Original research

Unionisation and injury risk in construction: a replication study

Lynda S Robson ●, Victoria Landsman ●, Desiree Latour-Villamil, Hyunmi Lee, Cameron Mustard ●

ABSTRACT

Objective To replicate, in a more recent time period, a previous cross-sectional study to estimate the association between unionisation and the risk of workers’ compensation injury claims.

Methods The sampling frame was workers’ compensation company account records in the industrial, commercial and institutional construction sector in the province of Ontario, Canada, 2012–2018. Company unionisation status was determined through linkage with records of unionised contractors. Outcomes were cumulative counts of workers’ compensation injury claims, aggregated to company business. Risk ratios were estimated with multivariable negative binomial regression models. Models were also fit separately to lost-time claims stratified by company size.

Results Business unionisation was associated with a lower lost-time claim incidence (crude risk ratio, CRR=0.69, 95% CI 0.65 to 0.74); adjusted risk ratio, ARR=0.75, 95% CI 0.71 to 0.80). In subgroup analyses, the magnitude of the ARR declined as company size decreased and was not statistically significant for the smallest-sized companies of ≤4 full-time equivalent employees. Unionisation was associated (positively) with the incidence of no-lost-time claims in a crude model, but not in an adjusted model (CRR=1.80, 95% CI 1.71 to 1.89; ARR=1.04, 95% CI 0.98 to 1.09).

Conclusions Company unionisation was associated with a lower risk of lost-time workers’ compensation injury claims, corroborating a similar study from an earlier time period. The protective effect of unionisation declined as company size decreased. In contrast to the previous study, a positive relationship between company unionisation and no-lost-time claim incidence was not found, due in part to a methodological refinement.

INTRODUCTION

Unions have played an important role in developing occupational health and safety (OHS) protections. Unions have advocated for legislative advances1 2 and for OHS provisions within collective agreements.3 4 Unionisation has been associated with more stringent enforcement by authorities,5 6 more effective joint-health-and-safety committees,7 the presence of an OHS management system8 and dissemination of OHS information;9 and are known to conduct OHS research, provide OHS training and develop OHS interventions.10 A clear understanding of the influences of unionisation on worker health and safety, especially in the context of declining unionisation in many jurisdictions, is important.

Research investigating the relationship between unionisation and workplace injuries dates back decades, but findings have not been consistent with those anticipated from the above. Donado11 reviewed 25 studies published up until 2009. They were based in the USA primarily; conducted in mining, manufacturing or across all sectors; and analysed at the level of individual, workplace or state. These studies typically found the expected...
workplace protective relationship of unionisation with fatal injuries, whereas with non-fatal injuries, the relationship was usually found to be unfavourable. Reduced fatalities have continued to be favourably associated with unionisation in the studies published since the Donado review. Findings based on non-fatal injuries have been inconsistent, with some showing a favourable relationship, and others an unfavourable one.

To explain an unfavourable association between unionisation and non-fatal injuries, most studies in the Donado review suggested differential reporting between unionised and non-unionised workplaces. The premise is a unionised setting, relative to one non-unionised, encourages more worker reporting of injuries because fear of employer reprisal is less. The presence of a union may also help ensure enterprises are reporting injuries to authorities. While Donado’s own analysis, based on self-reported work-related injury/illness provides evidence to the contrary, the work of Morantz is consistent with the hypothesis. Her study found fatal injuries and severe traumatic injuries in US coal mines had a favourable relationship with unionisation, while two other types of injury outcomes—all other injuries and total non-fatal injuries—showed an unfavourable one. Her study illustrates the value of measuring injury outcomes of varying levels of severity, since more serious injuries should be less subject to differential reporting between unionised and non-unionised workplaces.

