.	.	.

## Appendix 8. Carpal tunnel syndrome results

Table 1. Risk of Carpal Tunnel Syndrome among the Manitoba Occupational Disease Surveillance System cohort, by sex and industry

Industry	Overall			Men			Women		
	Person-Occupation Combinations	CTS cases	HR (95% CI)	Person-Occupation Combinations	CTS cases	HR (95% CI)	Person-Occupation Combinations	CTS cases	HR (95% CI)
<b>Healthcare</b>	<b>22062</b>	<b>702</b>	<b>0.74 (0.68-0.81)***</b>	<b>3424</b>	<b>66</b>	<b>0.80 (0.62-1.02)</b>	<b>18638</b>	<b>636</b>	<b>0.75 (0.69-0.83)***</b>
<b>Manufacturing</b>	<b>26523</b>	<b>1012</b>	<b>1.52 (1.41-1.63)***</b>	<b>22337</b>	<b>681</b>	<b>1.25 (1.15-1.37)***</b>	<b>4186</b>	<b>331</b>	<b>2.25 (2.00-2.53)***</b>
Aircraft Manufacturing and Repair	1085	69	1.93 (1.52-2.45)***	852	44	1.67 (1.24-2.25)***	233	25	2.56 (1.73-3.80)***
Clothing/ Textile Manufacturing	537	35	1.88 (1.35-2.62)***	258	10	1.48 (0.79-2.75)	279	25	2.12 (1.43-3.15)***
Light Manufacturing	1732	69	1.49 (1.18-1.90)**	1581	59	1.46 (1.12-1.89)**	105	10	1.71 (0.92-3.19)
Manufacturing Electronics	293	18	1.91 (1.20-3.03)**	188	6	1.18 (0.53-2.63)	105	10	1.71 (0.92-3.19)
Meat Processing	1394	134	3.48 (2.93-4.14)***	940	54	2.37 (1.81-3.10)***	454	80	5.07 (4.05-6.34)***
Paper & Printing	1426	73	1.69 (1.34-2.13)***	1001	42	1.58 (1.17-2.15)**	425	27	1.75 (1.20-2.56)**
Plastic Manufacturing	1473	59	1.35 (1.04-1.75)*	1179	34	1.08 (0.77-1.51)	294	25	2.04 (1.38-3.03)***
Vehicle Manufacturing	1940	73	1.30 (1.03-1.64)*	1738	55	1.15 (0.88-1.51)	202	18	2.08 (1.31-3.31)**
Wood & Millwork	3482	101	1.05 (0.86-1.28)	2720	54	0.78 (0.60-1.02)	762	47	1.69 (1.27-2.26)***
<b>Natural Resources</b>	<b>3513</b>	<b>148</b>	<b>1.61 (1.36-1.90)***</b>	<b>3022</b>	<b>116</b>	<b>1.53 (1.27-1.84)***</b>	<b>491</b>	<b>32</b>	<b>1.90 (1.34-2.69)***</b>
Agriculture	2063	71	1.28 (1.01-1.62)*	1643	44	1.06 (0.79-1.43)	420	27	1.87 (1.28-2.73)**
Mining	879	60	2.50 (1.94-3.23)***	830		2.53 (1.94-3.29)***			
<b>Public Administration</b>	<b>14778</b>	<b>370</b>	<b>0.77 (0.69-0.85)***</b>	<b>9706</b>	<b>203</b>	<b>0.73 (0.63-0.84)***</b>	<b>5072</b>	<b>167</b>	<b>0.81 (0.69-0.95)**</b>
Educational Institutions	4611	169	0.92 (0.79-1.07)	1723	63	1.34 (1.04-1.73)*	2888	103	0.80 (0.65-0.97)*
Social Services	1908	39	0.59 (0.43-0.81)**				1359		0.70 (0.50-0.99)*
<b>Service</b>	<b>20958</b>	<b>585</b>	<b>0.84 (0.77-0.92)***</b>	<b>8778</b>	<b>182</b>	<b>0.82 (0.70-0.95)**</b>	<b>12180</b>	<b>403</b>	<b>0.85 (0.76-0.95)**</b>
Accommodation and Restaurants	6671	157	0.87 (0.74-1.02)	2670	28	0.56 (0.38-0.81)**	4001	121	1.00 (0.83-1.20)
<b>Trade</b>	<b>22656</b>	<b>692</b>	<b>1.10 (1.02-1.20)*</b>	<b>15530</b>	<b>392</b>	<b>1.08 (0.97-1.21)</b>	<b>7126</b>	<b>300</b>	<b>1.14 (1.01-1.29)*</b>
Supermarket & Department Stores	11719	361	1.03 (0.93-1.15)	6105	106	0.88 (0.72-1.07)	5614	245	1.18 (1.03-1.35)*
Automotive Related	6035	207	1.44 (1.25-1.66)***	5571	146	1.30 (1.10-1.54)**	464	22	1.44 (0.94-2.19)
<b>Transportation</b>	<b>13830</b>	<b>359</b>	<b>0.88 (0.79-0.98)*</b>	<b>11998</b>	<b>291</b>	<b>0.86 (0.76-0.97)*</b>	<b>1832</b>	<b>68</b>	<b>0.93 (0.73-1.19)</b>
Trucking	5753	137	0.81 (0.68-0.96)*	5460	126	0.79 (0.66-0.95)*	293	11	0.92 (0.51-1.66)

Postal Service & Courier	2049	47	0.70 (0.52-0.93)*	1461	23	0.54 (0.36-0.81)**	588	24	0.97 (0.65-1.45)
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! Adjusted for age and sex. Each industry occupational group is compared to all others.

Associations with p-values of less than 0.05, 0.01, and 0.001 were reported, signified by (\*), (\*\*), and (\*\*\*), respectively.

