

# Do differences in work disability duration by inter-jurisdictional claim status vary by industry and jurisdictional context?

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## Key messages:

### 1. What is already known about this subject?

- Inter-jurisdictional workers are known to experience longer work disability duration than their within-jurisdiction counterparts. However, existing studies are limited by factors such as the types of claims represented (e.g., privately insured low-back pain claims in the United States), the origin and destination of the workers (e.g., Atlantic province residents working in the province of Alberta), and analyses typically looking at overall differences as opposed to industry and jurisdiction-specific differences.

### 2. What are the new findings?

- This study examined the differences in disability days paid among inter-jurisdictional workers and within-jurisdictional workers using data from six Canadian provincial workers' compensation jurisdictions. Inter-jurisdictional workers were paid more disability days than within-jurisdictional workers and the difference increased as disability duration increased. Differences were largest in construction, transportation and warehousing, mining, quarrying and oil and gas extraction sectors, and western Canadian provinces.

### 3. How might this impact on policy or clinical practice in the foreseeable future?

- The evidence from this study shows that workers' compensation systems, employers and healthcare providers may need to tailor specific interventions for workers living in one jurisdiction but working in another when a work-related injury occurs, particularly those working in resource economy regions and in employment associated with such regions.

## **Abstract**

### **Objectives**

To examine whether differences in work disability duration between out-of-province and within-province workers differed by industry and jurisdictional context.

### **Methods**

Workers' compensation data were used to identify comparable lost-time, work-related injury and musculoskeletal disorder claims accepted in six Canadian jurisdictions between 2006 and 2015. Out-of-province workers were identified as workers who filed claims in a different provincial jurisdiction to their province of residence. Coarsened exact matching was used to match out-of-province workers with within-province workers based on observable characteristics. Quantile regression models were used to estimate differences in cumulative disability days paid between out-of-province workers and within-province workers at different percentiles in the disability distribution, adjusting for confounders.

### **Results**

Compared to within-province workers, out-of-province workers were paid more disability days even after matching and adjusting on observable characteristics. Differences between the two groups of workers were observed for short, medium and long-duration claims (differences of 1.57, 6.39, 21.42, 46.43 days at the 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup> and 90<sup>th</sup> percentiles, respectively). Industry-specific models showed that differences were largest in construction, transportation and warehousing, and mining, quarrying and oil and gas extraction. Jurisdiction-specific models showed that differences were largest in the western provinces where out-of-province workers were concentrated in those sectors.

### **Conclusions**

Out-of-province workers are a vulnerable group with respect to risk of longer work disability duration. Workers' compensation systems, employers and healthcare providers may need to tailor specific interventions for these types of workers, particularly those employed in resource economy-dependent regions that are far from their regions of residence.

## Introduction

Mobility for work ranges across a spectrum from relative immobility (work at home), extended daily travel to and within work, to longer distance travel within and between intra- and international jurisdictions [1]. While mobility for work is not a new phenomenon, there is growing interest in understanding the occupational health and workers' compensation implications of different kinds of extended/complex mobility [2]. Of particular concern is where workers experience work-related injuries in different jurisdictions from where they are resident, such as inter-regional workers in countries where workers' compensation falls under different regional jurisdictions, such as Canada and Australia [3]. In Canada, inter-jurisdictional workers represent approximately 2.5% of the employed population [4]. While comparable statistics are not available for other countries, in Australia, workers with long distance commutes (100+ km between places of residence and work) typically capture inter-jurisdictional workers and represent approximately 1.9% of the employed population [5]. Compared to their within-jurisdiction counterparts, inter-jurisdictional workers may face greater challenges in recovery and return-to-work (RTW) due to the nature of their work and the injuries they experience, how they navigate the workers' compensation and health care systems, the availability of work accommodation, and their proximity to social support.

Only two studies have quantified RTW-related outcomes of inter-jurisdictional workers. In the United States, a study of low back pain claims for a private insurer found that workers who worked and resided in the same state had fewer disability days than those who did not [6]. In the Canadian province of Alberta, a study found that workers from the Atlantic provinces working in Alberta when injured were half as likely to transition off disability benefits than their Alberta counterparts but that this difference disappeared after accounting for where the worker received treatment [7]. These studies offer insight into the differences in work disability outcomes of inter-jurisdictional workers but have limitations. For example, the former study only encompasses privately insured workers with low back pain claims whereas the latter study encompasses a unique group of, long-distance inter-jurisdictional workers characteristic of the resource economy. Furthermore, these studies do not examine how differences in disability duration may vary by industry and jurisdictional context.

In Canada, workers' compensation benefits are administered at the provincial or territorial level (12 jurisdictions) under statutory, no-fault systems that provide coverage for wage replacement and

other benefits via employer-paid insurance premiums. In addition to sharing core features in each jurisdiction, differences can be found in terms of coverage, benefits, rehabilitation, healthcare, administration, and job protection [8]. All jurisdictions have signed an Inter-jurisdictional Agreement for the purposes of ensuring equity for workers whose employment requires duties in more than one jurisdiction, the adjudication of their claims, assessments of their employers, and the delivery of benefits and services to them [9]. Each jurisdiction has its own legislation that determines where a claim should be made and, in some cases, workers may choose between the jurisdiction in which the injury occurred or where they typically work and reside [10].

Using a large multi-jurisdictional dataset from Canada, the objectives of this study are to (1) examine whether out-of-province workers have longer disability duration than their within-province counterparts and, (2) examine whether the effect of being an out-of-province worker on work disability duration varies by industry and jurisdiction.

