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Improving information on worker health protection in Ontario

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Executive Summary

This research study had the broad purpose of evaluating emergency department encounter records as a source of information for monitoring work-related injury and illness in Ontario. The primary objective of the study was to conduct a formal record linkage of emergency department records for the treatment of work-related injury and illness and workers' compensation claims over the period 2004-2017. A primary interest of this study is to describe the characteristics of the approximately 50,000 annual emergency department records for the treatment of a work-related injury or illness that do not link to a workers' compensation claim.

Two sources of administrative records were used in this study, obtained for the period 2004-2017: workers' compensation claims (N=3,722,646) and records of non-scheduled emergency department visits where the main problem is attributed to a work-related exposure (N=1,907,241). We used deterministic methods to link records from the two data sources, using the following information common to both sources: date of injury and the birthdate, gender and residential postal code of the injured worker. Overall, 64% of episodes of emergency department care for the treatment of work-related injury or illness were linked to a corresponding workers' compensation claim. Conversely, 605,183 episodes of care, representing 36% of all episodes of care for the treatment of a work-related injury or illness were not linked to a corresponding workers' compensation claim.

There was only minor variation in the record linkage rate by age, gender and geography. The overall linkage rate of 64% was general similar over the five geographic regions of the province; slightly higher in western Ontario (67%) and slightly lower in metropolitan Toronto (58%). Episodes of care for younger men and women were slightly less likely to link to a corresponding workers' compensation claim (61% and 58%) than was found for older workers (69% for both men and women 55 years of age and older). There was no important difference in the record linkage rate between men and women.

Trends in the frequency of workers' compensation claims and emergency department visits were paralleled over time. In the period of the global financial crisis, worker's compensation claims declined dramatically by 27% (from 321,000 in 2007

to 240,800 in 2009) and emergency department visits for the treatment of work-related injury and illness declined by 23% (from 149,000 in 2007 to 115,700 in 2009). Following the global financial crisis, there was a modest rise in the frequency of both workers' compensation claims and emergency department visits (2010-2017: 3% in worker's compensation claims and 8% increase in emergency department visits).

Within this pattern of parallel time trends in the annual frequency of work-related injury and illness, there is an important divergence. The proportion of emergency department visit records that link to a worker's compensation claim declines abruptly in the period surrounding the global financial crisis, from 69% in 2007-2008 to 59% in 2011. In the period prior to the decline, the record linkage rate was broadly similar for three age groups (<35, 35-54, 55+), with the highest rates observed for the oldest age group, and slightly lower for the youngest age group. However, following the 2009-2010 period, the differences in age group record linkage widens substantially. For the youngest group of workers (ages <35), the record linkage rate becomes fixed at approximately 55%. In contrast, among the oldest group of workers (ages 55+), the record linkage rate slowly increases to approximately return to the rate prior to 2009-2010.

Analysis of the frequency of traumatic injuries treated in emergency departments stratified by an ICD10 classification of the nature of injury found that classifications with the highest frequency were superficial wounds (16% of all traumatic injuries), open wounds (27% of all traumatic injuries) and fracture injuries (44% of all traumatic injuries) The record linkage rate (ED visit records linked to a workers' compensation claim) did not meaningfully differ across traumatic injury groups. For example, the proportion of superficial injuries that linked to a workers' compensation claim (66.1%) is similar to the proportion of fractures of the knee that linked to a workers' compensation claim (70.2%). This finding contradicts an expectation of the project team that more serious injury, for example traumatic injury resulting in fracture, would be more likely to link to a workers' compensation claim.

The record linkage phase of this project found that approximately 50,000 annual emergency department visits associated with the treatment of work-related injury or illness do not match to a parallel record in the provincial workers' compensation system. It is a regulatory requirement of the provincial workers' compensation system that among insured workers, incidents of work-related injury or illness receiving medical attention are to be reported to the WSIB. The report describes a

number of features of the administration of workers' compensation claims that may explain a portion of emergency department visits not registered with the Ontario WSIB.

This study has applied a novel method to assess the frequency of non-reporting of work-related injury and illness in the Canadian province of Ontario. The proportion of work-related injury and illness presenting for treatment in emergency department settings that appear not to have been documented in a worker's compensation claim is substantial. The finding in this study that approximately 35-40% of emergency department visits may not be reported to the provincial workers' compensation authority is generally consistent with evidence reported in many jurisdictions in North America.

This study has demonstrated the feasibility of record linkage between two population-based administrative data sources to monitor the incidence of work-related injury and illness. We identify four additional strengths of this study. The first strength is reliance upon two independent sources of information that can be used to estimate the frequency of work-related injury. Second, both sources of administrative data applied in this study are population-based, each providing high coverage of the Ontario labour force. The third strength is the fourteen 14-year period of observation, during a period of when the Ontario labour market experienced a sharp recession. We note a fourth strength. Relying on administrative data sources, this study is a cost-efficient research method relative to available alternatives such as cross-sectional or longitudinal surveys.

Following on the primary findings of this study, we recommend the importance of additional research to understand more completely the factors primarily responsible for the unreported incidents of work-related injury and illness presenting for treatment in Ontario emergency departments. One study design to be considered would involve conducting a follow-up interview with workers identified in a Health Professional's Report (Form 8) where a worker's compensation claim was not registered and accepted by the WSIB. Information collected through worker interview would identify the primary factors responsible for the incomplete registration of workers' compensation claims.

Goals and Objectives

More than 80% of the increase in life expectancy over the past 100 years in North America is attributed to advances in public health (1). Among the 10 most important public health contributions to the improvement in population health are the achievements in reducing hazardous exposures arising from work. Despite these contributions, work exposures continue to cause a large, preventable burden of injury and illness in working-age adults; in both the United States and Canada, approximately one quarter of traumatic injuries resulting in activity limitation are work-related (2-3).

This study had the broad purpose of evaluating emergency department encounter records as a source of information for the surveillance of work-related injury and illness. Within this broad purpose, the study had the primary objective of conducting a formal record linkage of records of emergency department visits for the treatment of work-related injury and illness and workers' compensation claims (both lost-time claims and claims for medical care only) over the period 2004-2017. Completion of the record linkage enabled the following three analytic objectives. The first objective was to identify the factors associated with a divergence in the two administrative data sources following the 2009 recession in Ontario. The second objective was to improve understanding of geographic differences in trends in the nature of injury and injury events. The third objective was to improve the detail and quality of nature of injury and injury event information associated with compensation claims for medical care only.

These objectives address areas of neglected attention in occupational injury epidemiology in Canada and will inform ongoing controversies concerning the reliability of workers' compensation administrative records as a source of surveillance information on the incidence of work-related injury and illness. These controversies center on concerns about the integrity of workplace reporting of work-related injury and illness and the lack of information about some groups of workers who are excluded from insurance coverage in Ontario (self-employed and independent contractors and the majority of the financial services sector) (4-13).