# Empty cells are due to MCHP policy to not publish data with cells less than 6 or cells that would allow calculation of a cell with  $n < 6$

Table 2. Risk of Carpal tunnel syndrome among the Manitoba Occupational Disease Surveillance System cohort, by sex and occupation (2016 National Occupational Classification)

Occupation	Overall			Men			Women		
	Person-Occupation Combination s	CTS cases	HR (95% CI)	Person-Occupation Combination s	CTS cases	HR (95% CI)	Person-Occupation Combination s	CTS cases	HR (95% CI)
<b>0 Management occupations</b>	<b>3843</b>	<b>119</b>	<b>0.92 (0.77-1.10)</b>	<b>2122</b>	<b>54</b>	<b>0.87 (0.66-1.14)</b>	<b>1721</b>	<b>65</b>	<b>0.96 (0.75-1.22)</b>
065 Managers in customer and personal services, n.e.c.	331	20	1.85 (1.19-2.87)**	237	15	2.07 (1.25-3.44)**			
0651 Other services managers	331	20	1.85 (1.19-2.87)**	237	15	2.07 (1.25-3.44)**			
<b>1 Business, finance and administration occupations</b>	<b>7617</b>	<b>238</b>	<b>0.88 (0.77-1.01)</b>	<b>3765</b>	<b>77</b>	<b>0.77 (0.61-0.96)*</b>	<b>3852</b>	<b>161</b>	<b>0.97 (0.82-1.14)</b>
15 Distribution, tracking and scheduling co-ordination occupations	4181	98	0.78 (0.64-0.96)*	3131	60	0.73 (0.56-0.94)*	1050	38	0.89 (0.64-1.22)
223 Technical occupations in civil, mechanical and industrial engineering	397	19	1.59 (1.02-2.50)*	295		1.46 (0.83-2.57)	102		1.82 (0.87-3.82)
2233 Industrial engineering and manufacturing technologists and technicians	186	11	1.83 (1.01-3.31)*	128		1.67 (0.75-3.73)			
<b>3 Health occupations</b>	<b>15006</b>	<b>437</b>	<b>0.71 (0.64-0.79)***</b>	<b>2115</b>	<b>24</b>	<b>0.43 (0.29-0.64)***</b>	<b>12891</b>	<b>413</b>	<b>0.75 (0.67-0.83)***</b>
301 Professional occupations in nursing	3035	79	0.64 (0.51-0.81)***				2775		0.67 (0.53-0.84)***
3012 Registered nurses and registered psychiatric nurses	2995	76	0.63 (0.50-0.79)***				2740		0.65 (0.52-0.82)***
32 Technical occupations in health	2940	73	0.70 (0.55-0.88)**	736	7	0.40 (0.19-0.84)*	2204	66	0.75 (0.59-0.96)*
323 Other technical occupations in health care	2091	42	0.56 (0.41-0.76)***				1550	39	0.62 (0.46-0.86)**
3233 Licensed practical nurses	1284	35	0.66 (0.47-0.92)*				1195	35	0.70 (0.50-0.97)*

3234 Ambulance attendants and other paramedical occupations	776	7	0.35 (0.17-0.73)**						
34 Assisting occupations in support of health services	8584	274	0.81 (0.71-0.91)***	1070	15	0.51 (0.31-0.84)**	7514	259	0.84 (0.74-0.96)**
341 Assisting occupations in support of health services	8584	274	0.81 (0.71-0.91)***	1070	15	0.51 (0.31-0.84)**	7514	259	0.84 (0.74-0.96)**
3413 Nurse aides, orderlies and patient service associates	7503	241	0.82 (0.71-0.93)**	900	13	0.53 (0.31-0.91)*	6603	228	0.85 (0.74-0.97)*
<b>4 Occupations in education, law and social, community and government services</b>	<b>13200</b>	<b>293</b>	<b>0.59 (0.52-0.67)***</b>	<b>4130</b>	<b>61</b>	<b>0.57(0.44-0.74)***</b>	<b>9070</b>	<b>232</b>	<b>0.60 (0.52-0.69)***</b>
41 Professional occupations in law and social, community and government services	1037	25	0.65 (0.44-0.97)*	315	6	0.71 (0.32-1.59)	722	19	0.64 (0.41-1.00)
42 Paraprofessional occupations in legal, social, community and education services	4466	90	0.55 (0.44-0.68)***	768	13	0.66 (0.38-1.13)	3698	77	0.53 (0.42-0.66)***
421 Paraprofessional occupations in legal, social, community and education services	4466	90	0.55 (0.44-0.68)***	768	13	0.66 (0.38-1.13)	3698	77	0.53 (0.42-0.66)***
4212 Community and social service workers	2435	55	0.63 (0.48-0.82)***	550	8	0.57 (0.28-1.14)	1885	47	0.64 (0.48-0.85)**
4214 Early childhood educators and assistants	1592	28	0.48 (0.33-0.70)***				1490		0.46 (0.31-0.68)***
43 Occupations in front-line public protection services	1682	19	0.44 (0.28-0.69)***	1502	16	0.43 (0.26-0.70)***			
431 Occupations in front-line public protection services	1682	19	0.44 (0.28-0.69)***	1502	16	0.43 (0.26-0.70)***			
4311 Police officers (except commissioned)	783	8	0.41 (0.20-0.82)*	661		0.52 (0.26-1.04)			
4312 Firefighters	890	11	0.48 (0.26-0.86)*	832		0.38 (0.19-0.75)**			
44 Care providers and educational, legal and public	5791	153	0.69 (0.59-0.81)***	1448	23	0.62 (0.41-0.93)*	4343	130	0.71 (0.60-0.85)***