## Methods

### *Data*

Comparable cohorts of lost-time workers' compensation claims were created using administrative claims data provided by the workers' compensation boards from the following six Canadian provinces over a ten-year period (2006-2015): British Columbia (BC); Alberta (AB); Saskatchewan (SK); Manitoba (MB); Ontario (ON); and New Brunswick (NB). During the study period, the average workforce coverage for workers' compensation benefits in the six jurisdictions ranged from 94.7% in BC to 73.1% in ON [11]. The average proportion of inter-jurisdictional workers across the study jurisdictions during this period ranged from 5.9% in AB, to 2.2% in BC, with the proportion of these being shorter-distance cross-border workers ranging from as much as 66.6% in ON, to less than 48.6% in AB [4].

### *Study cohort*

Comparable cohorts were created based on similar claim eligibility and follow-up across the six jurisdictions. Eligible claims included non-fatal, work-related injuries and musculoskeletal disorders (MSDs) that occurred between the years 2006 and 2015, resulting in at least one day of compensated lost-time. Benefit payments for all claims included a maximum follow-up time of one-year, post-injury. Occupational disease and mental health claims were excluded due to differences in coverage and processing/timing between exposure onset and claim registration. Workers had to be 15 to 80 years of age at the time of injury for a claim to be included.

Claims missing study variables were excluded from the analyses with the exception of pre-injury annual earnings and firm size, where unknown categories were included. These variables had higher proportions of incomplete information, particularly in NB where most claims of less than three days are not initially adjudicated as lost-time claims. In total, the study cohort included 1,648,523 unique claims (see Supplementary Table 1 for details regarding the cohort restrictions).

### *Outcome measure*

The outcome measure was the cumulative disability days paid within one year of the injury. To account for workers on different workweek schedules (e.g. three-day versus five-day) and disability day payments (e.g. partial versus full), adjustments were made to standardize the measure to full integer days based on a five-day workweek. Claims with more than 260 days (equivalent to one year based on a five-day workweek) were right-censored. Three disability days were imputed for all lost-time claims in NB that were originally adjudicated as lost-time medical aid only claims according to

their three-day waiting period legislation. In all other jurisdictions, workers are typically compensated for days with lost-time after the injury day.

*Main explanatory variable: out-of-province claim*

Injured workers with a residential postal code from a different province to where they filed their claim were identified as out-of-province workers whereas those with a residential postal code from the same province as where they filed their claim were identified as within-province workers.

*Confounders*

Other analytical variables included the provincial jurisdiction of the worker's claim, urban-rural residential classification, gender, age at time of injury, occupation, industry, firm size (categorized, derived from full-time equivalent estimates in payroll), pre-injury annual earnings (province-specific quintiles). Urban-rural classification was based on the Statistical Area Classification type of the 2011 Census [12]. Injury data were coded using Canadian Standards Association Z795-03 coding for work injury and disease [13]. Injury types were defined based on research using similar data [14,15], resulting in five categories: non-MSDs, back soft tissue injuries, other soft tissue injuries, limb fractures and other fractures. Occupation was coded to the National Occupational Classification 2006 [16] using a combination of concordance tables and manual re-assignment of codes based on decision rules of the research team. Industry was coded to North American Industry Classification System 2012 [17] using a similar method.

*Matching out-of-province claims with within-province claims*

Previous research using claims data has shown that out-of-province workers are different to within-province workers in terms of their demographic, employment and injury characteristics [7]. In order to produce unbiased estimates of the effect of out-of-province status on work disability duration, a matching strategy was used to balance the two groups on observable characteristics. Following similar research using workers' compensation data [18,19], a coarsened exact matching method was used. Accordingly, cross-tabulations and chi-squared tests were used to determine which variables had different distributions between the two groups. Claims were matched on sex/gender, age category, injury type, pre-injury earnings, occupation, industry, firm size, and jurisdiction. Differences in injury year and urban-rural residential classification of the two groups were also observed but not used as matching variables in order to maintain a sample as representative of out-

of-province workers as possible (e.g., representing at least 90% of out-of-province workers) (see Supplementary Table 2 for summary of jurisdiction-specific matching).

### *Statistical analyses*

Descriptive statistics were used to summarize the distribution of the claims by geographic, demographic, injury and employment-related characteristics overall and by out-of-province claim status. Quantile regressions models were used to estimate the number of additional disability days paid to out-of-province workers, relative to within-province workers, at different points in the disability distribution. Models were specified at the 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles of the disability distribution. Model estimates were used to calculate the adjusted predictions for out-of-province workers, holding other covariates at their mean values [20]. Separate models were run for the five most common industry sectors among out-of-province claims. Based on estimates of the industry-specific models, jurisdiction-specific models were run with the exclusion of public administration workers due to the overrepresentation of this sector in ON and NB, particularly government workers residing in Gatineau, Quebec (QC) who commute short distances to Ottawa, ON (the national Capital). Sensitivity analysis included sex/gender and injury-specific models.

## Results

Table 1 shows the descriptive statistics of the within and out-of-province workers for both the unmatched and matched cohorts. The unmatched cohort consisted of 1,619,626 within-province claims and 28,897 out-of-province claims. Compared to within-province workers, out-of-province workers had a higher proportion of male workers (76.5% vs. 62.8%), a younger average age (38.6 years vs. 40.5 years), and approximately double the proportion of fracture-related claims. In terms of employment characteristics, half of the out-of-province workers had trades and transport related occupations compared to just over a third for within-province workers. Out-of-province workers had higher annual earnings prior to injury and were largely employed in construction (25.5%), transportation and warehousing (12.8%), manufacturing (8.6%), public administration (8.1) and mining, quarrying and oil and gas extraction (7.6%). The compensation provinces most represented in the out-of-province population were AB (39.4%), ON (26.8%) and BC (18.0%). The urban-rural distribution of out-of-province workers was more rural than the within-province workers. Prior to matching the cohorts, out-of-province workers were paid more disability days than within-province workers (mean of 56.0 vs. 31.8, and median of 21.0 vs. 8.0 days). After matching, out-of-province workers were still paid more disability days but differences between the two groups decreased (mean of 55.4 vs. 37.6, median of 21.0 vs. 11.0).

