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Comparison of Compensated Low Back Pain Claims Experience in Australia with Limb Fracture and Non-Specific Limb Condition Claims: A Retrospective Cohort Study

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Abstract

Objectives To describe the incidence, duration, and patterns of working time loss claims in compensated Australian workers with low back pain (LBP), and compare this with limb fracture (LF) and non-specific limb condition (NSLC) claims. *Methods* The National Dataset for Compensation-based Statistics was used for this study. Accepted workers' compensation time loss claims for LBP, LF or NSLC occurring between July 2010 and June 2015 were included. Counts, rates per 10,000 covered workers, the relative risk and median duration of time loss were calculated. Multivariate Cox and quantile regression models were used to determine factors affecting time loss duration and patterns. *Results* There were 56,102 LBP claims, 42,957 LF claims, and 18,249 NSLC claims. The relative risk of a claim for LBP was significantly greater than LF after adjustment for all covariates (ARR 1.30, 95% CI 1.29–1.32, $p < 0.001$). LBP claims had similar median time loss (9.39 weeks) to LF claims (9.21 weeks). Claims for LBP were significantly more likely to be resolved in the early phase (10th and 25th quantiles of time loss; 25th quantile: − 1.12 weeks, 95% CI − 1.20 to − 1.05) than claims for LF, but significantly less likely to be resolved in the later phase (75th and 90th quantiles; 75th quantile: 7.02 weeks, 95% CI 6.42–7.61). Claims for NSLC had generally greater time loss than claims for LF, but less time loss than LBP above the 90th quantile. *Conclusions* The risk of a claim for LBP is higher than LF and NSLC. Although LBP claims are more likely to resolve in the early phase than limb fracture and NSLC claims, LBP claims have longer durations when workers are away from work more than seven weeks.

Keywords Low back pain · Workers' compensation · Return to work

Introduction

Low back pain (LBP) is a prevalent musculoskeletal symptom and the leading contributor to the burden of disease [1–3]. Non-specific LBP typically has a favourable prognosis, with the majority of people with LBP recovering normal function within two weeks of pain onset [3, 4]. However, LBP may be associated with activity limitation in the acute and even chronic setting [3, 5–7]. A large proportion of LBP sufferers are of working age [1–3]. A worker may seek wage replacement from an injury compensation or benefit system such as workers' compensation or social security if they are unable to work due to LBP [8].

In Australia, if a condition such as LBP is determined to be work-related, then the worker may be eligible for payment for lost wages and medical treatment from a workers' compensation scheme [9, 10]. Workers' compensation claims involving wage replacement for time away from work are referred to as time loss claims. Injury and musculoskeletal disorders constitute the majority of workers' compensation claims in Australia; 89% of serious claims in the 2016–2017 financial year were for injuries and musculoskeletal disorders [11, 12]. During the same period, body stressing in the upper and lower back were the most common mechanism and location of injury, respectively.

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While there have been previous estimates of the incidence of compensated musculoskeletal disorders in Australia [12], there are fewer estimates examining cases of work-related LBP specifically. Factors affecting time loss in compensated workers with LBP have previously been reported internationally [8], but not specifically for LBP in Australia [13–15]. Finally, comparisons of claim incidence and time loss between claims for LBP and other musculoskeletal conditions have rarely been made in published literature.

The objectives of this study were therefore to (1) Determine the incidence of compensated work-related LBP in Australia and compare that with the incidence of two other common compensated work-related musculoskeletal disorders—limb fracture (LF) and non-specific limb conditions (NSLC) and; (2) Determine and compare the duration of, patterns and factors affecting working time loss in compensated Australian workers with these three sets of conditions.

Methods

Data Source

This study used the National Dataset for Compensation-based Statistics (NDS). This administrative dataset is compiled by Safe Work Australia [16]. Each state (n = 6) and territory (n = 2) in Australia has its own workers' compensation scheme, and there are three Commonwealth (Federal) schemes [10]. These systems are cause-based; wage replacement is only provided to those where an injury or illness is "attributable to a specific employment-related cause" [9, 10, 17, 18]. Further description of the Australian workers' compensation setting is available elsewhere [9, 10]. These schemes provide data to Safe Work Australia to be collated in the NDS annually. The NDS contains claim-level data including: worker age, sex, occupation, industry, jurisdiction, socioeconomic status, remoteness, employment status, and cumulative time loss (reported in weeks). Safe Work Australia also supply a denominator dataset that contains the number of workers covered by workers' compensation insurance in a given year for each of sex, age, occupation, and jurisdiction. The NDS and denominator data have been used in several previous studies [19, 20].

