Protecting Construction Worker Health and Safety in Ontario, Canada

Identifying a Union Safety Effect

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Objectives: Do Ontario unionized construction firms have lower workers' compensation claims rates compared with nonunion firms? **Methods:** Building trade and construction trade association lists of union contractors were linked to Workplace Safety and Insurance Board claims data for 2006 to 2012. Data were pooled for 2006 to 2012, and negative binomial regressions conducted with adjustment to estimate a union safety effect. **Results:** The sample included 5797 unionized and 38,626 nonunion construction firms. Total claims rates were 13% higher (1.13, 1.09 to 1.18) in unionized firms because of higher allowed no-lost-time claim rates (1.28, 1.23 to 1.34), whereas the lost-time claims rate was 14% lower (0.86, 0.82 to 0.91). **Conclusions:** Unionized construction firms compared with nonunion firms have higher no-lost-time and lower lost-time claims rates. Unionized firms may encourage occupational injury reporting and reduce risks through training and hazard identification and control strategies.

There has been a long-standing debate about the role of unions in protecting worker health and safety.[1,2] The role of unions in occupational health and safety (OHS), often referred to as the union safety effect, remains underspecified. Studies spanning multiple time periods, industries, countries, and methodological designs have found mixed results.[1,2] Canadian, US, and British studies have found beneficial effects (lower injury and illness rates/shorter disability duration) of working in a unionized environment,[3–12] no effect,[1,13–19] mixed effects,[20,21] or a detrimental effect where unionized environments experience more injuries and illnesses or longer durations of disability.[22–27] Four studies within the US construction sector found no union effect,[28] a beneficial effect,[29,30] and mixed effects.[31] There are no Canadian studies on the role of unions in construction work occupational health and safety.

Canadian research on the relationship between unions and occupational health and safety has been conducted in Ontario, Quebec, and British Columbia with a focus on return to work outcomes for injured workers[9,10,12,27] and joint health and safety committee (JHSC) activity.[32,33] Four studies found positive effects[9,12,32,33] and two negative effects.[10,27]

Overall, there is a limited amount of research on the union safety effect in construction and limited research in Canada with mixed results. This research seeks to understand if there is a relationship between the union status of Industrial, Commercial, and Institutional (ICI) construction firms and their occupational health and safety record. The research question is—do unionized ICI construction firms in Ontario, Canada, have lower workers' compensation claim rates compared with nonunion firms?

METHODS

Sample

Data from construction trade associations and building trade unions on unionized ICI construction firms (see supplemental materials 1, http://links.lww.com/JOM/A217, for sources of lists) were linked to Ontario Workplace Safety and Insurance Board (WSIB) claims data for WSIB-registered firms reporting payroll within construction classification units (CUs) for the period 2006 to 2012. The WSIB is the workers' compensation insurer for most Ontario employers (eg, banks, insurance companies, and some software development companies are not covered). The WSIB CUs represent the finest classification of construction firms by business activity (eg, electrical vs roof shingling) or risk associated with that activity (eg, structural demolition, structural steel erection) within the WSIB classification system (industry sector and rate group are higher-order classifications). They are meant to represent the most occupationally homogeneous groups and are the level at which registered firms report their payroll. The WSIB construction industry is composed of a total of 75 CUs.

Exclusion/Inclusion Criteria

Firms were included in the sample if they reported more than one full-time equivalent worker (FTE) of payroll within at least 1 of the 38 targeted CUs related to the trades represented by the 25 Employer and Employee Bargaining Agencies working in the ICI construction sector over the 2006 to 2012 period. Of the excluded 37 WSIB construction CUs, 7 cover the residential homebuilding sector, 12 are for executive employees who perform non-construction work, 6 are for non-trade work (eg, Interior Design), and 12 are for non-ICI construction sectors (eg, Pipeline).

Data Linkage

Linkage between the lists of unionized construction companies and WSIB-registered firms was done using phone number, postal code, and firm name (trade and legal names). A WSIB-registered firm was classified as unionized if a match was found on the building trades and construction trade association lists for at least name and one of postal code or phone number. Firms matching on postal code and phone number, but with different names were labeled as probably unionized. The validity of the linkage methodology was assessed by calculating the percent of workers employed in the firms in our sample from unionized ICI construction firms and comparing it to the percentage of

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construction workers in Ontario that are unionized as estimated using Statistics Canada's Labour Force Survey (LFS) data. To become certified to represent the workers of a firm, a union must apply to the Ontario Labour Relations Board (OLRB). Data from the OLRB were used to assess changes in unionization status over our study period.