Background

The objective of surveillance in public health and occupational health is the systematic and ongoing assessment of population health status, based on the timely collection, analysis and dissemination of information on health status and health risks (14). Optimal characteristics of surveillance systems include continuity of measurement over time, consistency of measurement over time, population-based sampling and reliability in the measurement of health status and health risks. Most occupational health surveillance systems rely on the monitoring of routinely collected administrative data and as such, represent passive surveillance. The accuracy of surveillance information drawn from administrative sources is clearly dependent on the integrity of reporting compliance in administrative information systems and there are ongoing controversies concerning the completeness of the reporting of work injuries to provincial workers' compensation insurance agencies (4-10).

The Ontario Workplace Safety and Insurance Board (WSIB) provides coverage to approximately 70% of Ontario workers (15). Access to medically necessary health services, including emergency department care, in the province of Ontario is provided to all residents registered with the provincial universal health insurance plan. Approximately 30% of all work injuries and illnesses requiring medical care present to a hospital emergency department. In the PRISM study of workplace injury claim suppression in Ontario, among 3,000 manually reviewed abandoned claims, approximately 30% of records with a completed Form 8 (medical practitioner's report) originated from an emergency department (12). A separate analysis of more than 2,700 no lost-time claims associated with injury to the head, back, shoulder or multiple injuries, found that 30% of claimants received medical treatment in a hospital emergency department. A concordant estimate of emergency department use is available from the 2003 Canadian Community Health Survey. In this survey, an estimated 630,000 Canadian workers experienced at least one activity-limiting occupational injury in the previous 12 months. Of these injuries, 66% were reported to require medical attention, and 50% of these injuries needing medical attention presented to a hospital emergency department (16-17).

Record linkage to understand the divergence in the two administrative data sources following the 2009 recession

Our previous work has described a strong concordance in temporal trends in the two administrative data sources in the period 2004-2009. There was a 17.3% reduction in emergency department visits attributed to work-related causes and a 17.8% reduction in lost-time compensation claims over the period 2004 to 2008 (17). The annual percent decline was 3.5% in emergency department visits and 3.0% in compensation claims. Subsequent analyses have documented a concordant portrait of the impact of the economic recession in Ontario arising from the global financial crisis. Between 2008 and 2009 (a single year), the incidence of lost-time and no lost-time compensation claims declined by 16% and the incidence of work-related injury and illness treated in emergency departments declined by 15% (20). These declines in the incidence of work-related injury are much greater than decreases in hours of work during the recession (21).

Of concern, however, is a divergence in the estimates of work-related injury and illness in the period of economic recovery following the 2009 recession. In the period 2009-2014, the annual percentage decline in the incidence of lost-time and no lost-time claims was -1.8%. However, the percentage change in emergency department visits increased by 2.6% annually over this period. In the five-year period prior to the 2009 recession, emergency department visits as a percent of WSIB compensation claims was stable (approximately 44%). However, from 2009 to 2014, emergency department visits as a percent of WSIB compensation claims increased from 43% to 54%. To give weight to these estimates of annual percent change, there were 22,000 fewer accepted compensation claims in 2014 compared to 2009. Conversely, there were 12,000 more emergency department visits for work-related disorders in 2014 compared to 2009. This divergence in the ascertainment of work-related injury and illness in the two population-based administrative data sources raises concerns about the integrity of the administration of the provincial workers compensation scheme and indicates the importance of performing an administrative record linkage.

Record linkage to improve information on injuries administered as no lost-time claims

Between 1991 and 2006 the number of claims submitted to Ontario‘s Workplace Safety and insurance Board (WSIB) for work-related injuries requiring time off work

(lost-time claims) declined by 46%. Over the same time period, work-related injuries that required health care only (not requiring time off work) declined by less than 10%. By the end of this period, there were twice the number of no lost-time claims (NLTCs) as lost-time claims (LTCs) (18).

However, information on the nature of injury and injury event is, unfortunately, not coded and classified by the WSIB in the administration of no lost-time claims. From a prevention perspective it is important to know if the smaller decline in the no lost-time claim rate in Ontario between 1991 and 2006 reflects more effective primary prevention (e.g. worker protection or equipment guarding) that has resulted in injuries that formerly required time off work becoming less severe (e.g. open wounds becoming bruises); or if this trend reflects a shifting of claims from lost-time claims to no-lost-time claims through workplace practices promoting return to work the day after an injury (secondary prevention). In recent years, an IWH team has conducted a series of analytic projects to better understand the divergent trends in lost-time and no lost-time claim rates. Analysis of trends in health care expenditures for no lost-time claims documented that expenditures per claim increased between 1998 and 2006, a trend generally similar across demographic and industrial subgroups (18). Analysis of the duration of health care over the time period 1991 to 2006, describing the probability of receiving health care in five time windows post-injury (0 to 30 days; 31 to 90 days; 91 to 180 days; 181 to 365 days; and one to two years), found the largest increases in the probability of health care use occurred in the time periods 31 days to 90 days, and 91 days to 180 days post injury. The increasing health care spending per claim since 1998 is a prominent factor underlying both the relatively stable no lost-time claim rate and the aggressive declines in the lost-time claim rate in Ontario during this period.

An additional component of this work involved the manual coding of injury information from 9,250 no lost-time claims to document the injury event, the source of injury, the nature of injury and part of body injured (18). We remind the reader that the Ontario workers' compensation scheme collects, but does not code, this valuable information on no lost-time claims. The objective of this work was to determine if there have been important changes over time in the characteristics of injuries that have been registered as no lost-time claims over period 1996 to 2005. This analysis found no evidence of an important increase in injury severity over time among no lost-time claims. Over the period of observation, the proportion of no lost-time claims

was consistently in the range of 20% in each of three injury groups: 1) open wounds due to contact with equipment; 2) surface wounds, bruising and muscular injuries resulting from contact with equipment; and 3) overexertion claims (19).

The linkage of records of no lost-time claims to records of emergency department visits provides the opportunity to add valuable information on the nature of injury and the injury event to the no lost-time claim record on a routine basis.

Administrative procedures related to the reporting of work-related injury and illness in the Ontario workers' compensation system

There are two features of administrative policies and procedures in the Ontario workers' compensation system that are relevant for understanding the methods and findings of this study.

In all Canadian provinces, both the provincial health insurance plan and the provincial workers' compensation authority reimburse health-care providers for the provision of insured health care services. In Ontario, physician services for the treatment of work-related conditions are reimbursed directly by the provincial health insurance plan (OHIP). Health-care providers providing treatment for work-related disorders are expected to indicate in the treatment reimbursement claim that the 'responsibility for payment' is assigned to the Ontario WSIB. The provincial health insurance plan in turn recovers these reimbursement expenditures annually from the WSIB. In addition, Ontario hospitals submit reimbursement claims directly to the WSIB for the recovery of expenditures associated with ambulatory care services (diagnostic imaging, emergency department services) and for in-patient care provided for the treatment of work-related injury and illness.