Sample

All accepted time loss claims by workers who sustained work-related (1) LBP, (2) LF, and (3) NSLC between 1 July 2010 and 30 June 2015 (i.e., five Australian financial years) were included. Each of the three groups were defined using the Type of Occurrence Classification System (TOOCS) version 3 revision 1 (see Supplementary Files) [21]. LFs were selected as they typically have distinct healing and recovery timelines, with clear time points when functional capacity can increase [22, 23]. LBP lacks this clinical and recovery "clarity"; recovery can be very complex and the condition can be recurrent [3, 24, 25]. NSLCs were also selected because in many ways they are similar to LBP. Most do not have an identifiable underlying cause or are presumed to be a soft tissue injury, so it was hypothesised that their clinical course may be similar to LBP. Based on these recovery timelines, LF claims were used as the reference group in all later analyses. Out of scope conditions included wounds, lacerations, traumatic joint injuries, and traumatic muscle and tendon injuries. The sample included workers aged ≥ 15 years and ≤ 80 years. Claims were excluded if they contained unlikely weekly working hours prior to a claim (< 1 h and > 100 h). Claims with time loss less than two weeks or greater than 365 weeks were excluded, and a censor indicator marked the maximum duration of any one claim at 104 weeks' time loss (i.e., 2 years) [19, 20, 26]. Filtering claims in this manner creates a standardised cohort across all jurisdictions. For example, some jurisdictions require an employer to pay the first 10 business days wage replacement (i.e., the two week filter), and each jurisdiction has a different maximum wage replacement period (i.e., censoring at 104 weeks, or 2 years). These eligibility criteria have been applied previously in studies using the NDS [19, 20, 26]. Application of these eligibility criteria is described in Fig. 1.

Outcome Variables

The primary outcome variables for this study were (1) the incidence of accepted workers' compensation time loss claims per 10,000 covered workers, and (2) duration of time loss for workers with accepted claims in weeks. These outcomes have been used in previous similar studies [19, 20, 26].

Independent Variable

Worker condition (i.e., LBP, LF, or NSLC) was the independent variable.

Covariates

Covariates were chosen based on past association with study outcomes in groups of workers with LBP and other musculoskeletal conditions, and availability within the dataset [16, 19, 26]. Age at the time of injury was reported as age group (15–24 years, 25–34 years, 35–44 years, 45–55 years, and 55 > years), and sex reported in binary terms (male/female). Australian and New Zealand Classification of Occupations (ANZSCO) major codes were used to define eight major occupation groups [27]. Jurisdiction was defined as the