protection support occupations									
441 Home care providers and educational support occupations	4569	130	0.70 (0.58-0.83)***	641	11	0.66 (0.36-1.19)	3928	119	0.71 (0.59-0.85)***
4412 Home support workers, housekeepers and related occupations	2906	81	0.71 (0.57-0.88)**	434	10	0.90 (0.48-1.67)	2472	71	0.69 (0.55-0.88)**
4413 Elementary and secondary school teacher assistants	1646	47	0.68 (0.51-0.91)**				1439		0.74 (0.55-0.99)*
<b>5 Occupations in art, culture, recreation and sport</b>	<b>928</b>	<b>6</b>	<b>0.21 (0.10-0.47)***</b>						
<b>6 Sales and service occupations</b>	<b>26325</b>	<b>877</b>	<b>1.06 (0.98-1.14)</b>	<b>11875</b>	<b>270</b>	<b>0.91 (0.80-1.03)</b>	<b>14450</b>	<b>607</b>	<b>1.16 (1.05-1.27)**</b>
63 Service supervisors and specialized service occupations	4311	163	1.32 (1.13-1.54)***	2208	53	1.30 (0.99-1.71)	2103	106	1.39 (1.14-1.69)***
6322 Cooks	2329	74	1.17 (0.93-1.48)	1181	18	0.87 (0.55-1.39)	1148	56	1.34 (1.03-1.74)*
633 Butchers and bakers	701	52	2.42 (1.84-3.19)***	357	22	2.43 (1.59-3.69)***	344	30	2.40 (1.67-3.44)***
6331 Butchers, meat cutters and fishmongers - retail and wholesale	262	21	2.89 (1.88-4.44)***	199	12	2.38 (1.35-4.19)**	63	9	3.99 (2.07-7.68)***
6332 Bakers	439	31	2.17 (1.53-3.10)***	158	10	2.47 (1.33-4.60)**	281	21	2.04 (1.33-3.14)**
634 Specialized occupations in personal and customer services	126	11	2.47 (1.37-4.46)**	68		3.05 (1.37-6.77)**			
6345 Upholsterers	68	7	3.42 (1.63-7.16)**						
64 Sales representatives and salespersons - wholesale and retail trade	3205	82	0.78 (0.63-0.97)*	1313	20	0.61 (0.39-0.95)*	1892	62	0.86 (0.67-1.11)
6421 Retail salespersons and sales clerks	2997	77	0.79 (0.63-0.98)*	1173	17	0.59 (0.36-0.95)*	1824	60	0.87 (0.67-1.12)

65 Service representatives and other customer and personal services occupations	3602	80	0.73 (0.58-0.91)**	1405	23	0.65 (0.43-0.98)*	2197	57	0.75 (0.57-0.97)*
651 Occupations in food and beverage service	1210	17	0.49 (0.30-0.79)**				1007		0.53 (0.33-0.86)**
6513 Food and beverage servers	961	10	0.36 (0.19-0.67)**				833	10	0.38 (0.20-0.70)**
6541 Security guards and related security service occupations	1010	18	0.61 (0.38-0.97)*	749	10	0.50 (0.27-0.94)*	261	8	0.80 (0.40-1.60)
66 Sales support occupations	3715	131	1.19 (1.00-1.41)	1679	27	0.74 (0.51-1.09)	2036	104	1.41 (1.16-1.72)***
6611 Cashiers	1104	51	1.37 (1.03-1.80)*				982		1.36 (1.02-1.81)*
662 Other sales support and related occupations	2611	80	1.09 (0.87-1.36)	1557	24	0.71 (0.47-1.06)	1054	56	1.43 (1.09-1.86)**
6622 Grocery clerks and store shelf stockers	2284	70	1.09 (0.86-1.38)	1356	20	0.69 (0.44-1.07)	928	50	1.44 (1.09-1.91)*
67 Service support and other service occupations, n.e.c.	10781	396	1.08 (0.98-1.20)	4878	130	0.98 (0.82-1.17)	5903	266	1.15 (1.01-1.30)*
6741 Dry cleaning, laundry and related occupations	500	30	1.47 (1.02-2.10)*				402		1.73 (1.21-2.48)**
<b>7 Trades, transport and equipment operators and related occupations</b>	<b>54094</b>	<b>1471</b>	<b>1.14 (1.06-1.23)***</b>	<b>50987</b>	<b>1333</b>	<b>1.12 (1.04-1.22)**</b>	<b>3107</b>	<b>138</b>	<b>1.22 (1.03-1.45)*</b>
72 Industrial, electrical and construction trades	13069	374	1.22 (1.09-1.36)***	12636	349	1.19 (1.06-1.34)**	433	25	1.85 (1.25-2.75)**
7201 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	120	6	1.81 (0.81-4.02)	114		1.93 (0.87-4.30)			
7202 Contractors and supervisors, electrical trades and telecommunications occupations	72	6	3.13 (1.41-6.97)**						



723 Machining, metal forming, shaping and erecting trades	3976	133	1.38 (1.16-1.65)***	3834	124	1.36 (1.13-1.62)***	142	9	2.04 (1.06-3.92)*
7231 Machinists and machining and tooling inspectors	395	19	1.75 (1.12-2.75)*	388		1.67 (1.05-2.66)*			
7237 Welders and related machine operators	2602	88	1.42 (1.15-1.76)**	2487	80	1.37 (1.10-1.71)**	115	8	2.35 (1.17-4.72)*
7241 Electricians (except industrial and power system)	1301	43	1.42 (1.05-1.92)*	1268		1.41 (1.03-1.92)*			
729 Other construction trades	1702	55	1.42 (1.09-1.85)*	1640	51	1.40 (1.06-1.84)*			
7292 Glaziers	141	8	2.40 (1.20-4.80)*			2.21 (1.05-4.64)*			
7294 Painters and decorators	456	21	1.69 (1.10-2.59)*	413		1.59 (1.00-2.52)			
73 Maintenance and equipment operation trades	7316	295	1.64 (1.46-1.86)***	7139	290	1.67 (1.48-1.89)***			
731 Machinery and transportation equipment mechanics (except motor vehicles)	2736	133	1.91 (1.60-2.27)***	2691	131	1.93 (1.62-2.30)***			
7311 Construction millwrights and industrial mechanics (except textile)	705	41	2.05 (1.51-2.79)***	692		2.09 (1.53-2.84)***			
7312 Heavy-duty equipment mechanics	1257	66	2.10 (1.65-2.69)***	1250	66	2.13 (1.67-2.72)***			
7314 Railway carmen/women	44	6	5.42 (2.43-12.1)***			5.54 (2.49-12.3)***			
732 Automotive service technicians	3178	127	1.67 (1.39-1.99)***	3115	127	1.72 (1.44-2.05)***			
7321 Automotive service technicians, truck mechanics and mechanical repairers	2659	108	1.68 (1.39-2.04)***	2619	108	1.72 (1.42-2.09)***			
7322 Motor vehicle body repairers	519	19	1.52 (0.97-2.39)	496		1.61 (1.03-2.53)*			
7452 Material handlers	4839	104	0.85 (0.70-1.03)	4278	77	0.77 (0.62-0.97)*	561	23	1.13 (0.75-1.71)