**Table 1.** Descriptive statistics of the unmatched and matched within-province and out-of-province workers' compensation claims, 2006-2015.

	Unmatched cohort (n=1,648,523)				Matched cohort (n=54,216)			
	Within-province (n=1,619,626)		Out-of-province (n=28,897)		Within-province (n=27,108)		Out-of-province (n=27,108)	
	N	%	N	%	N	%	N	%
Sex/gender								
Men	1,017,337	62.8	22,114	76.5	20,901	77.1	20,901	77.1
Women	602,289	37.2	6,783	23.5	6,207	22.9	6,207	22.9
Age group								
15-24	226,191	14.0	4,678	16.2	4,322	15.9	4,322	15.9
25-34	339,617	21.0	7,112	24.6	6,675	24.6	6,675	24.6
35-44	380,603	23.5	6,635	23.0	6,286	23.2	6,286	23.2
45-54	425,850	26.3	6,770	23.4	6,468	23.9	6,468	23.9
55-64	222,928	13.8	3,333	11.5	3,067	11.3	3,067	11.3
65-80	24,437	1.5	369	1.3	290	1.1	290	1.1
Injury type								
Non-MSD	455,875	28.2	7,578	26.2	7,191	26.5	7,191	26.5
Other soft tissue	635,712	39.3	10,964	37.9	10,465	38.6	10,465	38.6
Back soft tissue	399,372	24.7	6,144	21.3	5,818	21.5	5,818	21.5
Other fracture	108,762	6.7	3,479	12.0	3,088	11.4	3,088	11.4
Limb fracture	19,905	1.2	732	2.5	546	2.0	546	2.0
Injury year								
2006	195,904	12.1	3,813	13.2	3,248	12.0	3,592	13.3
2007	192,957	11.9	3,689	12.8	3,151	11.6	3,465	12.8
2008	188,296	11.6	3,720	12.9	3,059	11.3	3,490	12.9
2009	157,598	9.7	2,763	9.6	2,596	9.6	2,612	9.6
2010	148,771	9.2	2,651	9.2	2,462	9.1	2,494	9.2
2011	150,241	9.3	2,574	8.9	2,572	9.5	2,412	8.9
2012	149,074	9.2	2,526	8.7	2,484	9.2	2,353	8.7
2013	147,609	9.1	2,530	8.8	2,526	9.3	2,358	8.7
2014	147,216	9.1	2,573	8.9	2,532	9.3	2,398	8.9
2015	141,960	8.8	2,058	7.1	2,478	9.1	1,934	7.1
Occupation								
Management	34,868	2.2	491	1.7	383	1.4	383	1.4
Business and finance	106,148	6.6	1,405	4.9	1,305	4.8	1,305	4.8
Natural and applied science	25,691	1.6	786	2.7	570	2.1	570	2.1
Health	162,089	10.0	1,245	4.3	1,197	4.4	1,197	4.4
Social science and related	62,929	3.9	668	2.3	590	2.2	590	2.2
Arts and recreation	9,015	0.6	166	0.6	92	0.3	92	0.3
Sales and service	417,137	25.8	4,931	17.1	4,705	17.4	4,705	17.4
Trades and transport related	581,625	35.9	14,540	50.3	14,148	52.2	14,148	52.2
Primary industry	46,349	2.9	2,863	9.9	2,511	9.3	2,511	9.3
Processing and manufacturing	173,775	10.7	1,802	6.2	1,607	5.9	1,607	5.9
Pre-injury annual earnings								
Lowest quintile	321,278	19.8	4,610	16.0	4,268	15.7	4,268	15.7
Medium-low quintile	321,160	19.8	4,413	15.3	4,153	15.3	4,153	15.3
Middle quintile	320,203	19.8	4,866	16.8	4,612	17.0	4,612	17.0
Medium-high quintile	319,971	19.8	5,644	19.5	5,291	19.5	5,291	19.5
Highest quintile	316,273	19.5	9,114	31.5	8,590	31.7	8,590	31.7
Unknown	20,741	1.3	250	0.9	194	0.7	194	0.7
Industry								
Agriculture, forestry, fishing and hunting	29,630	1.8	1,244	4.3	1,067	3.9	1,067	3.9
Mining, quarrying, and oil and gas extraction	14,590	0.9	2,207	7.6	1,982	7.3	1,982	7.3
Construction	185,963	11.5	7,377	25.5	7,206	26.6	7,206	26.6
Manufacturing	251,983	15.6	2,489	8.6	2,398	8.9	2,398	8.9
Wholesale trade	63,968	4.0	779	2.7	743	2.7	743	2.7