Outcomes

Injury and illness claims registered with the WSIB with date of injury in the period 2006 to 2012 were included. The WSIB estimates the number of FTEs within each CU of a firm based on the payroll data reported by employers within that CU and the average wage rate for injured workers employed within the corresponding rate group. FTEs were calculated for each year and for the total time period. The following WSIB claim rates (per 100 FTEs) were calculated:

- Total claims (allowed and not allowed)
- No-lost-time claims allowed (NLTA)
- Lost-time claims allowed (LTA)

Within LTAs, two additional rates were calculated for musculoskeletal disorders (MSDs) and critical injuries (CIs). CIs include those that jeopardize life, cause blindness, or injuries that result in amputations, major burns, fracture of large bones, and loss of consciousness.

Covariates

Five covariates were considered.

(1) Postal area is a six-level variable to account for potential regional variability in safety practices. Canadian postal codes are similar to US zip codes but composed of six characters in the format A2A 2A2. The first letter defines a postal area that corresponds to an entire province or territory with the exception of Ontario and Quebec which are divided into multiple postal areas because of their large area and population. Ontario is divided into five postal areas (Eastern Ontario, Central Ontario, Toronto, Southwestern Ontario, and Northern Ontario). Northern Ontario is the reference category.
(2) CU (see supplemental materials 2, http://links.lww.com/JOM/A218, for a list of CUs) is a 38-level variable included to account for type/riskiness of the work. CUs are nested within rate groups and are the unit for which payroll is reported. The Carpenters and Flooring CU is the reference category.
(3) Business complexity represents the number of CUs that the firm reported payroll to WSIB (ranging from 1 to 5+). Two is the reference category.
(4) Firm size is a three-level variable (Small: less than 20 FTEs on average per year (reference category); Medium: 20–50 FTEs; Large: more than 50 FTEs on average per year) to account for differences in resources among firms to address safety issues. The Ministry of Labour defines small firms as less than 50 employees. Twenty was chosen as a cut point because firms with 20 or more employees must have a JHSC as regulated in the Ontario Occupational Health and Safety Act. The JHSC may be one mechanism through which the union influences health and safety at the worksite. We, therefore, use less than 20 to define small and between 20 and 50 to define medium. We do not differentiate firms greater than 50 (eg, separating the large from the very large firms) because of small numbers in our construction sector sample.
(5) Business longevity is a five-level variable describing the length of time (calculated using the opening and closing dates for the CU portion of a firm as recorded in WSIB) a business has remained active and registered with the WSIB: less than 5 years, 5 to 9.9, 10 to 14.9,15 to 19.9, and 20+ (reference category).

Statistical Analyses

All analyses were conducted using SAS v9.3 (SAS Institute Inc, 100 SAS Campus Drive Cary, NC).[34] All outcomes were modeled as event counts accumulated over the 7-year period within a CU within a firm using negative binomial regression models with logarithm of 7-year accumulated FTE as an offset variable. A negative binomial model was used as opposed to a Poisson model because it showed better fit because of over-dispersion. To examine the presence of a union safety effect, a variable indicating whether the firm was unionized or not was included in the model. First, union effects were estimated unadjusted for covariates, an ''unadjusted effect.'' Second, because firms may report payroll in multiple CUs, outcomes were modeled taking into account the potential for error correlation between observations from the same firm. We assumed an exchangeable working correlation matrix structure and defined clusters by firm account number using the ''repeated'' statement in SAS. The addition of an error correlation term did not change the results, so final models were estimated without adjustment for error correlation. Third, covariates were introduced into the model to determine whether they were significant and whether their inclusion changed the magnitude of the union effect. All effects represent risk ratios and are reported with 95% confidence limits. Fourth, two multivariable models are reported for the ''adjusted'' union parameter: one contains all covariates except firm size, and then the final model with firm size included. The effects with firm size are presented separately given the clear distinction in the sample between the size of unionized and nonunion firms.