The procedure for reimbursing health-care providers and hospitals for the treatment of work-related conditions is not conditional on the submission and approval of a worker's compensation claim. This policy has the consequence of enabling the timely treatment (and reporting) of work-related conditions. The specific guidance to health-care providers related to the documentation of services provided in the treatment of work-related conditions includes the following:

Health Professional's Report (Form 8)

When your patient suffers a work- related injury/illness and comes to see you, you must complete a Form 8 (281.2kb, PDF), even if that patient first visited an Emergency Department. When your completed form arrives at the WSIB, it is first scanned into the appropriate WSIB claim record and then sent for payment processing.

Use the Form 8 whether your patient states that an injury or illness is related to his or her work or whether you simply believe it is. Section 37 of the Workplace Safety and Insurance Act provides the legal authority for health care practitioners, hospitals and health facilities to submit, without consent, information relating to a worker claiming benefits to the WSIB.

Health-care providers are reimbursed for the submission of Form 8 regardless of the outcome of the claim registration/adjudication. It is generally understood that emergency department physicians will complete and submit a Health Professional's Report (Form 8) to the WSIB for each worker receiving care for a work-related condition and will encourage and often support a worker's completion and submission of a Form 6 (Worker's Report of Injury/Disease). In the event a worker does not submit a Form 6, and the health-care provider submits a Form 8, the WSIB classifies the episode as 'partially registered'. The annual count of 'partially registered' claims is not publicly reported by the WSIB and are not included in the reported count of 'abandoned claims'.

Methodology

Study Design

A cross-sectional, observational study of work-related injuries, obtained from two independent sources, for a complete population of occupationally active adults in the province of Ontario over the period 2004-2017.

Study Population and Study Sample

Occupationally active adults in Ontario aged 15-64 years of age.

Data Sources

Administrative Records of Workers' Compensation Claims

The Institute for Work & Health and the Ontario WSIB have entered into a Research Access Agreement providing research access to WSIB compensation claim records. These records contain information describing registered employers and individual compensation claims. For lost-time claim records, information is abstracted to the electronic compensation claim record documenting the date and time of injury, the gender, birth date, occupation (coded to NOC 1991), industry and years of employment tenure of the injured worker. WSIB coding staff apply a national coding standard (CSA Z-795) to classify information describing the injury event characteristics and the injury characteristics: 1) the nature of injury, 2) the part of body involved, 3) the source of injury or disease and 4) the event or exposure. These coding standards adhere to guidelines set out in the National Work Injury Statistics Program. Wage replacement benefits and health care service expenditures have been linked to the compensation claim record for each individual beneficiary.

The project extracted approximately 3,700,000 lost-time and no lost-time compensation claims over the period 2004-2017.

National Ambulatory Care Reporting System (NACRS)

NACRS was established by the Canadian Institute for Health Information in 1997, providing data on individual client visits to facility-based ambulatory care services, primarily emergency departments in acute care hospitals. In July 2000, the province of Ontario mandated the reporting of all emergency department visits to NACRS. In a typical year there are approximately 5,000,000 emergency department visits in the province of Ontario recorded in NACRS. For the purposes of this study, we obtained extracts of all NACRS records reported in the province of Ontario over the period January 2004 to December 2017 with a 'responsibility for payment' code indicating the Workplace Safety and Insurance Board. This coding indicates the clinical determination of a work-related cause of the injury or illness presenting for emergency department treatment and is independent of the registration or acceptance of a workers' compensation claim. Variables included in the extracted records were: Gender, Birth Date, six digit residential postal code, Visit Type, Triage Date, Triage Time and a series of up to 10 fields documenting the main problem and the external cause of injury, coded to ICD10.CA. In a typical year, approximately

130,000 emergency department visits are associated with the treatment of work-related injury or illness.

The project extracted approximately 1,900,000 non-scheduled emergency department visits for the treatment of work-related injury or illness over the period 2004-2017.

Measures

Characteristics of the Injury

Two measures were obtained from lost-time compensation claim records: 1) Nature of Injury: The nature of injury is defined as the principal physical characteristic(s) of the injury or disease (e.g. heat burns, amputations, bruises or contusions, fractures); 2) Part of Body Injured: The part of body classification identifies the part or parts of the injured person's body directly affected by the nature of injury or disease classification code previously selected (e.g. ears, face, abdomen, fingers). Characteristics of the injury obtained from emergency department records were defined by the 'main problem' leading to the emergency department visit. In NACRS records, the Main Problem and the External Cause (if a traumatic injury) are classified to ICD-10.

Characteristics of the Injury Event

Two measures were obtained from compensation claim records: 1) Source of Injury: The source of injury or disease classification identifies the object, substance, exposure or bodily motion that directly produced or inflicted the injury or disease identified under the nature of injury classification (e.g. ladders, building systems, floor, machinery), and 2) Event Leading to Injury: The event or exposure identifies the manner in which the injury or disease was produced or inflicted by the identified source (e.g. bending, contact with fire, fall from roof, struck by object).

Characteristics of the worker

Gender, birth date, occupation (coded to NOC 1991), industry, years of employment tenure.

Geography

Workers' compensation claims and emergency department visits were classified to the five economic regions in Ontario, using residential postal code information available in both data sources.

Analytic Objectives

This study had three analytic objectives: 1) identification of factors associated with a divergence in the two administrative data sources following the 2009 recession in Ontario (specifically, an increase in ER visits for work-related conditions, contrasted to a continuing decline in the registration of lost-time and no lost-time claims in Ontario), 2) analysis of geographic differences in trends in the nature of injury and injury events, and 3) analysis of the nature of injury and injury event information associated with compensation claims for medical care only.

Implementation

This project involved three consecutive phases of work. In the first phase, the project team negotiated data access authorizations with the two data custodian organizations. In the second phase, the project team tested and implemented a methodology for linking individual emergency department visit records to individual compensation claim records. In the third phase, the project team conducted descriptive analyses to identify the factors associated with a divergence in the two administrative data sources following the 2009 recession in Ontario (specifically, an increase in ER visits for work-related conditions, contrasted to a continuing decline in the registration of lost-time and no lost-time claims in Ontario), analysis of geographic differences in trends in the nature of injury and injury events, and analysis of the nature of injury and injury event information associated with compensation claims for medical care only.