Retail trade	183,998	11.4	1,634	5.7	1,568	5.8	1,568	5.8
Transportation and warehousing	154,525	9.5	3,700	12.8	3,512	13.0	3,512	13.0
Information and cultural industries*	19,507	1.2	196	0.7	142	0.5	142	0.5
Financial and insurance**	17,888	1.1	340	1.2	284	1.1	284	1.1
Professional, scientific and technical services	11,941	0.7	326	1.1	208	0.8	208	0.8
Administrative and support, waste management and remediation services	62,214	3.8	1,208	4.2	1,095	4.0	1,095	4.0
Education services	70,752	4.4	399	1.4	362	1.3	362	1.3
Health care and social assistance	231,554	14.3	1,701	5.9	1,643	6.1	1,643	6.1
Arts, entertainment and recreation	20,873	1.3	483	1.7	370	1.4	371	1.4
Accommodation and food services	102,462	6.3	1,734	6.0	1,630	6.0	1,630	6.0
Other services (except public administration)	48,570	3.0	739	2.6	682	2.5	681	2.5
Public administration	149,208	9.2	2,341	8.1	2,216	8.2	2,216	8.2
Employer classification								
<20 FTEs	293,642	18.1	7,379	25.5	6,757	24.9	6,757	24.9
20+ FTEs	1,132,948	70.0	18,195	63.0	17,318	63.9	17,318	63.9
Self-insured	156,135	9.6	2,857	9.9	2,673	9.9	2,673	9.9
Unknown	36,901	2.3	466	1.6	360	1.3	360	1.3
Provincial workers' compensation jurisdiction								
BC	516,713	31.9	5,200	18.0	4,928	18.2	4,928	18.2
AB	263,182	16.3	11,386	39.4	10,659	39.3	10,659	39.3
SK	94,456	5.8	2,193	7.6	1,957	7.2	1,957	7.2
MB	140,915	8.7	1,504	5.2	1,359	5.0	1,359	5.0
ON	553,515	34.2	7,733	26.8	7,466	27.5	7,466	27.5
NB	50,845	3.1	881	3.1	739	2.7	739	2.7
Urban-rural classification***								
CMA	1,128,459	69.7	14,551	50.4	17,352	64.0	13,797	50.9
CA	240,547	14.9	5,840	20.2	4,379	16.2	5,427	20.0
Strong MIZ	66,308	4.1	1,472	5.1	1,186	4.4	1,365	5.0
Moderate MIZ	89,133	5.5	3,217	11.1	1,800	6.6	3,021	11.1
Weak/No MIZ/Territories	95,179	5.9	3,817	13.2	2,391	8.8	3,498	12.9
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	40.5	12.8	38.9	12.7	38.9	12.6	38.9	12.6
Disability days	31.8	54.3	56.0	73.4	37.6	58.9	55.4	72.9
	Median	IQR	Median	IQR	Median	IQR	Median	IQR
Age	41	30-51	39	28-49	39	28-49	39	28-49
Disability days	8	3-34	21	5-77	11	3-44	21	5-76

Note: AB = Alberta; BC = British Columbia; CA = Census agglomeration; CMA = Census Metropolitan Area; IQR = Interquartile range; FTE = Full-time equivalent; MB = Manitoba; MIZ = Metropolitan influenced zone; MSD = Musculoskeletal disorder; NB = New Brunswick; ON = Ontario; SK = Saskatchewan. \* includes utilities. \*\* includes real estate and rental and leasing, management of companies and enterprises. \*\*\* A CMA or CA is formed by one or more adjacent municipalities centred on a population centre (known as a core). A CMA must have a total population of at least 100,000 of which 50,000 must live in the core. A CA must have a core population of at least 10,000. MIZs differentiate municipalities outside of CMAs or CAs according to the degree of influence (strong to no influence) that the CMAs or CAs have on them, based on the percentage of their resident employed labour force that commutes to work in the core(s) of CMAs or CAs.

Table 2 shows the quantile regression results for the overall model and industry-specific models, indicating that out-of-province workers had more cumulative disability days paid compared to within-province workers at short, medium and long durations of disability. At the 25<sup>th</sup> percentile, out-of-province workers had just under two additional disability days paid than their within-province counterparts (1.57, 95% CI = 1.29-1.84). At the 50<sup>th</sup> percentile, out-of-province workers had just over a week more of disability days paid (6.39, 95% CI = 5.62-7.17). By the 75<sup>th</sup> and 90<sup>th</sup> percentiles, out-of-province workers had more than a month of work disability (21.42, 95% CI = 19.36-23.47) and almost two and a half months more of work disability (46.43, 95% CI = 42.44-50.41) than within-province workers, respectively.

Industry-specific models also show that out-of-province workers were paid more disability days than their within-province counterparts but the extent of this varied across and within industry. Among shorter durations, the absolute differences were greatest in transportation and warehousing (3.37, 95% CI 2.21-4.53), and mining, quarrying, and oil and gas extraction (3.37, 95% CI = 1.98-4.76). From the 50<sup>th</sup> percentile onwards, the differences in disability days paid were largest in construction with approximately 2.5 weeks more work disability (12.33, 95% CI = 10.24-14.42), followed by around 2 weeks more in mining, quarrying, oil and gas extraction (11.13, 95% CI = 7.50-14.76) and transportation and warehousing (10.23, 95% CI 7.58-12.87). At the 75<sup>th</sup> and 90<sup>th</sup> percentiles, construction and transportation and warehousing presented the largest differences, with approximately 3 additional months of work disability paid to out-of-province workers. In contrast, differences in the public administration sector were small and less than 1 month at the 90<sup>th</sup> percentile (14.45, 95% CI 1.85-27.05) whereas in manufacturing the differences increased exponentially with the disability distribution.