75 Transport and heavy equipment operation and related maintenance occupations	12233	313	0.86 (0.77-0.97)*	11488	286	0.85 (0.75-0.96)**	745	27	0.88 (0.60-1.29)
745 Longshore workers and material handlers	4861	104	0.85 (0.70-1.03)	4300	77	0.77 (0.61-0.97)*	561	27	1.22 (0.84-1.79)
751 Motor vehicle and transit drivers	9254	240	0.85 (0.74-0.97)*	8625	214	0.82 (0.71-0.94)**	629	26	0.97 (0.66-1.44)
7511 Transport truck drivers	6216	164	0.85 (0.73-1.00)	5971	154	0.83 (0.70-0.98)*			
7514 Delivery and courier service drivers	2139	43	0.75 (0.55-1.01)	1998	36	0.69 (0.50-0.96)*			
761 Trades helpers and labourers	11979	273	0.98 (0.87-1.11)	11141	230	0.93 (0.81-1.07)	838	43	1.46 (1.08-1.98)*
7612 Other trades helpers and labourers	6782	161	0.96 (0.82-1.13)	6144	128	0.89 (0.75-1.07)	638	33	1.42 (1.01-2.01)*
<b>8 Natural resources, agriculture and related production occupations</b>	<b>3243</b>	<b>113</b>	<b>1.38 (1.14-1.66)***</b>	<b>2708</b>	<b>80</b>	<b>1.24 (0.99-1.55)</b>	<b>535</b>	<b>33</b>	<b>1.85 (1.31-2.61)***</b>
82 Supervisors and technical occupations in natural resources, agriculture and r	745	37	1.84 (1.33-2.55)***	670	31	1.75 (1.23-2.50)**	75	6	2.39 (1.07-5.31)*
823 Underground miners, oil and gas drillers and related occupations	349	24	2.58 (1.73-3.85)***			2.48 (1.65-3.74)***			
8231 Underground production and development miners	281	19	2.47 (1.57-3.88)***	277		2.35 (1.48-3.74)***			
84 Workers in natural resources, agriculture and related production	1538	48	1.20 (0.90-1.59)	1222	29	0.97 (0.68-1.41)	316	19	1.80 (1.15-2.83)*
843 Agriculture and horticulture workers	1357	44	1.24 (0.92-1.67)	1053	25	0.97 (0.66-1.45)	304	19	1.88 (1.19-2.95)**
8431 General farm workers	1296	42	1.25 (0.92-1.70)	1021	25	1.01 (0.68-1.49)	275	17	1.91 (1.18-3.07)**
8614 Mine labourers	111	8	2.97 (1.49-5.93)**			3.29 (1.65-6.58)***			

<b>9 Occupations in manufacturing and utilities</b>	<b>16092</b>	<b>664</b>	<b>1.53 (1.41-1.67)***</b>	<b>12755</b>	<b>380</b>	<b>1.18 (1.06-1.31)**</b>	<b>3337</b>	<b>284</b>	<b>2.38 (2.10-2.69)***</b>
92 Processing, manufacturing and utilities supervisors and central control operators	667	28	1.38 (0.95-2.00)	569	23	1.39 (0.92-2.09)			
921 Supervisors, processing and manufacturing occupations	184	12	2.03 (1.15-3.58)*	126		2.56 (1.33-4.93)**			
9213 Supervisors, food, beverage and tobacco processing	85	8	2.97 (1.49-5.94)**	49		5.76 (2.74-12.1)***			
94 Processing and manufacturing machine operators and related production workers	3892	171	1.53 (1.31-1.78)***	3084	83	1.02 (0.82-1.27)	808	68	2.31 (1.81-2.95)***
943 Machine operators and related workers in pulp and paper production and wood	403	15	1.31 (0.79-2.17)	336	7	0.77 (0.37-1.63)	67	8	3.21 (1.60-6.43)***
944 Machine operators and related workers in textile, fabric, fur and leather products	287	25	2.05 (1.38-3.05)***				238		2.01 (1.31-3.09)**
9416 Metalworking and forging machine operators	598	7	0.42 (0.20-0.89)*	575		0.38 (0.17-0.85)*			
9446 Industrial sewing machine operators	210	19	2.05 (1.30-3.22)**				204		2.02 (1.27-3.22)**
946 Machine operators and related workers in food, beverage and associated production	794	60	2.68 (2.08-3.46)***	551	26	1.94 (1.32-2.86)***	243	34	3.81 (2.71-5.35)***
9461 Process control and machine operators, food and beverage processing	292	17	2.13 (1.32-3.43)**	226	9	1.64 (0.85-3.16)	66	8	3.22 (1.61-6.45)***
9462 Industrial butchers and meat cutters, poultry preparers and related workers	441	41	3.37 (2.47-4.58)***	300	17	2.37 (1.47-3.82)***	141	24	4.79 (3.20-7.16)***