Phase 1: Data access authorizations

The project team negotiated data access authorizations over the period January 2018 to October 2018. To conduct the record linkage in Phase 2 of the project workplan, the study team required access to person-identifying information, specifically: birth date (year, month and day) and six-digit residential postal code. Review and approval of the research study protocol was provided by the University of Toronto Research Ethics Board. Data custodian officials with the Ontario

Workplace Safety & Insurance Board and the Canadian Institute for Health Information reviewed the research access requests for person-identifying information. Both organizations provided authority to access person-identifying information, conditional on specific requirements concerning the transfer of electronic records to the Institute for Work & Health, the secure storage of person-identifying information, and the destruction of person-identifying information upon the completion of the Phase 2 record linkage. Authorizations were received from the Ontario Workplace Safety & Insurance Board in June 2018 and from the Canadian Institute for Health Information in September 2018.

Phase 2: Record linkage methodology

The record linkage phase was conducted over the period November 2018 to January 2019. The objective of the record linkage phase was to identify emergency department visit records that contained the same person-identifying information as a WSIB compensation claim. The record linkage procedure required a perfect match on three variables: subject gender, birthdate and six-digit residential postal code. In addition, a record match required that the emergency department visit date and the date of injury recorded on the WSIB compensation claim agreed within three days. We identified a small proportion of emergency department visits that appeared to represent episodes of treatment over time. For example, an episode of three visits over consecutive weeks occurring to the same unique individual. We defined an episode of care as multiple emergency department visits within 60 days of a first (or index) emergency department visit.

Phase 3: Descriptive analyses

The third phase was conducted over the period February 2019 to December 2019 to address three objectives: 1) to identify the factors associated with a divergence in the two administrative data sources following the 2009 recession in Ontario (specifically, an increase in ER visits for work-related conditions, contrasted to a continuing decline in the registration of lost-time and no lost-time claims in Ontario), 2) analysis of geographic differences in trends in the nature of injury and injury events, and 3) analysis of the nature of injury and injury event information associated with compensation claims for medical care only.

Results

Table 1 summarizes the primary findings from the record linkage phase. Over the period 2004 to 2017, there were approximately 1,321,000 individual workers who had 1,901,300 visits to an emergency department for the treatment of a work-related injury or illness.

The 1,901,300 visits represented 1,680,878 episodes of care (an episode defined as multiple emergency department visits within 60 days of a first visit).

Using episodes of care as the unit of analysis, 64% of the individual workers receiving treatment in an emergency department were linked to a corresponding workers' compensation claim. Conversely, 605,183 episodes of care, representing 36% of all episodes of care for the treatment of a work-related injury or illness were not linked to a corresponding workers' compensation claim.

The overall linkage rate of 64% was general similar over the five geographic regions of the province. The linkage rate was slightly higher in western Ontario (67%) and slightly lower in metropolitan Toronto (58%).

Episodes of care for younger men and women were less likely to link to a corresponding workers' compensation claim (61% and 58%) than was found for older workers (69% for both men and women 55 years of age and older). There was no important difference in the record linkage rate between men and women received treatment for work-related conditions in Ontario emergency departments.

As a final observation in Table 1, emergency department visits for the treatment of traumatic injury were more likely to link to a corresponding workers' compensation claim than was found for the treatment of other work-related conditions (66% vs 58%).

As an overall observation, there was only minor variation in the record linkage rate by age, gender and geography.

Table 2 summarizes information on the frequency of workers' compensation claims and the frequency of emergency department visits for the treatment of work-related injury and illness for individual years 2014-2017.

As a general observation, trends in the frequency of workers' compensation claims and emergency department visits are paralleled over time. In the period of the global financial crisis, worker's compensation claims declined dramatically by 27% (from

321,000 in 2007 to 240,800 in 2009) and emergency department visits for the treatment of work-related injury and illness declined by 23% (from 149,000 in 2007 to 115,700 in 2009). Following the global financial crisis, there was a modest rise in the frequency of both workers' compensation claims and emergency department visits (2010-2017: 3% in worker's compensation claims and 8% increase in emergency department visits).

Within this pattern of parallel time trends in the annual frequency of work-related injury and illness, there is an important divergence. The proportion of emergency department visit records that link to a worker's compensation claim declines abruptly in the period surrounding the global financial crisis, from 69% in 2007-2008 to 59% in 2011. In the subsequent period 2012 to 2017, there is only a modest recovery in the record linkage rate. Using the record linkage rate observed in 2007, the cumulative count of emergency department visits that appear not to have been reported as a claim with the Ontario WSIB represents 81,200 work-related injuries and illnesses over the period 2010-2017. 9% fewer than would be expected if 2007 was continued over this period.

Table 2 also provides an annual estimate of the proportion of workers' compensation claims that linked to an emergency department treatment record. Consistent with information from other sources, approximately 27-31% of workers' compensation claimants appear to have received health care services in an Ontario emergency department.

Figure 1 presents an important observation supplementing the information on trends over time summarized in Table 2. In Figure 1, the record linkage rate for emergency department visits is stratified by three age groups of workers: <35, 35-54 and 55+. There is a steep and abrupt decline in the record linkage rate over the 24 month24-month period 2009-2010 for all three age groups. This time period corresponds to the period of employment contraction and work hour reductions during and immediately following the global financial crisis. In the period prior to the decline, the record linkage rate was broadly similar for the three age groups, with the highest rates observed for the oldest age group, and slightly lower for the youngest age group. However, following the 2009-2010 period, the differences in age group record linkage widens substantially. For the youngest group of workers (ages <35), the record linkage rate becomes fixed at approximately 55%. In contrast, among the oldest group of workers (ages 55+), the record linkage rate slowly increases to

approximately return to the rate prior to 2009-2010. Interpretation of these diverging trends in age-specific record linkage will be discussed in the Conclusions section of this report.

Figure 2 presents the frequency of emergency department visits for the treatment of a work-related fracture over the period 2004-2017. Frequencies are reported for emergency department visits that linked to a worker's compensation claim, and those work-related fractures that did not link to a workers' compensation claim. Among emergency department visits that linked to a workers' compensation claim, the trend over time parallels the pattern described in Figure 1: a steep and abrupt decline in the record linkage rate over the 24 month24-month period 2009-2010, followed by a gradual increase. However, the frequency of emergency department visits that did not link to a workers' compensation claim, unexpectedly, does not have the same trend as observed for the linked records. Interpretation of these diverging trends will be discussed in the Conclusion section.

Table 3 reports the frequency of traumatic injuries treated in emergency departments, stratified by an ICD10 classification of the nature of injury. This classification represents an approximate ranking of injury by severity. The classifications with the highest frequency are superficial wounds (16% of all traumatic injuries) and open wounds (27% of all traumatic injuries). Fracture injuries (44% of all traumatic injuries) are further classified to 11 categories describing the anatomic region involved.