**Table 2.** Adjusted quantile regression results for differences in disability days paid for out-of-province workers relative to within-province workers for all industries and five most common industries for out-of-province workers using matched cohorts

	25th		50th		75th		90th	
	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
<b>All industries (n=54,216)</b>								
Days paid to out-of-province workers relative to within-province workers	1.57	(1.29-1.84)	6.39	(5.62-7.17)	21.42	(19.36-23.47)	46.43	(42.44-50.41)
Predicted days paid to within-province workers	4.45	(4.22-4.67)	14.04	(13.40-14.67)	43.14	(41.45-44.82)	98.02	(94.75-101.28)
Predicted days paid to out-of-province workers	6.01	(5.78-6.24)	20.43	(19.78-21.08)	64.55	(62.84-66.26)	144.4	(141.12-147.76)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	35.3		45.5		49.7		47.4	
<b>Construction (n=14,412)</b>								
Days paid to out-of-province workers relative to within-province workers	2.97	(2.17-3.77)	12.33	(10.24-14.42)	37.35	(32.49-42.21)	57.01	(48.44-65.58)
Predicted days paid to within-province workers	5.13	(3.64-6.62)	17.92	(14.00-21.83)	55.34	(46.26-64.42)	135.89	(119.87-151.91)
Predicted days paid to out-of-province workers	8.1	(6.60-9.59)	30.25	(26.32-34.17)	92.69	(83.58-101.80)	192.9	(176.83-208.98)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	57.9		68.8		67.5		42	
<b>Transportation and warehousing (n=7,024)</b>								
Days paid to out-of-province workers relative to within-province workers	3.37	(2.21-4.53)	10.23	(7.58-12.87)	29.89	(22.93-36.84)	58.57	(47.88-69.25)
Predicted days paid to within-province workers	7.26	(5.41-9.11)	21.4	(17.18-25.62)	53.2	(42.11-64.28)	117.14	(100.10-134.17)
Predicted days paid to out-of-province workers	10.6	(8.78-12.48)	31.63	(27.41-35.85)	83.08	(72.00-94.17)	175.7	(158.67-192.73)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	46.4		47.8		56.2		50	
<b>Manufacturing (n=4,796)</b>								
Days paid to out-of-province workers relative to within-province workers	1.01	(0.44-1.57)	4.56	(2.27-6.85)	20.98	(14.56-27.39)	50.85	(38.48-63.21)
Predicted days paid to within-province workers	4.63	(3.07-6.18)	22.01	(15.67-28.35)	47.31	(29.53-65.08)	88.53	(54.27-122.78)
Predicted days paid to out-of-province workers	5.63	(4.07-7.19)	26.57	(20.21-32.93)	68.28	(50.46-86.11)	139.37	(105.02-173.72)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	21.8		20.7		44.3		57.4	
<b>Public administration (n=4,432)</b>								
Days paid to out-of-province workers relative to within-province workers	0.54	(0.24-0.84)	1.14	(0.06-2.22)	4.19	(-0.10-8.48)	14.45	(1.85-27.05)
Predicted days paid to within-province workers	4.09	(3.55-4.63)	12.14	(10.22-14.07)	46.94	(39.28-54.59)	118.18	(95.71-140.66)
Predicted days paid to out-of-province workers	4.63	(4.09-5.17)	13.28	(11.35-15.22)	51.13	(43.44-58.82)	132.64	(110.07-155.20)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	13.2		9.4		8.9		12.2	
<b>Mining, quarrying, and oil and gas extraction (n=3,964)</b>								
Days paid to out-of-province workers relative to within-province workers	3.37	(1.98-4.76)	11.13	(7.50-14.76)	25.92	(17.29-34.55)	42.71	(27.33-58.10)
Predicted days paid to within-province workers	26.94	(22.21-31.66)	44.98	(32.61-57.35)	93.84	(64.42-123.27)	151.69	(99.25-204.12)
Predicted days paid to out-of-province workers	30.31	(25.58-35.04)	56.11	(43.73-68.48)	119.76	(90.32-149.21)	194.4	(141.94-246.86)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	12.5		24.7		27.6		28.2	

Note: CI = confidence interval. Coef. = number of disability days paid unless otherwise specified. Adjusted for gender/sex, age, injury type, injury year, occupation, pre-injury annual earnings, employer classification, provincial jurisdiction, urban-rural classification. Adjusted prediction of disability days paid when all other variables are set at the sample means.

Jurisdiction-specific models also showed variations in disability days paid across and within the study populations (Table 3). Overall, large differences were observed in the compensation provinces of BC, AB, SK, and MB, with small or null differences in ON and NB. More specifically, with the exception of the 75<sup>th</sup> percentile, where the largest difference was observed in MB (35.39, 95% CI 24.40-46.38), the largest differences were observed in AB, ranging from over 3.5 days at the 25<sup>th</sup> percentile (3.68, 95% CI 3.09-4.26), over 2.5 weeks at the 50<sup>th</sup> percentile (13.37, 95% CI = 11.87-14.87), to almost 3.5 additional months of work disability at the 90<sup>th</sup> percentile (67.05, 95% CI 80.84-73.27). At the 75<sup>th</sup> and 90<sup>th</sup> percentiles, differences between the other jurisdictions were similar. In contrast, differences in both ON and NB were largest at the 75<sup>th</sup> percentile with less than 1 additional week of work disability in ON (4.30, 95% CI = 0.07-8.54), and 3 additional weeks of work disability in NB (14.84, 95% CI = 1.40-28.27). Additional sex/gender and injury-specific analyses (Supplementary Table 3) show that differences were larger for men than women, and for fracture claims compared to back soft tissue injuries.