The cross-sectional analysis of Amick et al. examining industrial, commercial and institutional (ICI) construction over 2006–2012 in Ontario, Canada, had similar findings to that of Morantz: a favourable relationship between unionisation and workers’ compensation injury claims requiring time away from work and an unfavourable one between unionisation and workers’ compensation injury claims requiring time away from work and an unfavourable one.14 Based on self-reported work-related injury/illness数据, evidence to the contrary, the work of Morantz is consistent with the hypothesis. Her study found fatal injuries and severe traumatic injuries in US coal mines had a favourable relationship with unionisation, while two other types of injury outcomes—all other injuries and total non-fatal injuries—showed an unfavourable one. Her study illustrates the value of measuring injury outcomes of varying levels of severity, since more serious injuries should be less subject to differential reporting between unionised and non-unionised workplaces.

METHODS

More detail about the methods can be found in a recent grey literature report.

Data sources

Workers’ compensation records

Deidentified worker injury/illness claim records and company account records from 2012 to 2018 were obtained from Ontario’s Workplace Safety and Insurance Board (WSIB). The WSIB is a provincial agency administering a single-payer no-fault workers’ compensation scheme, under which all workers in the construction sector are covered, including, since 2013, those self-employed. Workers are insured for work-related physical injuries, illnesses and diseases. Occupational disease claims were excluded from this study.

Worker injury/illness claim record information included the incident date, the company account number and the classification unit to which the worker belonged. Classification unit was WSIB terminology corresponding to industrial sub-sector. Claims were of two types: allowed LT claims, for which time was lost from work, and allowed no-LT (NLT) claims for which there was medical aid only. Rejected and abandoned claims were not included. LT claims (only) were coded for nature of injury, part of body and nature of event. Since 95% of these claims were assigned a ‘nature of injury’ code corresponding to traumatic injury (as opposed to illness), this paper will refer to them as injury claims.

Company account information included annual information on legal company name, trade name (optional), address, postal code, phone number, classification unit type and the number of full-time equivalent employees (FTEs), which was computed from payroll dollars. Some companies had more than one line of business, each classified into a different classification unit; for these, business-level FTE information was obtained too.

Unionsed contractor records

Twenty-four lists of companies holding a collective agreement with a building trade union and working in ICI construction (‘unionised contractors’) were obtained from 11 unions and 13 employer associations, representing all types of ICI building trades. Under a collective agreement, a company must hire unionised workers if working under the trade covered by the agreement. Labour relations in the Ontario ICI sector are regulated, with collective bargaining occurring simultaneously every 3 years. Access to these lists was facilitated by the Ontario Construction Secretariat, a joint management-labour non-profit organisation representing the interests of unions and unionised contractors in the ICI sector. Across all lists, there were 25,772 records.

Study sample

An initial sample of WSIB company account records included all companies whose largest line of business (based on payroll), for at least one of the years between 2012 and 2018, was classified into one of 39 classification units involving ICI construction trades (eg, Electrical Work), thereby aligning with the sector coverage of the 24 lists of unionised contractors. These 107,939 companies were composed of 123,224 lines of business (referred to as ‘businesses’ henceforth) and 515,205 business-years between 2012–2018. Exclusion criteria were then applied: (1) business-year if associated classification unit was not one of the 39 ICI classification units; (2) business-year if annual FTE information was missing and (3) business if cumulative annual FTEs for 2012–2018 was ≤1. The final sample used in analysis consisted of 60,425 businesses nested in 58,837 companies.

Record linkage to identify unionised companies

Using five sequential steps, WSIB company account records were linked (matched) to unionised contractor records at the company level using company name, postal code and phone number. The steps used a combination of deterministic and probabilistic methods, including SAS functions SPEDIS and COMPGED, which compare text strings, the R software package text2vec, which enabled text mining, and manual review.

If a WSIB company record was matched, it was classified as unionised. Matches were considered strong and included in the main analysis if at least two of three variables were matched. Matches were considered weak and included only in a sensitivity
Classification unit category (39 levels) was included to control for the different risks associated with different types of work.

Company complexity was a five-level categorical variable (1, 2, 3, 4 and 5+) corresponding to the number of businesses in the companies, since more complex organisations may have better resources for managing OHS.

Geographical region was a six-level variable created from the first letter of the postal code (K, L, M, N, P, ‘other province or country’) to control for regional variation in OHS culture, knowledge and regulatory enforcement.