Table 3 also stratifies traumatic injuries into three groups. Among the emergency department records that linked to a workers' compensation claim, the table reports the count and percent of traumatic injuries that resulted in a lost-time or a no lost-time compensation claim. The table also reports the frequency of emergency department visits that did not link to a workers' compensation claim. There are three important observations contained in Table 3. The first observation is that the linkage of emergency department records to workers' compensation claims provides information on nature of injury (and injury event) that is not currently coded and classified on WSIB no lost-time claims. For example, approximately 50% of no lost-time claims are associated with superficial or open wound injuries, compared to approximately 28% of lost-time claims. The second observation is to note that among traumatic injuries that linked to a workers' compensation claim there are important differences in the percent of injuries that resulted in a lost-time compensation claim.

For example, the proportion of open wound injuries that resulted in a lost-time claim (15%) is much lower than the proportion of knee fractures resulting in a lost-time claim (58%). These differences are consistent with the expected degree of physical impairment between less severe and more severe traumatic injuries. The third observation is that the record linkage rate (ED visit records linked to a workers' compensation claim) does not meaningfully differ across traumatic injury groups. For example, the proportion of superficial injuries that linked to a workers' compensation claim (66.1%) is similar to the proportion of fractures of the knee that linked to a workers' compensation claim (70.2%). This finding contradicts an expectation of the project team that more serious injury, for example traumatic injury resulting in fracture, would be more likely to link to a workers' compensation claim. Interpretations for this unexpected finding will be discussed in the Conclusions section.

Table 4 reports the frequency of traumatic injuries treated in emergency departments, stratified by an ICD10 classification of the event responsible for the injury. The classifications with the highest frequency are contact with inanimate mechanical force (51% of all traumatic injuries) falls (17% of all traumatic injuries) and overexertion (15% of all traumatic injuries). The patterns observed in Table 4 are generally similar to those seen in Table 3.

Table 1: Record linkage outcome, by geography, sex and age, 2004-2017

	Linked ED episodes		Unlinked ED episodes		Row % linked/all
Total, ED visits (unique CIHIID)	1,222,496		678,805		0.64
Total, ED episodes *	1,075,695		605,183		0.64
Total, unique claimants or patients	789,491		531,478		0.60
ED episode is a unit of analysis					
Geographic Region					
K Postal Code prefix (N, column%, row%)	176,476	0.164	96,940	0.160	0.65
L Postal Code prefix (N, column%, row %)	355,412	0.330	193,612	0.320	0.65
M Postal Code prefix (N, column%, row %)	103,772	0.096	74,474	0.120	0.58
N Postal Code prefix (N, column%, row%)	310,462	0.289	153,930	0.260	0.67
P Postal Code prefix (N, column%, row%)	120,958	0.112	73,162	0.120	0.62
Other PC prefix (N, column%, row%)	8,615	0.008	13,065	0.020	0.40
Male					
Total, episodes for males	763,793		430,515		
<25 (N, column%, row%)	147,847	0.194	96,173	0.223	0.61
25-34 (N, column%, row%)	191,499	0.251	119,883	0.278	0.61
35-44 (N, column%, row%)	179,045	0.234	96,479	0.224	0.65
45-54 (N, column%, row%)	162,654	0.213	79,928	0.186	0.67
55+ (N, column%, row%)	82,748	0.108	38,052	0.088	0.69
Female					
Total, episodes for females	311,902		174,668		
<25 (N, column%, row%)	53,105	0.170	39,170	0.224	0.58
25-34 (N, column%, row%)	64,714	0.207	41,221	0.236	0.61
35-44 (N, column%, row%)	72,284	0.232	37,535	0.215	0.66
45-54 (N, column%, row%)	80,119	0.257	38,401	0.220	0.68
55+ (N, column%, row%)	41,680	0.134	18,341	0.105	0.69
ED visit is a unit of analysis					
Main diagnosis (ICD-10)					
Prefix S or T	947,141	0.775	479,951	0.707	0.66
Prefix not S or T	275,355	0.225	198,854	0.293	0.58

Table 2: Record linkage outcome, by year, 2004-2017

Year	WSIB Claims	ED Records	ED Records linked to WSIB Claims	Percent ED records linked to WSIB claims	WSIB Claims linked to ED Episodes	Percent WSIB Claims linked to ED records
2004	342,311	161,837	109,007	0.67	96,357	0.28
2005	344,799	166,109	112,459	0.68	99,372	0.29
2006	328,226	155,031	104,880	0.68	92,384	0.28
2007	321,676	149,024	102,179	0.69	89,869	0.28
2008	301,421	141,118	97,187	0.69	85,390	0.28
2009	240,759	115,705	73,887	0.64	64,683	0.27
2010	230,647	121,239	72,142	0.60	62,781	0.27
2011	228,079	124,516	73,523	0.59	64,152	0.28
2012	227,422	126,272	75,933	0.60	66,526	0.29
2013	228,534	128,886	78,342	0.61	68,636	0.30
2014	230,109	128,668	79,758	0.62	70,160	0.30
2015	227,255	127,876	79,723	0.62	70,407	0.31
2016	234,342	129,195	81,503	0.63	72,399	0.31
2017	237,066	131,765	82,432	0.63	72,754	0.31
Total	**3,722,646**	**1,907,241**	**1,222,955**		**1,075,870**	

Figure 1: Percent of linked records, by age and year, 2004 to 2017

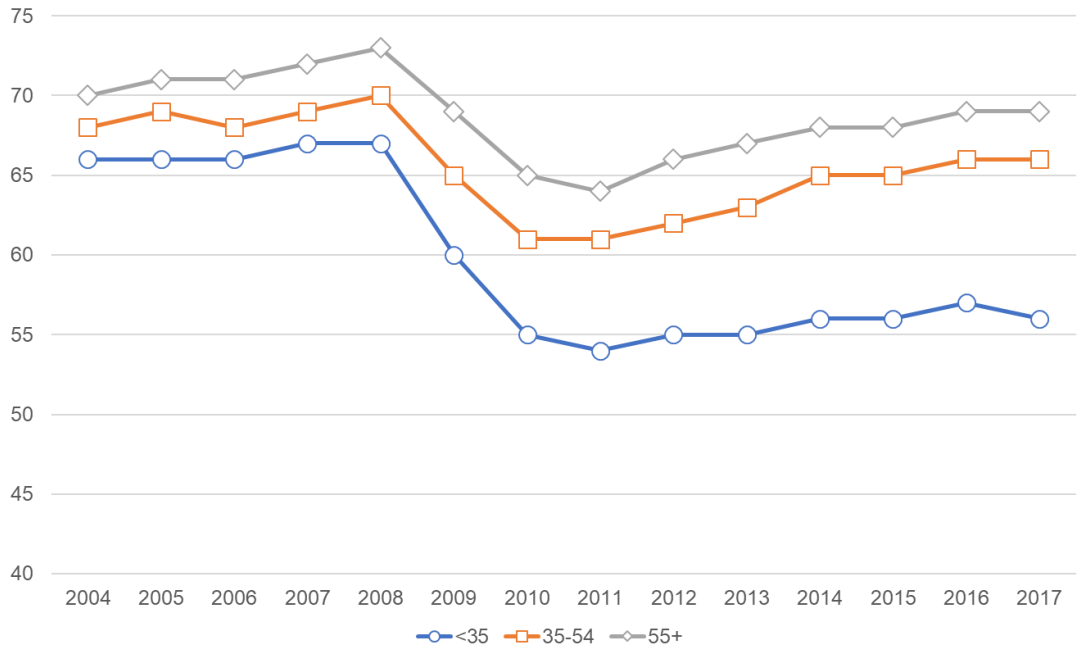

Figure 2: Frequency of work-related fracture injury, ED visits, by year and linkage status, 2004 to 2017