**Table 3.** Difference in disability days paid for out-of-province workers relative to within-province workers for six provincial jurisdictions using matched cohorts

	25th		50th		75th		90th	
	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
<b>BC (n=9,572)</b>								
Days paid to out-of-province workers relative to within-province workers	2.2	(1.37-3.03)	9.88	(7.51-12.26)	32.61	(26.80-38.42)	54.13	(45.83-62.42)
Predicted days paid to within-province workers	7.5	(6.31-8.68)	23.21	(19.82-26.60)	59.16	(50.85-67.48)	117.38	(105.51-129.25)
Predicted days paid to out-of-province workers	9.7	(8.51-10.89)	33.09	(29.69-36.49)	91.78	(83.44-100.11)	171.51	(159.60-183.41)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	29.3		42.6		55.1		46.1	
<b>AB (n=20,504)</b>								
Days paid to out-of-province workers relative to within-province workers	3.68	(3.09-4.26)	13.37	(11.87-14.87)	34.03	(30.85-37.21)	67.05	(60.84-73.27)
Predicted days paid to within-province workers	6.08	(5.13-7.03)	19.39	(16.95-21.84)	46.44	(41.27-51.61)	93.3	(83.19-103.40)
Predicted days paid to out-of-province workers	9.75	(8.78-10.72)	32.76	(30.27-35.25)	80.48	(75.21-85.74)	160.35	(150.07-170.63)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	60.5		69		73.3		71.9	
<b>SK (n=3,704)</b>								
Days paid to out-of-province workers relative to within-province workers	2.32	(1.31-3.33)	9.48	(5.59-13.36)	31.16	(21.14-41.17)	57.81	(42.09-73.54)
Predicted days paid to within-province workers	4.57	(3.65-5.49)	17.5	(13.97-21.03)	54.45	(45.33-63.56)	112.26	(97.95-126.58)
Predicted days paid to out-of-province workers	6.89	(5.94-7.84)	26.98	(23.33-30.63)	85.6	(76.19-95.02)	170.08	(155.28-184.87)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	50.8		54.2		57.2		51.5	
<b>MB (n=2,580)</b>								
Days paid to out-of-province workers relative to within-province workers	2	(0.79-3.22)	9.92	(6.19-13.65)	35.39	(24.40-46.38)	55.91	(37.61-74.20)
Predicted days paid to within-province workers	4.87	(3.81-5.93)	16.4	(13.15-19.65)	41.2	(31.63-50.78)	104.74	(88.80-120.68)
Predicted days paid to out-of-province workers	6.87	(5.77-7.97)	26.32	(22.94-29.70)	76.6	(66.65-86.54)	160.64	(144.09-177.20)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	41.1		60.5		85.9		53.4	
<b>ON (n=12,034)</b>								
Days paid to out-of-province workers relative to within-province workers	0.54	(0.23-0.85)	1.05	(0.10-2.00)	4.3	(0.07-8.54)	3.83	(-4.54-12.19)
Predicted days paid to within-province workers	3.25	(3.00-3.50)	10.47	(9.71-11.23)	39.35	(35.96-42.73)	113.85	(107.17-120.53)
Predicted days paid to out-of-province workers	3.79	(3.54-4.04)	11.52	(10.75-12.29)	43.65	(40.22-47.07)	117.68	(110.91-124.45)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	16.6		10		10.9		3.4	
<b>NB (n=1,390)</b>								
Days paid to out-of-province workers relative to within-province workers	1.12	(-0.48-2.73)	7.09	(0.04-14.15)	14.84	(1.40-28.27)	25.68	(-1.12-52.48)
Predicted days paid to within-province workers	10	(8.25-11.74)	26.19	(18.53-33.86)	74.97	(60.37-89.56)	143.93	(114.80-173.05)
Predicted days paid to out-of-province workers	11.12	(9.22-13.02)	33.29	(24.95-41.63)	89.8	(73.92-105.68)	169.6	(137.92-201.29)
Percentage increase in predicted days paid to out-of-province workers relative to within-province workers	11.2		27.1		19.8		17.8	

Note: AB = Alberta; BC = British Columbia; CI = confidence interval; Coef. = number of disability days paid unless otherwise specified; MB = Manitoba; NB = New Brunswick; ON = Ontario; SK = Saskatchewan. Adjusted for gender/sex, age, injury type, occupation, pre-injury annual earnings, industry, employer classification, urban-rural classification. Adjusted prediction of disability days paid when all other variables are set at the sample means.

## **Discussion**

### **Main findings**

This study examined whether workers claiming lost-time compensation outside of their province of residence had different work disability durations from those claiming inside their province of residence and whether this differed by industry and provincial jurisdiction. The findings showed that, compared to within-province workers, out-of-province workers had larger mean and median cumulative disability days paid and this persisted after matching on observable characteristics. The multivariable quantile regression models showed that, compared to within-province workers, out-of-province workers had more disability days paid across short, medium and long-term disability durations. Overall, the absolute and relative differences in disability days paid between the two groups of workers increased as claim duration increased (except at the 90<sup>th</sup> percentile where the absolute difference increased but relative difference decreased marginally).

When analysed by industry, differences were typically largest in construction, transportation and warehousing, and mining, quarrying, and oil and gas extraction, and smallest in public administration and manufacturing. When analysed by claim jurisdiction, differences were largest in western provinces, like AB, where sectors such as construction, transportation and warehousing, mining, quarrying, and oil and gas extraction relied more heavily on out-of-province workers. In contrast, provinces such as ON and NB, where out-of-province workers are more likely to be travelling from closer, bordering provinces [4], presented the smallest differences, even after excluding public administration workers.

### **Interpretation of findings**

Previous research found that out-of-province workers from Atlantic Canada working in AB were half as likely to transition off disability benefits than their matched within-province counterparts [7]. This difference between was partially attenuated when accounting for individual-level characteristics and fully attenuated when accounting for whether treatment was received in the province of residence or AB. Interviews conducted with a sample of the out-of-province workers highlighted barriers they faced when injured, including the financial strain of keeping two homes while on disability benefits, opportunities for appropriate modified work, and opportunities for receiving medical treatment in their province of residence [7].