Several sensitivity analyses were conducted. The robustness of the results to misclassification of union status was assessed by removing: (1) unionized firms that had been labeled probably unionized from the union group; (2) firms that had been identified as members of the Christian Labor Association of Canada (CLAC), an independent alternate union that differs significantly from the Building Trade unions (see below for additional description), from the nonunion group; and (3) firms that underwent a change in unionization status during the study window from the union group. To become certified to represent the workers of a firm, a union must apply to the OLRB allowing the tracking of changes in union status. Finally, to examine whether the results were consistent across CUs, CU-specific effects adjusted only for firm size were calculated and patterns across CUs described. Because of smaller sample sizes, only substantive patterns are described and not statistical patterns.

Although the OLRB recognizes CLAC as a union, CLAC is not affiliated with the American Federation of Labor and Congress of Industrial Organizations nor is it recognized as one of the Building Trade unions under the Labor Relations Act. CLAC firms were classified as nonunion for this study. Employers certified by CLAC tend to be organized along multi-trade lines and the agreements are not negotiated provincially. These key distinguishing characteristics differentiate them from the Building Trade union contractors.

RESULTS

Sample

The final sample includes almost 6000 unionized firms and 39,000 nonunion firms (see Fig. 1). Because the percentages of large and medium-sized firms are greater for unionized firms compared with nonunion firms (7.3% vs 0.4% and 12.2% vs 1.7%, respectively), the number of employees is closer to equal as there are a far greater number of small nonunionized firms (see Table 1). Firm size differences are also a likely explanation for the differences in business complexity, as larger firms are more likely to have reported work in different CUs. Although Table 1 shows that unionized and

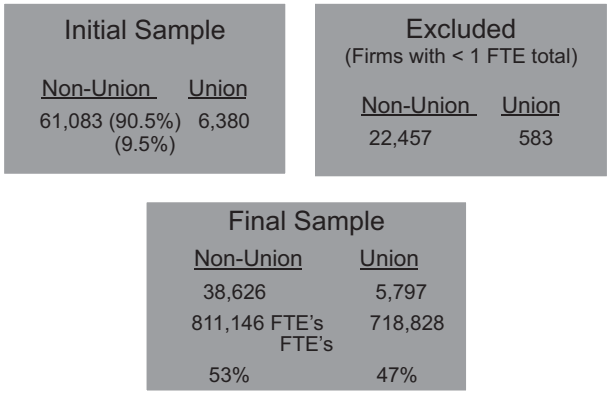

FIGURE 1. ICI construction sector firm sample selection. ICI, Industrial, Commercial, and Institutional.

nonunion firms have almost equal numbers of claims, nonunion firms tend to experience more LTAs than unionized firms and fewer NLTAs. Many CUs have a small number of firms reporting payroll in them.

Linkage

Out of the total of 5797 firms having more than one FTE over the study window that were tagged as being unionized, 3332 (58%) matched exactly on all three matching variables, 1469 (25%) matched on name and either phone number or postal code, whereas 996 (17%) were tagged as probable matches (matched on postal code and phone number, but not name).

The percent of unionized workers, represented by FTEs, in our sample of ICI construction firms was 47%. Although the estimate obtained using Statistics Canada 2012 LFS data is lower at 39%, the difference can be explained by the fact that the LFS does not discriminate between residential and ICI construction and unionization tends to be lower in the residential construction sector.

Covariate Selection

Although thought to be conceptually important, business longevity did not change the estimate of union effect in any significant way for any of the outcomes and created convergence problems for models that also controlled for firm size. For these reasons, we chose to exclude it from our analyses. We retained CU, postal code, business complexity, and firm size as covariates.

Union Safety Effect

Table 2 describes the estimated union effects from univariate and multivariate models. Two multivariate models were estimated (controlling or not for firm size in addition to postal region, CU, and firm complexity). Overall, unionized firms have 13% higher rates of total claims. Adjusting for firm size does not affect this result. The higher unionized total effect is because of a higher NLTA rate. The adjusted risk ratio for NLTAs drops from 1.35 to 1.28 after adjusting for firm size. LTA rates are significantly lower in unionized firms by 23%. Again, adjusting for firm size reduces the effect to 14% but it remains significant. Within LTAs, musculoskeletal injury (MSI) and CI rates are each lower in unionized firms, 17% and 29% respectively. Firm size reduces the MSI effect to 8%. Given the smaller number of injuries, the CI risk ratio cannot be estimated controlling for size because the model does not converge. Therefore, we rely on the union effect estimated using the reduced version of the model (supplemental materials 3, http://links.lww.com/JOM/A219, show the full tables with all effects).