Negative binomial regression models
To estimate the association between claim counts and unionisation, negative binomial (NB) regression models were fit to each of the four outcomes with log (FTE) as the offset (FTE in the offset were cumulative FTE at the business level). Crude models included unionisation as the only predictor. Adjusted models also included company size, classification unit, company complexity and geographical region variables. All crude and adjusted models with the full sample showed a dispersion coefficient consistent with an NB model. Model fit was considered satisfactory following visual inspection of rootograms. Alternative approaches to modelling were explored, including using zero-inflated NB and zero-inflated Poisson models; using company size as continuous rather than categorical; and accounting for the nesting of businesses in companies. All had little impact on the unionisation effect estimate. Three sensitivity analyses were conducted to explore potential sources of bias associated with the matching processes or misalignment of the WSIB and unionised contractor sector coverage.

NB models were also fit separately to LT claims stratified by company size: ≤4, 5–19, 20–49 and 50+ FTEs. To allow model convergence in all subgroups, observations belonging to three smaller classification unit categories were first removed from all subgroups, reducing the total sample size to 60337.

RESULTS

Description of the sample
Characteristics of the 60 425 businesses included in the analysis are summarised in table 1 and online supplemental appendix A. Comparing unionised and non-unionised businesses, large differences are seen in company size and complexity. More modest differences are seen with regard to industrial sector (online supplemental appendix A), though non-unionised firms had greater representation in painting and decorating, carpeting and flooring, terrazzo and tile work and roof shingling. Geographical distributions of the two groups were similar.

Table 2 examines the distribution of FTEs and claims by unionisation status. Although 8.7% of businesses were classified as unionised, 45% of FTEs were employed by them; and 31% of LT claims and 52% of NLT claims were attributed to them. The ratio of NLT claims to LT claims was 5.9 for unionised businesses and 2.5 for non-unionised.

Association of unionisation and injury claim incidence
Table 3 presents the main findings from a series of regression analyses. Substantial differences are seen between crude and adjusted risk ratio (ARR) estimates in the outcomes involving NLT claims. Unionisation was associated with a 25% lower risk of LT claims after adjustment. In contrast, for NLT claims, unionisation was associated with a statistically non-significant 4% elevation in risk.

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The severe injury category of LT claims, with an ARR of 0.84 (95% CI 0.73 to 0.96), was found to have similar results to the category of all LT injury claims.

Association of unionisation of LT injury claim incidence by company size

The association between unionisation and LT injury claim incidence by company size was of interest because of the well-recognised differences in OHS capacity between large and small/medium-sized companies. As well, size was the most influential covariate in the regression analyses. After dividing the study sample of businesses into four groups, according to company size, analyses were carried out separately for each.

<table>
<thead>
<tr>
<th>Complexity (no of businesses in company)</th>
<th>Unionised (n=5267)</th>
<th>Non-unionised (n 55 158)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1</td>
<td>894 (17.0)</td>
<td>32 646 (59.2)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>2–4</td>
<td>1034 (19.6)</td>
<td>13 636 (24.7)</td>
<td></td>
</tr>
<tr>
<td>5–19</td>
<td>1640 (31.1)</td>
<td>7 134 (12.9)</td>
<td></td>
</tr>
<tr>
<td>20–49</td>
<td>823 (15.6)</td>
<td>1 283 (2.3)</td>
<td></td>
</tr>
<tr>
<td>50+</td>
<td>876 (16.6)</td>
<td>459 (0.8)</td>
<td></td>
</tr>
</tbody>
</table>

P values based on Pearson’s χ² test for differences. The distribution of industrial subsector (classification unit) for unionised and non-unionised businesses is presented in online supplemental appendix A. ICI, industrial, commercial and institutional.