In the current study, differences in disability duration between within-province and out-of-province workers persisted after accounting for a wide range of claim characteristics. A unique finding to this study was that differences in disability duration between the two groups also increased as claim duration increased. While injury severity was not specifically captured in the analysis, the finding of increasing differences even among fracture injuries suggests that differences between the two groups of workers are not simply due to injury severity but also factors such as the availability of modified work and how these factors are compounded by the challenges of complex work-related mobility. The findings from the industry and jurisdiction-specific analysis are likely shaped by factors such as the industries the workers are employed in, opportunities and effectiveness of modified work, and the geographic distances between their places of work and residence. Western provinces like AB and SK rely upon fly-in, fly-out (FIFO) workers from across Canada for the oil and gas industry and other industries related to it, such as construction. Research in Australia has suggested that FIFO workers are at an increased risk physically and mentally due to factors including long working hours and compressed workweeks while being separated or isolated from families and friends [27]. Since opportunities for modified work are shown to be lower in industries like construction [21], it is possible that opportunities for modified work are fewer for out-of-province workers and less effective given the mobile nature of their work.

In contrast to the western provinces, out-of-province workers represented in the central and Atlantic provinces, represented by ON and NB in this study, are more likely to be short or medium-distance commuters to geographically accessible areas of southern ON, including federal government employees based in Ottawa but travelling from nearby Gatineau, Quebec [22]. The public administration-specific model captured these types of out-of-province workers and the effect of being from out-of-province was much smaller than in other industries. When excluding public administration from the jurisdiction-specific models, differences between within-province and out-of-province workers were small but persisted in ON and NB. Overall, these findings are intuitive given that research in Canada and the United States has shown that injured workers residing in areas with high proportions of commuters are associated with long disability durations [15,23]. Furthermore, research elsewhere has shown that increased sickness absences are associated with longer commuting times [24,25], and longer commuting distances [26].

### *Strengths and limitations*

This study has a number of strengths. Firstly, it included workers' compensation data from six provincial jurisdictions with coverage equivalent to 70% of Canada's workforce eligible for workers' compensation. Previous studies on work disability duration of inter-jurisdictional workers have been limited to low back pain claims filed with a private insurer in the United States [6] and workers from Atlantic provinces filing claims for injuries while working in AB, Canada [7]. Secondly, this study used a matching strategy to remove some of the selection bias of workers working out-of-province and balance the cohorts on observable characteristics. This improves on research that does not match cohorts [6] and on research that has matched on fewer characteristics [7]. Thirdly, this study used quantile regression models to account for the skewness of disability days paid and, in doing so, measured differences between workers at different points in the disability distribution.

The study is not without its limitations. It was not possible to identify recurring claims and this may have introduced unobserved differences between the out-of-province and within-province claims. The outcome variable was based on cumulative disability days paid within the first year of a claim. This does not necessarily indicate the number of days between injury and RTW. Claimants may transition off disability benefits and onto other forms of disability, such as vocational rehabilitation or permanent disability. Therefore, while it is possible that an out-of-province worker took longer to transition off disability benefits, a within-province worker may not necessarily have experienced faster RTW. While the outcome variable was standardized to full integer values based on a five-day workweek, it was not possible to control for partial disability days which may have captured RTW in a reduced capacity. Right-censoring at one year was imposed on the outcome variable to ensure that all claims had the same follow-up time. While this restricted the distribution of the claim durations, it would have only potentially reduced differences between longer out-of-province and within-province claims. However, if this introduced a bias it would have reduced the observed differences found. Nonetheless, measuring cumulative days in which claims receive disability benefits has been used in other comparative studies of work disability [14,15,27], and has been used in previous research on inter-jurisdictional workers [6].

Identification of out-of-province workers was based on whether the worker's residential province was different to the province of their claim. This measure does not capture all out-of-province injuries because some workers may claim compensation in their home province. Nonetheless, in jurisdictions where data were available to identify such claims, they represented less than 1% of out-

of-province workers identified using the definition in this study. Lastly, as only one postal code record was available per claim, it was not possible to determine whether injured workers moved residence over time during the period of disability. However, the findings suggest that being out-of-province at the time of injury increases work disability duration and future research using linked data may be able to unpack the location of workers during their recovery and how this affects work disability duration.

## **Conclusions**

In contrast to within-province workers, out-of-province workers were compensated for more disability days and the difference between the two groups increased as claim duration increased. Differences between the two groups of workers were observed across a range of industry and jurisdictional contexts in a rigorously designed study. The findings suggest that out-of-province status has a persistent association with longer work disability durations, even after accounting for observable characteristics. Workers' compensation systems, employers and healthcare providers may need to tailor specific interventions for these types of workers, particularly those employed in resource economy-dependent regions that are far from their regions of residence. The findings are of relevance to other countries with increasingly mobile workers and where workers' compensation systems fall under regional jurisdiction.

## **Contributors**

RAM conceived the study, conducted the analysis, and drafted the manuscript. CBM conceived the study, guided the analysis, and helped draft the manuscript. All authors (including MK and BN) reviewed the data analysis, contributed to the manuscript preparation, and approved the final manuscript.

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## **Disclaimer**

All inferences, opinions, and conclusions drawn in this manuscript are those of the authors, and do not reflect the opinions of WorkSafeBC, Workers' Compensation Board of Alberta, Workers' Compensation Board of Saskatchewan, Workers Compensation Board of Manitoba, Workplace Safety & Insurance Board of Ontario, and WorkSafeNB.

## **Competing interests**

None declared.

## **Ethics approval**

This study was approved by the Behavioural Research Ethics Board of the University of British Columbia (H13-00132).