Sensitivity Analyses

The following sensitivity analyses did not change the magnitude or the significance of the effects shown in Table 2: removing firms labeled probably union, removing firms that were members of CLAC, and removing firms that changed their unionization status in the 2006 to 2012 period.

When examining variability in the magnitude of effects across CUs, four patterns were observed:

- In 25 of 36 CUs, the LTA effect is less than 1 (ie, lower LTA rate in union firms)
- In 20 of 30 CUs, the MSD effect is less than 1
- In 10 of 17 CUs, the CI effect is less than 1
- In 29 of 37 CUs, the NLTA effect is 1 or greater

Some effects could not be estimated for CUs with small sample sizes. Full results are available from the first author upon request.

DISCUSSION

Our research asks the question, is there a union safety effect in the ICI construction sector in Ontario, Canada? We linked data heretofore unlinked in Ontario on construction firm union status with firm-level workers' compensation claims data. Effects were adjusted for: firm size and complexity to account for variability in organizational resources devoted to occupational safety and health, region of Ontario the construction firm is located in to account for regional variations in safety culture, and the WSIB construction CUs to account for variability in occupational hazards. Unionized construction firms report 28% higher rates of NLTAs but 14% lower rates of LTAs. Among LTAs, the MSI and CI claims rates are significantly lower in unionized firms (8% and 29%, respectively). Although the MSI risk ratio is significant after full adjustment, the CI risk ratio could not be estimated with a firm size adjustment. All effects remain unchanged after multiple sensitivity analyses further supporting the conclusion that unionized ICI construction firms in Ontario have lower rates of LTAs including MSIs and CIs and have higher rates of NLTAs.

This is the first study of a construction union safety effect in Ontario and in Canada that does not focus on disability duration. Our findings align with earlier Ontario research showing unionized firms had a shorter workers' compensation claims duration in the late 1980s and early 1990s[11] and the early twenty-first century.[9] Unlike earlier work that focused on disability duration, this research examined a range of outcomes producing a pattern of results consistent with unions encouraging injury and illness reporting and reducing exposure to job hazards.

Similar to Gillen,[29] we found a union safety effect among construction employers using recorded claims. Using self-report outcome data Dedobbeleer found no effect.[28] An ecological study by Zullo found mixed results.[31] Two strengths of the current study are the use of claims versus self-report data and using the organization as the unit of analysis.

Why would we expect the observed effects?[2] Unions and unionized workplaces may do a better job educating workers in on-the-job hazards and occupational health and safety rights (eg, toolbox talks). Unions may be more effective in changing construction worker behavior through educational and training programs. In Ontario, unions and their contractor partners invest over $40 million annually in specialized apprenticeship, upgrade and safety training for their members.[35] Unions and unionized workplaces may have programs and practices that more effectively identify and reduce construction work hazards. Union workplaces may not only encourage the reporting of accidents, but also near misses. Union workers may be encouraged to report by having the