<table>
<thead>
<tr>
<th>Geographical region (first letter of postal code)</th>
<th>Unionised (n=5267)</th>
<th>Non-unionised (n 55 158)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>710 (13.5)</td>
<td>8059 (14.6)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>L</td>
<td>2197 (41.7)</td>
<td>23 282 (42.2)</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>673 (12.8)</td>
<td>7 690 (13.9)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>862 (16.4)</td>
<td>11 333 (20.6)</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>485 (9.2)</td>
<td>3 173 (5.8)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>340 (6.5)</td>
<td>1 621 (2.9)</td>
<td></td>
</tr>
</tbody>
</table>

Results in table 4 show that the ARRs differed markedly. While the two intermediate-sized categories showed results very similar to the overall findings, those for companies with 50+ FTEs showed unionisation was associated with a 44% lower adjusted risk of a LT claim. At the other extreme were companies with ≤4 FTEs, which showed no difference in risk.

Results of sensitivity analyses

To test the robustness of the union effect, several sensitivity analyses were conducted. The first involved an expansion of the group of WSIB companies classified as unionised to include both strong and weak matches. The effect on estimates were slight: the ARR for LT injury claims increased to 0.77 (95% CI 0.72 to 0.81) and the one for NLT injury claims increased to 1.05 (95% CI 1.00 to 1.10). A second analysis, restricting the sample to companies with only one business, resulted in a modest increase in the ARR for LT claims to 0.82 (95% CI 0.75 to 0.89). A third analysis, restricting the sample to seven classification units exclusively active in the ICI sector, resulted in a modest decrease in the ARR for LT claims to 0.71 (95% CI 0.60 to 0.84).

DISCUSSION

Principal findings and comparison with earlier study

This study replicates the finding of Amick et al\textsuperscript{20} that company unionisation is associated with a lower risk of LT injury claims in the Ontario ICI construction sector. In this study, company unionisation was associated with a 25% lower incidence of LT injury claims. Applied to table 1, this suggests unionisation may have prevented 2000 LT injuries over 2012–2018. Also repeated from before was the finding that unionisation was associated with a lower risk of LT claims related to injuries of a severe nature—this time with greater confidence because it was based on a fully adjusted regression model rather than a partially adjusted one.

This study did not repeat the earlier finding that unionisation was associated with a higher incidence of NLT claims. This between-study difference is partly related to improved control of confounding by company size. If the three company size categories from the earlier study would have been applied to the 2012–2018 data, a positive relationship would again have been found (ARR=1.16, 95% CI 1.10 to 1.22).

The magnitude of union effect on LT claim incidence in this study 0.75 (95% CI 0.71 to 0.80) is greater than the one reported in Amick et al\textsuperscript{20} (ARR=0.86, 95% CI 0.82 to 0.98).

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Table 1  Characteristics of the sample of Ontario ICI construction businesses by unionisation status

<table>
<thead>
<tr>
<th></th>
<th>Unionised (n=5267)</th>
<th>Non-unionised (n 55 158)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual full-time equivalent employees ≤1</td>
<td>894 (17.0)</td>
<td>32 646 (59.2)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
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P values based on Pearson’s χ² test for differences. The distribution of industrial subsector (classification unit) for unionised and non-unionised businesses is presented in online supplemental appendix A. ICI, industrial, commercial and institutional.

Table 2  Total numbers of businesses, FTEs and claims by unionisation status, 2012–2018

<table>
<thead>
<tr>
<th></th>
<th>Unionised</th>
<th>Non-unionised</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>No of businesses</td>
<td>5267</td>
<td>8.7</td>
</tr>
<tr>
<td>Annual FTEs, cumulative</td>
<td>772 797</td>
<td>44.6</td>
</tr>
<tr>
<td>Lost-time claims</td>
<td>5873</td>
<td>31.0</td>
</tr>
<tr>
<td>Severe lost-time claims</td>
<td>547</td>
<td>34.3</td>
</tr>
<tr>
<td>No-lost-time claims</td>
<td>34 904</td>
<td>51.7</td>
</tr>
<tr>
<td>Total lost-time and no-lost-time claims</td>
<td>40 777</td>
<td>47.2</td>
</tr>
</tbody>
</table>

FTEs, full-time equivalent employees.
and average job tenure is longer when Canadian construction companies do not need to have a supervisor present. As well, projects with less than four workers on site do not fit the OHS regulatory requirements differently from companies that have above-average expertise and their invisibility to authorities. In Ontario, their union effect on LT injury claim incidence was greater among the largest companies (50+ FTEs) compared to average annual FTEs (by dividing reported payroll by the average wage category size variable, yielding an estimate of 0.92 (95% CI 0.87 to 0.97). We are cautious in interpreting this as a true change over time, in part because there was an influx in 2013–2015 of companies newly registered with WSIB, due to changes in the insurer’s coverage requirements.