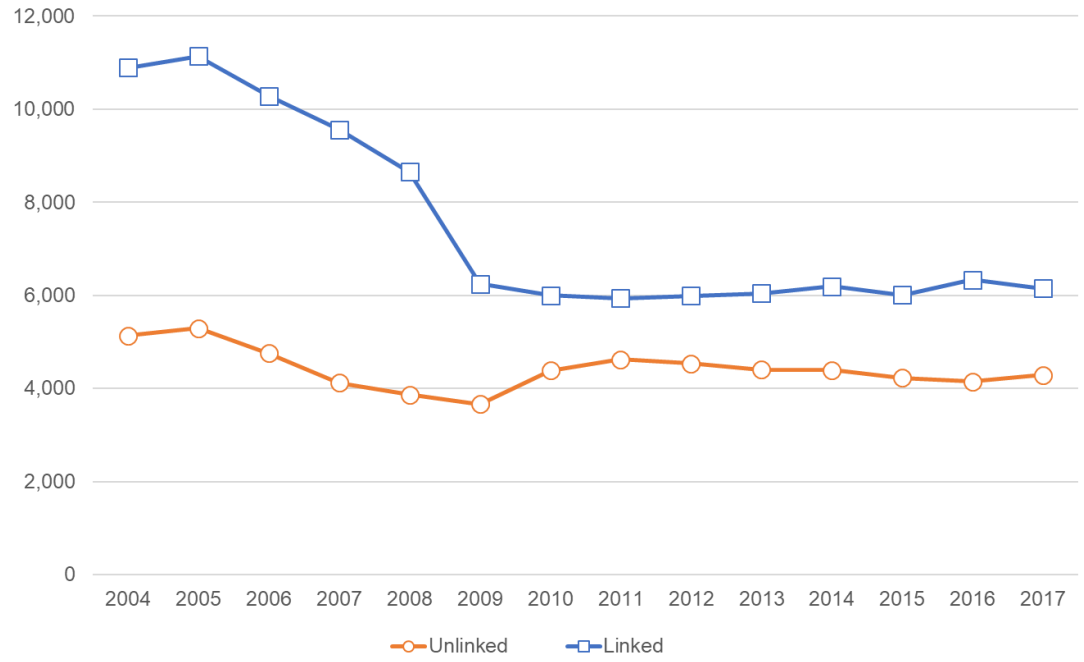

Table 3: Distribution of linked records, by claim status (lost-time vs no lost-time) and nature of injury (ICD10), for ED visits classified as injury ('S' or 'T')

Rows ordered from highest to lowest frequency, lost-time claims, 2004-2017

	Lost-time		No lost-time		Total Linked	Unlinked	L / U+L
	N	Row %	N	Row %	N		
Linked ED visits (unique CIHID)	403,422	0.33	819,291	0.67	1,222,713		
Total S and T, Linked (visit is a unit of analysis)	293,716		653,418		947,134	482,853	66.2
01_Superficial	44,400	0.29	108,584	0.71	152,984	78,393	66.1
02_Open wound	38,611	0.15	219,144	0.85	257,755	140,801	64.7
03_Fracture wrist	33,382	0.34	65,383	0.66	98,765	44,862	68.8
03_Fracture foot	27,347	0.46	31,817	0.54	59,164	28,210	67.7
03_Fracture knee	26,838	0.58	19,359	0.42	46,197	19,638	70.2
03_Fracture abdomen	25,494	0.50	25,656	0.50	51,150	23,291	68.7
03_Fracture head	23,944	0.36	41,824	0.64	65,768	36,230	64.5
03_Fracture shoulder	18,637	0.44	23,614	0.56	42,251	18,592	69.4
03_Fracture elbow	11,270	0.53	10,008	0.47	21,278	8,583	71.3
04_Burns	9,192	0.29	22,977	0.71	32,169	17,241	65.1
03_Fracture thorax	6,864	0.44	8,848	0.56	15,712	7,559	67.5
03_Fracture neck	6,688	0.47	7,408	0.53	14,096	6,758	67.6
04_Unspecified region	6,436	0.38	10,458	0.62	16,894	8,685	66.0
04_Foreign body	4,916	0.11	38,051	0.89	42,967	27,536	60.9
03_Fracture hip	3,057	0.56	2,378	0.44	5,435	2,407	69.3
04_Unspecified cause	2,911	0.30	6,846	0.70	9,757	7,086	57.9
04_Toxic	1,981	0.18	8,987	0.82	10,968	5,110	68.2
03_Fracture multiple	1,553	0.50	1,530	0.50	3,083	1,419	68.5
04_Frostbite	121	0.39	189	0.61	310	184	62.8
04_Poisoning	74	0.17	357	0.83	431	268	61.7

Table 4: Distribution of linked records, by claim status (lost-time vs no lost-time) and injury event (ICD10), for ED visits classified as injury ('S' or 'T')

Rows ordered from highest to lowest frequency, lost-time claims, 2004-2017

	Lost-time N	Row %	No lost-time N	Row %	Total row N	Column%	Unlinked	L / U+L
Linked ED visits (unique CIHID)	403,422		819,291		1,222,713		678,348	64.3
Total S and T, Linked (visit is a unit of analysis)	293,716		653,418		947,134		479,790	66.4
Contact with inanimate mechanical force	103,285	0.21	380,528	0.79	483,813	0.51	254,162	65.6
Falls	76,772	0.49	81,288	0.51	158,060	0.17	70,685	69.1
Overexertion	58,078	0.41	82,526	0.59	140,604	0.15	62,833	69.1
Other exposures	17,599	0.34	34,636	0.66	52,235	0.06	29,695	63.8
Transport accident	12,530	0.51	12,124	0.49	24,654	0.03	12,001	67.3
Contact with animate mechanical force	5,199	0.30	12,253	0.70	17,452	0.02	11,456	60.4
Assault	4,327	0.38	6,995	0.62	11,322	0.01	6,467	63.6
Contact with heat, hot substances	3,559	0.28	9,077	0.72	12,636	0.01	6,554	65.8
Accidental poisoning	3,530	0.20	14,130	0.80	17,660	0.02	8,604	67.2
Exposure to smoke, fire	3,215	0.31	7,195	0.69	10,410	0.01	5,826	64.1
Complications of medical care	1,454	0.49	1,484	0.51	2,938	0.00	3,347	46.7
Electricity, radiation, extreme temperature	1,262	0.21	4,697	0.79	5,959	0.01	3,148	65.4
Event of undetermined intent	469	0.20	1,936	0.80	2,405	0.00	1,288	65.1
Exposure to forces of nature	330	0.27	875	0.73	1,205	0.00	656	64.8
Contact with venomous animals, plants	323	0.15	1,826	0.85	2,149	0.00	1,179	64.6
Legal interventions	284	0.39	435	0.61	719	0.00	310	69.9
Sequelae	92	0.50	91	0.50	183	0.00	149	55.1
Intentional self-harm	19	0.40	28	0.60	47	0.00	72	39.5
Threats to breathing	18	0.30	42	0.70	60	0.00	32	65.2
Drowning/Submersion	6	0.40	9	0.60	15	0.00	17	46.9