947 Printing equipment operators and related occupations	358	24	2.12 (1.42-3.17)***	238	8	1.23 (0.61-2.46)	120	16	3.34 (2.04-5.46)***
9473 Binding and finishing machine operators	101	14	4.18 (2.47-7.06)***				44		5.87 (3.16-10.9)***
95 Assemblers in manufacturing	5067	199	1.40 (1.21-1.61)***	4281	132	1.16 (0.97-1.38)	786	88	2.80 (2.26-3.47)***
952 Mechanical, electrical and electronics assemblers	2035	96	1.60 (1.31-1.96)***	1717	61	1.28 (0.99-1.65)	318	35	2.76 (1.98-3.86)***
9521 Aircraft assemblers and aircraft assembly inspectors	214	15	2.19 (1.32-3.64)**	167		2.04 (1.10-3.78)*			
9522 Motor vehicle assemblers, inspectors and testers	548	27	1.59 (1.09-2.32)*	498	22	1.48 (0.97-2.25)			
9523 Electronics assemblers, fabricators, inspectors and testers	65	7	2.95 (1.40-6.19)**				33		4.34 (1.95-9.67)***
9524 Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	736	31	1.50 (1.05-2.13)*	591	15	0.98 (0.59-1.63)	145	16	2.90 (1.77-4.74)***
953 Other assembly and related occupations	3032	103	1.23 (1.01-1.49)*	2564	71	1.06 (0.84-1.35)	468	32	1.82 (1.28-2.58)***
9536 Industrial painters, coaters and metal finishing process operators	684	28	1.55 (1.07-2.25)*	637		1.60 (1.09-2.36)*			
9537 Other products assemblers, finishers and inspectors	1823	57	1.12 (0.86-1.45)	1526	34	0.85 (0.61-1.19)	297	23	2.05 (1.36-3.09)***
96 Labourers in processing, manufacturing and utilities	6466	266	1.50 (1.32-1.69)***	4821	142	1.22 (1.03-1.44)*	1645	124	2.01 (1.68-2.41)***
961 Labourers in processing, manufacturing and utilities	6466	266	1.50 (1.32-1.69)***	4821	142	1.22 (1.03-1.44)*	1645	124	2.01 (1.68-2.41)***
9617 Labourers in food, beverage and tobacco processing	1783	94	1.76 (1.43-2.16)***	1013	33	1.38 (0.98-1.95)	770	61	2.08 (1.61-2.68)***

9618 Labourers in fish processing	178	16	2.52 (1.55-4.12)***				86		3.55 (2.06-6.13)***
9619 Other labourers in processing, manufacturing and utilities	3110	114	1.34 (1.11-1.62)**	2431	71	1.20 (0.94-1.51)	679	43	1.68 (1.24-2.27)***

## Appendix 9. Contact dermatitis results

Table 1. Risk of contact dermatitis (CD) among the Manitoba Occupational Disease Surveillance System cohort, by sex and select industry (p-value<0.1)

Industry	Overall			Male workers			Female workers		
	P-O-C	CD cases	HR (95% CI)	P-O-C	CD cases	HR (95% CI)	P-O-C	CD cases	HR (95% CI)
<b>Construction</b>	<b>18507</b>	<b>427</b>	<b>0.81 (0.73-0.89)***</b>	<b>17957</b>	<b>410</b>	<b>0.81 (0.73-0.90)***</b>	<b>550</b>	<b>17</b>	<b>0.77 (0.48-1.25)</b>
Building Construction	15331	355	0.82 (0.73-0.92)***	148996	342	0.83 (0.74-0.93)	435	13	0.75 (0.43-1.29)
Heavy Construction	3176	72	0.80 (0.64-1.02)	3061	68	0.80 (0.63-1.02)	.	.	.
<b>Healthcare</b>	<b>21843</b>	<b>886</b>	<b>1.03 (0.95-1.12)</b>	<b>3358</b>	<b>107</b>	<b>1.15 (0.95-1.39)</b>	<b>18485</b>	<b>779</b>	<b>1.02 (0.93-1.11)</b>
<b>Manufacturing</b>	<b>26333</b>	<b>907</b>	<b>1.19 (1.10-1.28)***</b>	<b>22172</b>	<b>709</b>	<b>1.20 (1.10-1.30)***</b>	<b>4161</b>	<b>198</b>	<b>1.15 (1.00-1.34)</b>
Agriculture Manufacturing	839	13	0.53 (0.31-0.91)*	753		0.52 (0.33-1.01)	.	.	.
Heavy Metal Working	8241	300	1.31 (1.17-1.48)***	7912	284	1.32 (1.17-1.49)***	329	16	1.21 (0.74-1.98)
Manufacturing Chemicals/Paint	283	21	2.67 (1.74-4.09)***	263	20	2.81 (1.81-4.36)***	.	.	.
Manufacturing Electronics	284	11	1.17 (0.65-2.12)	.	.	.	100		1.94 (0.97-3.89)
Manufacturing Medication	400	26	1.88 (1.28-2.76)**	190	8	1.52 (0.76-3.03)	210	18	2.10 (1.3203.35)**
Vehicle Manufacturing	1928	79	1.39 (1.11-1.73)**	1731	73	1.50 (1.19-1.89)***	197	6	0.71 ((0.32-1.58)
Wood & Millwork	3441	107	1.01 (0.83-1.22)	2681	59	0.79 (0.61-1.02)	760	48	1.54 (1.16-2.05)**
<b>Natural Resources</b>	<b>3532</b>	<b>103</b>	<b>0.99 (0.81-1.20)</b>	<b>3036</b>	<b>78</b>	<b>0.92 ((0.74-1.16)</b>	<b>496</b>	<b>25</b>	<b>1.24 (0.84-1.84)</b>
Mining	888	29	1.13 (0.78-1.63)	840	26	1.08 (0.74-1.60)	.	.	.
<b>Public Administration</b>	<b>14669</b>	<b>498</b>	<b>1.04 (0.95-1.14)</b>	<b>9617</b>	<b>285</b>	<b>1.05 (0.93-1.19)</b>	<b>5052</b>	<b>213</b>	<b>1.02 (0.88-1.17)</b>
<b>Service</b>	<b>20766</b>	<b>753</b>	<b>1.04 (0.96-1.13)</b>	<b>8679</b>	<b>259</b>	<b>1.11 (0.97-1.26)</b>	<b>12087</b>	<b>495</b>	<b>1.00 (0.91-1.11)</b>
Supermarket & Department Stores	11638	342	0.85 (0.77-0.95)**	6060	132	0.79 (0.67-0.95)*	5578	210	0.90 (0.78-1.04)
<b>Trade</b>	<b>22514</b>	<b>673</b>	<b>0.93 (0.86-1.01)</b>	<b>15441</b>	<b>411</b>	<b>0.97 (0.87-1.08)</b>	<b>7073</b>	<b>262</b>	<b>0.88 (0.77-1.00)</b>
Other Trade	1741	61	1.10 (0.85-1.41)	1157	42	1.33 (0.98-1.80)	584	19	0.79 (0.50-1.24)