TABLE 1. Descriptive statistics on ICI construction sample in Ontario, Canada

Variables		Union (%)	Nonunion (%)
Outcomes			
Total claims		65,295	64,533
Allowed claims		55,382	52,768
No-lost-time allowed claims		46,538 (84%)	38,181 (72%)
Lost-time allowed claims		8,842 (16%)	14,581 (27%)
Musculoskeletal injury claims		3,359 (38%)	5,023 (34%)
Critical injury claims		498 (0.01%)	828 (0.02)%
Disability days (100%)		2,040,627	2,687,250
Disability days (all)		1,635,077	2,148,604
Covariates			
Firm size	Small	4,670 (80.6)	37,815 (97.9)
	Medium	706 (12.2)	649 (1.7)
	Large	421 (7.3)	162 (0.4)
Complexity			
(No. of classification units)	One	3,394 (58.5)	28,542 (73.9)
	Two	1,121 (19.3)	6,349 (16.4)
	Three	518 (8.9)	2,094 (5.4)
	Four	307 (5.3)	847 (2.2)
	Five or more	457 (7.9)	794 (2.1)
Region	K (Eastern Ontario)	675 (11.6)	6,076 (15.7)
	L (Central Ontario)	2,432 (42)	15,879 (41.1)
	M (Metropolitan Toronto)	961 (16.6)	4,979 (12.9)
	N (South Western Ontario)	967 (16.7)	7,847 (20.3)
	Other	231 (4)	1,124 (2.9)
	P (Northern Ontario)	531 (9.2)	2,721 (7)
Classification unit	4021099	611 (10.5)	3,053 (7.9)
	4111099	15 (0.3)	36 (0.1)
	4211001	53 (0.9)	106 (0.3)
	4211002	60 (1)	140 (0.4)
	4214000	321 (5.5)	1,741 (4.5)
	4215000	135 (2.3)	360 (0.9)
	4221000	28 (0.5)	34 (0.1)
	4222001	103 (1.8)	48 (0.1)
	4223000	52 (0.9)	57 (0.1)
	4224001	142 (2.4)	788 (2)
	4224002	40 (0.7)	96 (0.2)
	4224003	40 (0.7)	304 (0.8)
	4225000	14 (0.2)	15 (0)
	4227000	82 (1.4)	133 (0.3)
	4229000	2 (0)	2 (0)
	4231000	415 (7.2)	2,039 (5.3)
	4232000	188 (3.2)	2,463 (6.4)
	4233000	119 (2.1)	575 (1.5)
	4234001	64 (1.1)	326 (0.8)
	4234003	43 (0.7)	61 (0.2)
	4235000	46 (0.8)	2,354 (6.1)
	4236000	87 (1.5)	520 (1.3)
	4239000	29 (0.5)	164 (0.4)
	4241002	57 (1)	171 (0.4)
	4241099	779 (13.4)	5,949 (15.4)
	4244000	160 (2.8)	582 (1.5)
	4255000	185 (3.2)	740 (1.9)
	4256000	92 (1.6)	69 (0.2)
	4259000	50 (0.9)	527 (1.4)
	4261000	732 (12.6)	5,036 (13)
	4271099	461 (8)	2,244 (5.8)
	4275001	192 (3.3)	3,330 (8.6)
	4275002	24 (0.4)	27 (0.1)
	4276000	101 (1.7)	1,314 (3.4)
	4277099	87 (1.5)	2,202 (5.7)
	4292000	105 (1.8)	428 (1.1)
	4299000	46 (0.8)	79 (0.2)
	9942000	37 (0.6)	513 (1.3)

ICI, Industrial, Commercial, and Institutional.

TABLE 2. Estimation of union safety effects in the ICI construction sector in Ontario (N = 44,423)[a,b]

	Unadjusted risk ratio	Adjusted risk ratio 1[c]	Adjusted risk ratio 2[d]
Total allowed and not allowed claims	1.21 (1.17–1.26)	1.13 (1.09–1.17)	1.13 (1.09–1.18)
No-lost-time allowed claims	1.48 (1.42–1.55)	1.35 (1.30–1.41)	1.28 (1.23–1.34)
Lost-time allowed claims	0.76 (0.73–0.80)	0.77 (0.73–0.81)	0.86 (0.82–0.98)
Musculoskeletal injuries	0.83 (0.78–0.89)	0.83 (0.77–0.89)	0.92 (0.86–0.99)
Critical injuries	0.71 (0.62–0.80)	0.71 (0.65–0.85)	[e]

[a]Unit of observation is the CU portion of a firm *over 7 years.*
[b]Estimation Method by Negative Binomial Regression using SAS 9.3 with log(FTE) as an offset variable.
[c]Adjusted for classification unit, region, and complexity.
[d]Adjusted for classification unit, region, complexity, and firm size.
[e]Model could not be estimated.

safety net of the union, so they can report without fear of repercussions. Unions may have a role in influencing the stringency of regulatory oversight. A unionized workforce may be composed of more safety conscious workers and also may experience less worker turnover. Unionized workplaces may give workers voice and power to influence some decisions regarding health and safety or lead to health and safety committees having more widening influence. Our research does not allow a determination of which of the above explanations is most appropriate.