Discussion

There are gaps in our capacity to monitor the effectiveness of worker health protection in Ontario. Regulatory authorities in Ontario place a primary reliance on workers' compensation claims as a source of information on temporal, sectoral and regional patterns in work-related injury and illness. However, there are concerns about the reliance on workers' compensation claims as the sole source of surveillance of the health of the Ontario workforce. For example, approximately 2M workers (30% of labour force) in Ontario are not in employment relationships that provide insured coverage by the WSIB. Concerns about the integrity of workplace reporting of work-related injury also impair confidence in the use of workers' compensation administrative records as a reliable source of surveillance information on the incidence of work-related injury and illness.

The December 2010 report of the Expert Advisory Panel on Occupational Health and Safety commissioned by the Ontario Minister of Labour made a number of recommendations to improve the reliability and validity of data on the health of Ontario workers, both to improve the recognition of hazards in contemporary workplaces and to strengthen the measurement of the performance of the Ontario

prevention system. This project had the purpose of responding to these recommendations, by making use of population-based records of emergency department visits in the surveillance of work-related injury and illness in the province of Ontario.

This project has addressed a gap in occupational health surveillance capacity by developing methods to accurately estimate under-reporting of work-related injury and illness for labour force participants in Ontario for the period 2004-2014. Work-related injury and illness that is not reported to the provincial workers' compensation authority is an indicator of occupational health and safety vulnerability. These estimates of under-reporting can inform policy and program development within the Ontario Workplace Safety & Insurance Board, may be valuable in the targeting of labour inspection activity and may be useful in the design and delivery of worker awareness and training services.

As outlined in the proposal, emergency department records are population-based and have high coverage of the Ontario labour force. The determination of work-related conditions in emergency department treatment settings is independent of the acceptance of compensation claims in the provincial workers' compensation system. Emergency department records are available continuously from 2000 and are a cost-efficient option relative to available alternatives such as cross-sectional or longitudinal surveys. This study was designed to provide crucial information on gaps in the integrity of information in Ontario on the incidence of work-related injury and illness and we expect this information will be influential in identifying opportunities to address these gaps.

We expect that the Ontario Ministry of Labour and the Ontario Workplace Safety & Insurance Board will be primary users of the knowledge arising from this project. Additional stakeholders who may be interested in the results of this proposed research include policy-makers in provincial workers' compensation authorities, representatives of organized labour, and representatives of employer organizations in Ontario.

Conclusions

The record linkage phase of this project found that approximately 50,000 annual emergency department visits associated with the treatment of work-related injury or illness do not match to a parallel record in the provincial workers' compensation system. It is a regulatory requirement of the provincial workers' compensation system that among insured workers, incidents of work-related injury or illness receiving medical attention are to be reported to the WSIB.

The project team assumes that a Health Professional's Report (Form 8) has been submitted for a large majority of the 50,000 annual emergency department visits that did not match to a worker's compensation record. However, as we note in the Background section of this report, the registration of a workers' compensation claim requires the submission of a Form 6 (Worker's Report of Injury/Disease) by the worker. In the event a worker does not submit a Form 6, and the health-care provider submits a Form 8, the WSIB classifies the episode as 'partially registered'. The annual count of 'partially registered' claims is not publicly reported by the WSIB and are not included in the reported count of 'abandoned claims'.

There are four factors that may account for a portion of emergency records that do not have a parallel record in the provincial workers' compensation administrative data. First, approximately 25% of workers in Ontario are in employment arrangements that either exclude or do not mandate workers' compensation coverage. The risk of work-related injury and illness among workers in employment arrangements with excluded or non-mandated coverage is not known in Ontario, but may be assumed to be lower than risks experienced by insured workers. A Worker's Report of Injury/Disease (Form 6) that cannot be matched to an insured employer account will be classified as 'not allowed' on adjudication by the WSIB

A second factor arises in the registration of workers' compensation claims. Approximately 15% of claim registrations are determined to have been abandoned by the WSIB. As documented in the PRISM study of workplace injury claim suppression in Ontario, the most common administrative reason for determination of an abandoned claim is the absence of a Worker's Report of Injury/Disease (Form 6), responsible for approximately 45% of the administrative decisions concerning abandonment (12).

A third explanation that may account for an emergency department visit that does not link to an accepted workers' compensation claim would arise from errors in the recording of clinical history in emergency departments. In this case, emergency department clinical staff are erring in the attribution of a traumatic injury or acute episode to workplace exposure. Attribution errors would be expected in active emergency departments, both 'false positive' attributions (attributing a traumatic injury to a workplace exposure when the exposure arose in a non-work context) and 'false negative' attributions (attributing a traumatic injury to a non-work exposure when a workplace causation was the true exposure).

A fourth potential explanation may be attributed to errors in the methods used by the study to link emergency department records to workers' compensation claims. The most plausible source of significant record linkage error rests with the requirement that information on residential postal code must agree completely (all six characters) between the emergency department record and the workers' compensation record to determine a record match. Among workers who experience residential mobility (who change residences frequently), there is an increased probability that residential postal code information is not in agreement between the two administrative data sources. Approximately 10% of households in Ontario will change residences in a 12-month period, and residential mobility is more common among households of younger adults.

The abrupt decline in record linkage occurring during the 2009-2010 period would not plausibly be explained by errors of attribution to work exposures by emergency department clinical staff or explained by errors in the record linkage method arising from worker residential mobility. Both of these factors would be expected to have a similar influence over time. The abrupt decline in record linkage during the 2009-2010 period is most plausibly due to changes in decisions by workers regarding the reporting of work-related injury and illness to the Ontario WSIB.

This study has applied a novel method to assess the frequency of non-reporting of work-related injury and illness in the Canadian province of Ontario. The proportion of work-related injury and illness presenting for treatment in emergency department settings that appear not to have been documented in a worker's compensation claim is substantial. The finding in this study that approximately 35-40% of emergency department visits may not be reported to the provincial workers' compensation

authority is generally consistent with evidence reported in many jurisdictions in North America (22-25).