<b>Transportation</b>	<b>13740</b>	<b>364</b>	<b>0.87 (0.78-0.97)*</b>	<b>11917</b>	<b>294</b>	<b>0.85 (0.75-0.96)</b>	<b>1823</b>	<b>70</b>	<b>0.91 (0.72-1.16)</b>
Other Transportation	1185	25	0.70 (0.48-1.04)	1034	20	1.33 (0.98-1.80)	.	.	

- Bolded font indicates major industry groups; regular font indicates industry subgroups.
- Associations with p-values of less than 0.05, 0.01, and 0.001 were reported, signified by (\*), (\*\*), and (\*\*\*), respectively.

*Table 2. Risk of contact dermatitis (CD) among the Manitoba Occupational Disease Surveillance System cohort, by sex and select occupations*

Occupation	Overall			Male			Female		
	P-O-C	CD cases	HR (95% CI)	P-O-C	CD cases	HR (95% CI)	P-O-C	CD cases	HR (95% CI)
<b>0 Management occupations</b>	<b>3797</b>	<b>102</b>	<b>0.86 (0.71-1.05)</b>	<b>2100</b>	<b>53</b>	<b>0.89 (0.68-1.17)</b>	<b>1698</b>	<b>51</b>	<b>0.72 (0.55-0.95)*</b>
06 Middle management occupations in retail and wholesale trade and customer service	1824	49	0.84 (0.51-1.37)	790	20	0.92 (0.59-1.42)	1034	29	0.68 (0.47-0.98)*
063 Managers in food service and accommodation	506	11	0.61 (0.34-1.09)	.	.		343	6	0.42 (0.19-0.94)*
0631 Restaurant and food service managers	452	11	0.68 (0.44-1.63)	.	.		312	6	0.47 (0.21-1.04)
<b>1 Business, finance and administration occupations</b>	<b>7589</b>	<b>260</b>	<b>1.06 (0.94-1.20)</b>	<b>3753</b>	<b>103</b>	<b>0.97 (0.80-1.19)</b>	<b>3843</b>	<b>169</b>	<b>1.05 (0.90-1.23)</b>
12 Administrative and financial supervisors and administrative occupations	1108	52	1.23 (0.26-1.28)	271	7	0.91 (0.43-1.91)	837	45	1.32 (0.98-1.77)
122 Administrative and regulatory occupations	495	23	1.22 (0.81-1.84)	.	.		359		1.35 (0.87-2.10)
151 Mail and message distribution occupations	1503	57	1.13 (0.87-1.47)	970	26	0.92 (0.62-1.35)	533	31	1.40 (0.98-1.99)
1512 Letter carriers	774	27	1.06 (0.72-1.54)	521	10	0.65 (0.35-1.22)	253	17	1.63 (1.01-2.63)*
1523 Production logistics co-ordinators	68	7	3.43 (1.64-7.18)**						
<b>2 Natural and applied sciences and related occupations</b>	<b>2601</b>	<b>73</b>	<b>1.01 (0.80-1.28)</b>	<b>2046</b>	<b>63</b>	<b>1.11 (0.86-1.42)</b>	<b>569</b>	<b>29</b>	<b>1.25 (0.87-1.81)</b>
<b>3 Health occupations</b>	<b>14799</b>	<b>556</b>	<b>1.03 (0.94-1.13)</b>	<b>2064</b>	<b>62</b>	<b>1.08 (0.84-1.39)</b>	<b>12780</b>	<b>550</b>	<b>1.05 (0.95-1.15)</b>
3012 Registered nurses and registered psychiatric nurses	2969	111	0.92 (0.76-1.11)	.	.		2722	107	0.94 (0.78-1.14)
3212 Medical laboratory technicians	177	10	1.46 (0.78-2.71)	.	.		149		1.50 (0.78-2.87)
3213 Veterinary and animal health technologists and technicians	214	7	0.92 (0.44-1.93)	.	.		136	7	1.27 (0.61-2.67)