An important consideration is whether our results are generalizable outside of Ontario. Based on data from Human Resources and Skills Developments Canada, approximately 31% of all employees working in construction in Canada are unionized. Based on data assembled for our study, about 47% of employees in the ICI sector in Ontario are unionized. Because it would be expected that unionization would be lower in the residential construction sector, we consider our sample to be relatively representative of ICI construction sector workplaces in Canada. Ultimately, the generalizability of the results depends less on these comparisons than on future research identifying the mechanisms (as described in the above paragraph) that produce the union safety effect.

The study limitations are the limitations of any study using linked administrative data. Future research should collect primary data to better measure resources committed to OHS as well as the policies, procedures, and practices the resources are intended to influence. Misclassification of union status may still be a problem. Seven of the union contractor lists used for the study are maintained by trade associations (see supplemental materials on union lists, http://links.lww.com/JOM/A217). As larger construction firms are more likely to participate in these voluntary trade associations, some smaller unionized firms may be missing from these lists. We are unable to examine if firms that undergo a change in union status have a change in claims rates because of the small number of firms undergoing changes (1.6%). Future research should seek to model how change in union status predicts change in claims rates.

We examined whether the observed effects may be specific to a few construction trades or CUs, and thus the overall effect represents a unique effect in a few trades. The sensitivity analysis does not support the effect being driven by a small number of CUs. The differences in claim rates between unionized and nonunion ICI construction firms could be because of differences in the sociodemographic composition of unionized and nonunion organizations. Older, more experienced workers may be working in union-certified firms along with fewer vulnerable workers (eg, new workers and immigrants). Again, primary data collection will be required to examine this possible explanation. There could also be a methodological limitation associated with the estimation of FTEs. FTEs are calculated as the reported insurable payroll for the CU for the firm divided by the average insurable earnings for injured workers in the rate group. There is a cap on the salary amount that can be reported to the WSIB as payroll for a firm. If unionized wages are higher than nonunion wages for the same work, then unionized firms would appear to have fewer FTEs than they actually do reducing the numerator and inflating the claim rate. The denominator amount, however, is derived from the pre-injury salary of injured workers, and is also capped at specific salary levels. Unionized firms would appear as having more FTEs than they actually do, which would deflate their claim rates. Consequently, there is no way to know the bias in the estimation of FTEs.

Unionized and nonunion firms may have different claims management or claims suppression practices. Lipscomb[36] not only documents significant claims management and suppression among unionized carpenters, but also shows the importance of job site safety climate in encouraging injury reporting.[37] Morse[38] describes claim filing in unionized facilities in Connecticut showing unions support greater claim filing. Whether this research in the United States is transferrable to Canada and specifically Ontario is challenging, given some important differences in health and safety legislation. In Ontario, all workplaces with greater than 20 employees must have a JHSC by law. Those with 20 or less must have a health and safety representative. Shannon and Lowe[39] found no union effect on claim filing in Ontario firms. The limited literature for union influence on claims suppression and claims management is mixed suggesting the relationship between unionization and claims filing may be more complex. Reflecting on our pattern of results suggests more primary data would help disentangle this complexity. If nonunion construction firms suppress claims or manage claims to a higher extent than unionized construction firms, we would expect the injury rate to be lower for all types of claims in nonunion construction firms and the risk ratios to all be elevated. Given the cost differences between no-lost-time and lost-time claims, we might expect greater emphasis on suppressing or managing these claims either through safety incentive programs, direct suppression by management, or through encouraging quick medical management or work accommodation. More primary data collection is needed following the recent US work[40,41] that combines both quantitative and qualitative methods to better understand how these two approaches to claims reporting may operate differently in unionized and nonunion construction organizations.

Overall, the results of the data linkage and analyses suggest that unionized firms in the ICI construction sector in Ontario encourage injury reporting as reflected in higher rates of NLTA claims and reduce occupational hazards and improve safety programs to reduce the rates of more significant LTA claims compared with nonunion firms. This research is a first step in understanding how collaborative partnerships between unions and employers create safer and less hazardous construction workplaces. This research needs to be extended into construction workplaces to better understand differences in organizational behavior. Furthermore, a more detailed assessment of the role of unions on safety outcomes

whether through training, empowerment, or promoting regulatory change should be examined. This research presents rich new opportunities for further investigation.

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