This analysis extends the Amick et al. study by reporting the union effect found for four company size categories. Results indicate the union effect on LT injury claim incidence was greater among the largest companies (50+ FTEs) compared with companies with 5–19 or 20–49 FTEs. No union effect was observed among the smallest companies (≤4 FTEs). These very small organizations are particularly vulnerable to OHS challenges, because of their lack of OHS and operational expertise and their invisibility to authorities. In Ontario, their OHS regulatory requirements differ markedly from companies in the next largest category, 5–19 FTEs, with the latter needing to post OHS policies and have a health and safety representative. As well, projects with less than four workers on site do not need to have a supervisor present.

### Study strengths and limitations

A strength of this study was the availability of a single source of workers’ compensation administrative data for a jurisdiction, including several variables for control of potential confounders. Covariates included company size, a fine-grained categorisation of industrial sector, an indicator of company complexity and geographical region as covariates. Statistically significant risk ratios are shown in boldface. More detailed results can be found in Appendix G in Robson et al. FTE, full-time equivalent employees.

Regression analyses were conducted separately for each outcome, as described in the Methods section. Risk ratio is the risk of injury claims in unionised businesses divided by the risk in non-unionised. All risk ratios were derived from analyses with unionisation as the main independent variable. Adjusted risk ratios were from analyses including in addition company complexity, type of business activity and geographical region as covariates. Statistically significant risk ratios are shown in boldface. More detailed results can be found in Appendix G in Robson et al.

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to document and explain the union safety effect may benefit from considering this observation when formulating hypotheses and planning studies.

This study illustrates the value in examining injuries of differing severity separately, since the associated union effects differ. This was also found by Morantz,16 who proposed this arises from more minor injuries being more susceptible to a differential reporting bias. Earlier studies analysing all types of non-fatal injuries together, such as most research reviewed by Donado,14 may therefore have been misleading; such estimates are driven by the more frequent minor injuries. The findings of this study were mixed with regard to the differential reporting bias hypothesis: as expected, the relationship between unionisation and LT injuries was more negative than the one with NLT injury claims; contrary to expected, the negative relationship between unionisation and the severe subcategory LT injury claims was not stronger than the one with all LT injury claims. As well, fatal injuries, 103 of which occurred within the sample during the study period, were examined post hoc in a model controlling for company size only. Results showed no difference between union and non-union, though the estimate was less precise than for the other injury outcomes, ARR=0.97 (95% CI 0.56 to 1.67).

CONCLUSIONS

An association was found between company unionisation status and lowered risk of LT workers’ compensation injury claims, corroborating a previous study conducted in the same jurisdiction. The protective effect of unionisation declined as company size decreased. No relationship was found between a company being unionised and the risk of claims involving injuries requiring medical aid only.

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Contributors LSR and CM supervised the project. VL, LSR, DL-V, HL and CM developed the methods for record linkage and statistical analysis. HL extracted study data from WSIB sources. DL-V, VL and LSR carried out the record linkage. HL, DL-V and VL carried out statistical analyses. LSR, CM, VL, HL and DL-V interpreted the results. LSR drafted the article and CM, VL, HL and DL-V provided critical revisions. Katherine Jacobs from the Ontario Construction Secretariat had the concept for the study and facilitated the transfer of lists of unionized contractors from unions and employer associations. Methodological groundwork for this study was laid by colleagues Sheilah Hogg-Johnson and Benjamin Amick III, as well as by DL-V, in an earlier study.

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