3233 Licensed practical nurses	1268	61	1.16 (0.90-1.50)	.	.		1181	56	1.12 (0.86-1.46)	
3234 Ambulance attendants and other paramedical occupations	766	26	1.04 (0.71-1.53)		441	13	1.10 (0.64-1.89)	325	13	0.98 (0.57-1.69)
314 Therapy and assessment professionals	256	15	1.49 (0.90-2.48)	.	.		228	15	1.63 (0.97-2.69)	
3143 Occupational therapists	47	7	4.14 (1.97-8.69)***	.	.		43	7	4.38 (2.09-9.20)***	
3413 Nurse aides, orderlies and patient service associates	7423	313	1.06 (0.94-1.53)		874	32	1.32 (0.93-1.87)	6549	281	1.04 (0.91-1.17)
3414 Other assisting occupations in support of health services	1060	44	1.05 (0.78-1.41)	.	.		891	40	1.08 (0.79-1.48)	
<b>4 Occupations in education, law and social, community and government services</b>	<b>13045</b>	<b>453</b>	<b>1.03 (0.93-1.14)</b>		<b>4079</b>	<b>106</b>	<b>0.94 (0.77-1.14)</b>	<b>8981</b>	<b>367</b>	<b>1.00 (0.89-1.11)</b>
4155 Probation and parole officers and related occupations	273	14	1.54 (0.91-2.60)		141	6	1.57 (0.71-3.49)	132	8	1.51 (0.75-3.01)
4212 Community and social service workers	2404	109	1.20 (0.99-1.46)		546	16	1.06 (0.65-1.74)	1858	93	1.23 (1.00-1.51)
4311 Police officers (except commissioned)	777	30	1.31 (0.91-2.26)		655	24	1.34 (0.89-2.00)	122	6	1.21 (0.54-2.69)
4312 Firefighters	880	12	0.47 (0.27-0.83)**		823		0.48 (0.26-0.86)*	.	.	
4413 Elementary and secondary school teacher assistants	1640	71	1.09 (0.86-1.38)	.	.		1436	67	1.14 (0.89-1.45)	
442 Legal and public protection support occupations	1205	29	0.75 (0.52-1.08)		795	18	0.81 (0.51-1.29)	410	11	0.65 (0.36-1.18)
<b>5 Occupations in art, culture, recreation and sport</b>	<b>914</b>	<b>27</b>	<b>0.94 (0.65-1.38)</b>		<b>382</b>	<b>9</b>	<b>0.87 (0.45-1.67)</b>	<b>534</b>	<b>21</b>	<b>0.98 (0.64-1.51)</b>
<b>6 Sales and service occupations</b>	<b>26070</b>	<b>844</b>	<b>1.02 (0.94-1.10)</b>		<b>11760</b>	<b>341</b>	<b>1.07 (0.96-1.20)</b>	<b>14374</b>	<b>582</b>	<b>0.97 (0.88-1.07)</b>
632 Chefs and cooks	2445	83	1.02 (0.82-1.27)		1271	41	1.26 (0.92-1.72)	1174	42	0.87 (0.64-1.18)
6321 Chefs	145	7	1.59 (0.76-3.34)							
6322 Cooks	2300	76	0.99 (0.79-1.24)		1163	37	1.25 (0.90-1.73)	1137	39	0.83 (0.60-1.14)
6331 Butchers, meat cutters and fishmongers - retail and wholesale	262	8	1.00 (0.50-2.00)							
65 Service representatives and other customer and personal services occupations	3546	113	0.90 (0.75-1.09)		1390	42	1.12 (0.83-1.52)	2150	71	0.80 (0.63-1.01)
6623 Other elemental sales occupations	113	7	1.82 (0.87-3.82)							
671 Food counter attendants, kitchen helpers and related support occupations	3156	153	1.34 (1.14-1.57)***		821	31	1.51 (1.06-2.16)*	2335	122	1.29 (1.07-1.55)**
6711 Food counter attendants, kitchen helpers and related support occupations	3156	153	1.34 (1.14-1.57)***		821	31	1.51 (1.06-2.16)*	2321	108	1.24 (1.02-1.51)*

672 Support occupations in accommodation, travel and amusement services	331	10	0.88 (0.47-1.64)	166	8	1.77 (0.88-3.54)	.	.		
6731 Light duty cleaners	2516	97	0.97 (0.799-1.18)	463	12	0.90 (0.51-1.59)		2053	85	0.99 (0.79-1.22)
6732 Specialized cleaners	9903	23	0.88 (0.58-1.32)	760	21	1.05 (0.68-1.61)	.	.		
6733 Janitors, caretakers and building superintendents	3083	107	1.08 (0.89-1.31)	2325	72	1.06 (0.84-1.34)		758	35	1.11 (0.79-1.55)
<b>7 Trades, transport and equipment operators and related occupations</b>	<b>53652</b>	<b>1302</b>	<b>0.90 (0.83-0.97)**</b>	<b>50643</b>	<b>1314</b>	<b>0.87 (0.81-0.94)***</b>		<b>3094</b>	<b>111</b>	<b>0.86 (0.71-1.04)</b>
7231 Machinists and machining and tooling inspectors	390	20	1.81 (1.17-2.81)**	383	20	1.84 (1.19-2.86)**	.	.		
727 Carpenters and cabinetmakers	2229	43	0.68 (0.51-0.92)*	2119	42	0.72 (0.53-0.98)*	.	.		
7271 Carpenters	1984	36	0.65 (0.47-0.90)*	1923	36	0.69 (0.49-0.95)*	.	.		
7284 Plasterers, drywall installers and finishers and lathers	584	8	0.50 (0.25-1.00)*	571	8	0.52 (0.26-1.04)	.	.		
7294 Painters and decorators	452	17	1.30 (0.81-2.09)	410	16	1.39 (0.85-2.28)	.	.		
7312 Heavy-duty equipment mechanics	1259	29	0.82 (0.57-1.18)	1251	29	0.83 (0.57-1.19)	.	.		
7321 Automotive service technicians, truck mechanics and mechanical repairers	2646	78	1.05 (0.84-1.32)	2607	77	1.07 (0.85-1.34)	.	.		
75 Transport and heavy equipment operation and related maintenance occupations	12196	290	0.80 (0.71-0.90)***	11449	273	0.82 (0.72-0.93)**		747	17	0.54 (0.33-0.87)*
751 Motor vehicle and transit drivers	9234	222	0.80 (0.79-0.92)**	8600	206	0.82 (0.71-0.95)**		634	16	0.59 (0.36-0.97)*
752 Heavy equipment operators	1865	40	0.75 (0.55-1.02)	1804	39	0.75 (0.55-1.04)	.	.		
7611 Construction trades helpers and labourers	5158	177	0.82 (0.68-0.99)*	4958	111	0.83 (0.69-1.01)	.	.		
762 Public works and other labourers, n.e.c.	2613	92	1.20 (0.98-1.48)	2315	76	1.17 (0.93-1.47)		297	13	1.18 (0.68-2.04)
7612 Other trades helpers and labourers	6725	200	1.03 (0.89-1.19)	6088	170	1.02 (0.87-1.19)		637	30	1.13 (0.79-1/62)
7621 Public works and maintenance labourers	2270	84	1.26 (1.01-1.56)*	1991	68	1.21 (0.95-1.54)		279	16	1.43 (0.88-2.24)
<b>8 Natural resources, agriculture and related production occupations</b>	<b>3211</b>	<b>69</b>	<b>0.81 (0.64-1.02)</b>	<b>2704</b>	<b>71</b>	<b>0.96 (0.76-1.22)</b>		<b>527</b>	<b>22</b>	<b>1.03 (0.68-1.57)</b>
86 Harvesting, landscaping and natural resources labourers	945	25	0.94 (0.62-1.37)	804	21	0.99 (0.64-1.52)	.	.		
861 Harvesting, landscaping and natural resources labourers	945	25	0.92 (0.62-1.37)	804	21	0.99 (0.64-1.52)	.	.		
<b>9 Occupations in manufacturing and utilities</b>	<b>15921</b>	<b>502</b>	<b>1.14 (1.04-1.25)**</b>	<b>12656</b>	<b>431</b>	<b>1.26 (1.14-1.40)***</b>		<b>3328</b>	<b>157</b>	<b>1.14 (0.97-1.34)</b>