This study has demonstrated the feasibility of record linkage between two population-based administrative data sources to monitor the incidence of work-related injury and illness. We identify four additional strengths of this study. The first strength is reliance upon two independent sources of information that can be used to estimate the frequency of work-related injury. Second, both sources of administrative data applied in this study are population-based, each providing high coverage of the Ontario labour force. The third strength is the fourteen 14-year period of observation, during a period of when the Ontario labour market experienced a sharp recession. We note a fourth strength. Relying on administrative data sources, this study is a cost-efficient research method relative to available alternatives such as cross-sectional or longitudinal surveys.

Following on the primary findings of this study, we recommend the importance of additional research to understand more completely the factors primarily responsible for the unreported incidents of work-related injury and illness presenting for treatment in Ontario emergency departments. One study design to be considered would involve conducting a follow-up interview with workers identified in a Health Professional's Report (Form 8) where a worker's compensation claim was not registered and accepted by the WSIB. Information collected through worker interview would identify the primary factors responsible for the incomplete registration of workers' compensation claims.

References

1. Ten Great Public Health Achievements -- United States, 1900-1999. MMWR Weekly, Centers for Disease Control, April 02, 1999 / 48(12);241-243.
2. Smith GS, Wellman HM, Sorock GS, Warner M, Courtney TK, Pransky GS, Fingerhut LA. Injuries at Work in the US adult population: Contributions to the total injury burden. Am J Public Health. 2005;95:1213–1219.
3. Chambers A, Ibrahim S, Etches J, Mustard CA. Diverging trends in the incidence of occupational and non-occupational injury in Ontario 2004-2011. American Journal of Public Health 2015 Feb; 105(2):338-343.
4. Boden LI, Ozonoff AL. Capture-recapture estimates of nonfatal workplace injuries and illnesses. Ann Epidemiol 2008;18:500-506.
5. Shannon HS, Lowe GS. How many injured workers do not file claims for workers' compensation benefits. Am J Ind Med. 2002;42(6):467-73
6. Mustard C, Cole D, Shannon H, Pole J, Sullivan T, Allingham R. Declining trends in work-related morbidity and disability, 1993-1998: a comparison of survey estimates and compensation insurance claims. AJPH. 2003;93(8):1283-6
7. Rosenman KD, Kalush A, Reilly MJ, Gardiner JC, Reeves M, Luo Z. How much work-related injury and illness is missed by the current national injury surveillance system. J Occup Environ Med 2006;48:357-365.
8. McCurdy SA, Schenker MB, Samuels SJ. Reporting of occupational injury and illness in the semiconductor manufacturing industry. Am J Public Health. 1991;81:85–89.
9. Biddle J, Roberts K. Evidence on the level and determinants of workers’ compensation take-up rates. Working paper. 2001.
10. Morse T, Dillon C, Warren N, Levenstein C, Warren A. The economic and social consequences of work-related musculoskeletal disorders: The Connecticut upper-extremity surveillance project (CUSP). Int J Occup Environ Health. 1998;4:209–216.
11. Lakdawalla D, Reville RT, Seabury SA. How Does Health Insurance Affect Workers’ Compensation Filing? Econ Inquiry. 2007;45:286–303.
12. O’Grady J. Workplace injury claim suppression: Final report. Prism Economics and Analysis. 2013. Toronto.

http://www.wsib.on.ca/files/Content/FundingReviewClaimSuppressionStudy/WSIBClaimSuppression-FinalReport.pdf

13. Arthurs H. Funding Fairness. A report on Ontario's workplace safety and insurance system. 2012.
14. Teutsch SM, Churchill RE (eds), Principles and Practice of Public Health Surveillance. Second Edition. Oxford University Press, 2000, ISBN10: 0195138279.
15. Smith PM, Mustard CA, Payne JI. Methods for estimating the labour force insured by the Ontario Workplace Safety and Insurance Board: 1990-2000. Chronic Diseases in Canada. 2004;25(3-4):127-37
16. Mustard CA, Chambers A, McLeod C, Bielecky A, Smith P. Work injury risk by time of day in two population-based data sources. Occupational and Environmental Medicine 2013;70:49-56. doi: 10.1136/oemed-2012-100920.
17. Mustard CA, Chambers A, McLeod C, Bielecky A, Smith PM. Comparison of data sources for the surveillance of work injury. Occupational and Environmental Medicine 2012;69(5):317-24. doi: 10.1136/oemed-2011-100222.
18. Smith P, Chen C, Hogg-Johnson S, Mustard CA, Tompa E. Trends in the health care use and expenditures associated with no-lost-time claims in Ontario: 1991 to 2006. Journal of Occupational and Environmental Medicine 2010;53:211-217. doi: 10.1097/JOM.0b013e31820a416f .
19. Smith P, Chen C, Mustard C, Hogg-Johnson S, Tompa E. The relationship between worker, occupational and workplace characteristics and whether an injury requires time off work: a matched case-control analysis. American Journal of Industrial Medicine. 2015 Apr;58(4):402-10. doi: 10.1002/ajim.22420.
20. Mustard CA, Chambers A, Ibrahim S, Etches J, Smith P. Time trends in musculoskeletal disorders attributed to work exposures in Ontario using three independent data sources, 2004-2011. Occupational and Environmental Medicine 2015 Apr;72(4):252-7. doi: 10.1136/oemed-2014-102442.
21. Mustard CA, Petch J. The Canadian recession and the compensation of work-related injury and illness. Issue Briefing. Institute for Work & Health. February 2012. http://www.iwh.on.ca/briefings/workers-compensation-claims-and-the-recession

22. Groenewold MR, Baron SL. The proportion of work-related emergency department visits not expected to be paid by workers' compensation: implications for occupational health surveillance, research, policy, and health equity. Health Serv Res. 2013 Dec;48(6 Pt 1):1939-59. doi: 10.1111/1475-6773.
23. Wuellner SE, Adams DA, Bonauto DK. Unreported workers' compensation claims to the BLS Survey of Occupational Injuries and Illnesses: Establishment factors. Am J Ind Med. 2016 Apr;59(4):274-89. doi: 10.1002/ajim.22563.
24. Stock S, Nicolakakis N, Raïq H, Messing K, Lippel K, Turcot A. Underreporting work absences for nontraumatic work-related musculoskeletal disorders to workers' compensation: results of a 2007-2008 survey of the Québec working population. Am J Public Health. 2014 Mar;104(3):e94-e101. doi: 10.2105/AJPH.2013.301562.
25. Nadalin V, Smith PM. Examining the impact of occupational health and safety vulnerability on injury claim reporting in three Canadian provinces. Am J Ind Med. 2020 Feb 3. doi: 10.1002/ajim.23094. [Epub ahead of print] PubMed PMID:32011746.