## References

- 1 Roseman SR, Barber PG, Neis B. Towards a feminist political economy framework for analyzing employment-related geographical mobility. *Stud Polit Econ* 2015;**95**:175–203.
- 2 Neis B, Lippel K. Occupational health and safety and the mobile workforce: insights from a Canadian research program. *New Solut* 2019;**29**:297–316. doi:10.1177/1048291119876681
- 3 Gardner B, Alfrey KL, Vandelanotte C, *et al.* Mental health and well-being concerns of fly-in fly-out workers and their partners in Australia: a qualitative study. *BMJ Open* 2018;**8**. doi:10.1136/bmjopen-2017-019516
- 4 Statistics Canada. Employer-Employee Dynamics Database.
- 5 De Silva H, Johnson L, Wade K. Long distance commuters in Australia: a socio-economic and demographic profile. In: *34th Australasian Transport Research Forum*. Adelaide, Australia, 28-30 September 2011.:
- 6 Shraim M, Cifuentes M, Willetts J, *et al.* Length of disability and medical costs in low back pain: do state workers' compensation policies make a difference? *J Occup Environ Med* 2015;**57**:1275–83. doi:10.1097/JOM.0000000000000593
- 7 Cherry N, Galarneau J-M, Haynes W. Total disability days in interprovincial and home-province workers injured in Alberta, Canada: a mixed-methods study with matched-pair analysis of compensation data and participant interviews. *Am J Ind Med* 2019;**63**:146–55. doi:10.1002/ajim.23065
- 8 Association of Workers' Compensation Boards of Canada. Workers' compensation legislation & policy. Summary Tables. Available at: <https://awcbc.org/en/summary-tables/workers-compensation-legislation-policy> (accessed 12 Mar 2020).
- 9 Association of Workers' Compensation Boards of Canada. Interjurisdictional agreement on workers' compensation. 2017. Available at: <https://awcbc.org/wp-content/uploads/2018/03/IJ-Consolidated-Agreement-2017.pdf> (accessed 26 Oct 2020).
- 10 Lippel K, Walters D. Regulating health and safety and workers' compensation in Canada for the mobile workforce: now you see them, now you don't. *New Solut* 2019;**29**:317–48. doi:10.1177/1048291119868805

- 11 Association of Workers' Compensation Boards of Canada. Detailed key statistical measures report 2018. Key Stat. Meas. 2019. Available at: [http://awcbc.org/?page\\_id=9759](http://awcbc.org/?page_id=9759) (accessed 11 May 2020).
- 12 Statistics Canada. *Geography Catalogue, Census Year 2011*. Ottawa, Ontario: : Statistics Canada 2011.
- 13 Canadian Standards Association. *Z795-03 - Coding of Work Injury or Disease Information*. Mississauga, Ontario: : Canadian Standards Association 2013.
- 14 Macpherson RA, Lane TJ, Collie A, *et al.* Age, sex, and the changing disability burden of compensated work-related musculoskeletal disorders in Canada and Australia. *BMC Public Health* 2018;**18**. doi:<https://doi.org/10.1186/s12889-018-5590-7>
- 15 Macpherson RA, Amick B., Collie A, *et al.* Urban-rural differences in the duration of injury-related work disability in six Canadian provinces. *J Occup Environ Med* 2020;**62**:e200–7. doi:10.1097/JOM.0000000000001850
- 16 Government of Canada. About the NOC 2006. 2019.<http://noc.esdc.gc.ca/English/NOC/AboutNOC.aspx?ver=06> (accessed 9 Dec 2019).
- 17 Statistics Canada. North American Industry Classification System (NAICS) Canada 2012. Available at: <http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=118464> (accessed 9 Dec 2019).
- 18 Maas ET, Koehoorn M, McLeod CB. Return-to-work for multiple jobholders with a work-related musculoskeletal disorder: a population-based, matched cohort in British Columbia. *PLoS One* 2018;**13**:e0193618. doi:<https://doi.org/10.1371/journal.pone.0193618>
- 19 Choi K, Maas ET, Koehoorn M, *et al.* Time to return to work following workplace violence among direct healthcare and social workers. *Occup Environ Med* 2020;**77**:160–7. doi:10.1136/oemed-2019-106211
- 20 Williams R. Using the margins command to estimate and interpret adjusted predictions and marginal effects. *Stata J* 2012;**12**:308–31. doi:10.1177/1536867X1201200209
- 21 Maas ET, Koehoorn M, McLeod CB. Descriptive epidemiology of gradual return to work for workers with a work-acquired musculoskeletal disorder in British Columbia, Canada. *J Occup Environ Med* 2019;**62**:113–23. doi:10.1097/JOM.0000000000001768

- 22 Morissette R, Qiu H. Interprovincial Employment in Canada, 2002 to 2011. *Econ Insights* 2015;**047**.
- 23 Fan ZJ, Foley MP, Rauser E, *et al*. Effects of residential location and work-commuting on long-term work disability. *J Occup Rehabil* 2013;**23**:610–20. doi:10.1007/s10926-013-9424-2
- 24 Gimenez-Nadal J, Molina J, Velilla J. Commuting time and sick-day absence of US workers. *IZA Discuss Pap* 2018.
- 25 Guo M, Tang K, Wang Z. Commuting time and sickness absence in China: rural/urban variations and Hukou impacts. *Econ Labour Relations Rev* 2020;**31**:76–95. doi:10.1177/1035304619899770
- 26 Goerke L, Lorenz O. Commuting and sickness absense. *IZA Discuss Pap Ser* 2009;**119**:1–7.
- 27 Macpherson RA, Koehoorn M, Fan J, *et al*. Do differences in work disability duration between men and women vary by province in Canada? *J Occup Rehabil* 2019;**29**:560–8. doi:10.1007/s10926-018-9819-1