92 Processing, manufacturing and utilities supervisors and central control operators	669	19	0.94 (0.62-1.37)	568	11	0.68 (0.64-1.22)	101	8	1.92 (0.96-1.47)
941 Machine operators and related workers in mineral and metal products processing	1661	69	1.48 (1.17-1.88)**	1596	65	1.47 (1.15-1.88)**	.	.	
9416 Metalworking and forging machine operators	593	28	1.66 (1.14-2.40)**	569	25	1.56 (1.05-2.31)*	.	.	
95 Assemblers in manufacturing	5000	193	1.29 (1.06-1.49)***	4228	152	1.29 (1.09-1.51)**	772	41	1.28 (0.94-1.74)
952 Mechanical, electrical and electronics assemblers	2008	82	1.34 (1.08-1.67)**	1694	69	1.44 (1.13-1.83)**	313	10	0.81 (0.44-1.51)
9522 Motor vehicle assemblers, inspectors and testers	543	25	1.54 (1.04-2.28)*	494	24	1.68 (1.12-2.15)*	.	.	
953 Other assembly and related occupations	2992	111	1.23 (1.02-1.49)*	2534	83	1.16 (0.94-1.45)	458	28	1.48 (1.02-2.15)*
9537 Other products assemblers, finishers and inspectors	1800	68	1.24 (0.98-1.58)	1511	47	1.10 (0.82-1.46)	289	21	1.74 (1.13-2.68)*
9618 Labourers in fish processing	180	10	1.55 (0.83-2.89)	89	7	2.81 (1.34-5.90)**	.	.	
9619 Other labourers in processing, manufacturing and utilities	3072	111	1.18 (0.98-1.43)	2409	72	1.08 (0.86-1.37)	663	39	1.43 (1.04-1.96)*

**Table notes:**

- P-O-C refers to person-occupation-combinations.
- Bolded font indicates broad occupational groups; regular font indicates occupation subgroups.
- Associations with p-values of less than 0.05, 0.01, and 0.001 were reported, signified by (\*), (\*\*), and (\*\*\*), respectively.

## Appendix 10. Cancer results

*Table 1. Number of selected Cancer cases identified in the Manitoba Occupational Disease Surveillance System by sex*

Site	Total	Male	Female
Bladder	78	70	8
Leukemia	173	121	52
Lymphomas	209	150	59
Breast (female only)			504
Lung	559	331	228
Mesothelioma	65	>60	< 5

*Table 2. Cancer Hazard ratios and 95% confidence intervals for selected cancers by industry and occupation.\*#*

Cancer site	Industry or occupations	Number at risk	Number of cancer cases	Hazard ratio with 95% CI
Bladder	<i>Trade</i>	24202	20	1.98 (1.19-3.29)**
	<i>Automotive Related</i>	6431	8	2.21 (1.06-4.60)*
	<i>Heavy Metal Working</i>	9029	13	2.41 (1.32-4.40)**
Breast	9 Occupations in manufacturing and utilities	17678	21	2.34 (1.42-3.87)***
	<i>Business Services</i>	592	10	2.19 (1.17-4.10)*
	<i>Public Administration</i>	15256	38	2.22 (1.55-3.18)***
Leukemia	44 Care providers and educational, legal and public protection support occupations	6137	11	1.96 (1.05-3.69)*
	7612 Other trades helpers and labourers	7245	15	1.72 (1.01-2.95)*
	<i>Transportation</i>	14698	80	1.34 (1.05-1.70)*
Lung	<i>Construction Manufacturing</i>	1041	8	2.56 (1.27-5.15)**
	<i>Trucking</i>	6246	51	1.86 (1.38-2.50)***
	7 Trades, transport and equipment operators and related occupations	57498	223	1.37 (1.12-1.68)**
	75 Transport and heavy equipment operation and related maintenance occupations	13074	75	1.31 (1.02-1.69)*
	6622 Grocery clerks and store shelf stockers	2478	12	1.78 (1.00-3.15)*
	7511 Transport truck drivers	6728	53	1.59 (1.19-2.13)**
Lymphoma	<i>Healthcare</i>	23470	42	1.76 (1.17-2.63)**
	<i>Aircraft Manufacturing and Repair</i>	1128	6	2.73 (1.21-6.16)*
	3 Health occupations	15911	28	1.60 (1.02-2.50)*
	3012 Registered nurses and registered psychiatric nurses (female only)	2857	8	2.56 (1.21-5.39)*

	4412 Home support workers, housekeepers and related occupations (female only)	2678	6	2.51 (1.08-5.86)*
Mesothelioma	<i>Building Construction</i>	16313	16	2.22 (1.23-3.98)**
	<i>Railway</i>	1091	6	9.67 (4.17-22.4)***
	72 Industrial, electrical and construction trades	13872	21	2.94 (1.70-5.07)***
	724 Electrical trades and electrical power line and telecommunications workers	2277	7	3.48 (1.53-7.90)**
	725 Plumbers, pipefitters and gas fitters	1161	6	3.75 (1.49-9.39)**

# Industries and industrial subsectors in italics. Occupations with NOC classification in regular font.

\*Associations with p-values of less than 0.05, 0.01, and 0.001 were reported, signified by (\*), (\*\*), and (\*\*\*), respectively.