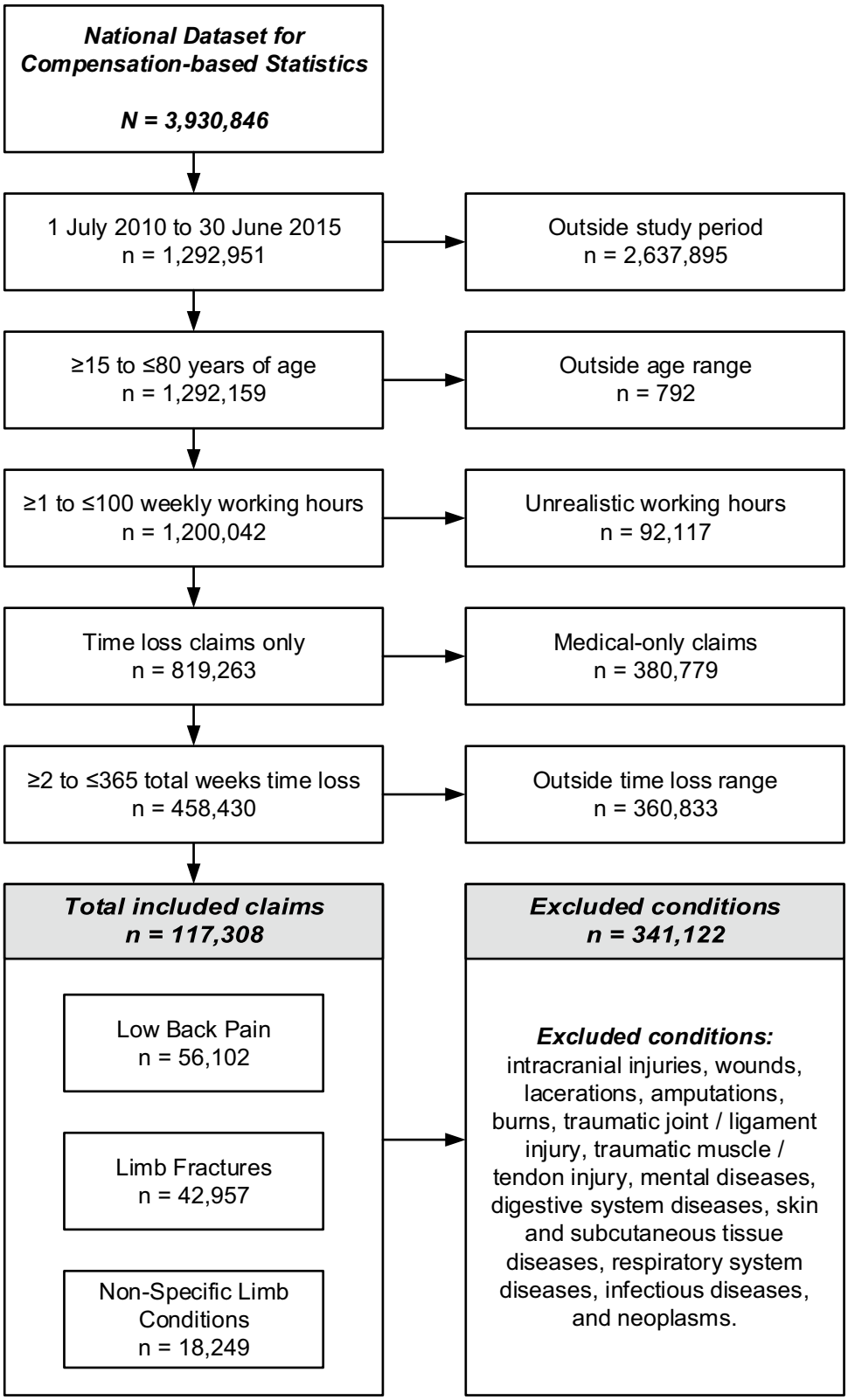

Fig. 1 Sample selection process and number of included claims. *NDS* National Dataset of Compensation-based Statistics

workers' compensation jurisdiction in which the claim was accepted. Socioeconomic status was defined by the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) [28, 29]. As per previous analyses, the middle three quintiles were collapsed, with the most advantaged and most disadvantaged quintiles at either extreme [26].

Accessibility/Remoteness Index of Australia (ARIA) provided five categories of remoteness [28, 30]. Finally, workers were classified as full-time if they worked ≥ 35 h per week, or part-time otherwise.

Portions of the IRSAD (8.54%), ARIA (8.43%), and ANZSCO (0.39%) variables had missing values. IRSAD and ARIA are both derived from postcode, likely leading to similar proportions of missing values. Multivariate Imputation by Chained Equations (MICE) was used to impute the missing variables. MICE was performed for 10 imputations with 20 iterations of each imputation [31].

Analysis

Descriptive statistics were first used to determine the counts of time loss claims for LBP and the comparator conditions for each covariate. Claim incidence was calculated for LBP and the comparator conditions for sex, age group, occupation and jurisdiction. Poisson regression was used to calculate the unadjusted relative risk (RR) of a claim for each condition. The covariates sex, age group, occupation, and jurisdiction were then added to an adjusted model. Other covariates were not included in Poisson regression as denominator data (i.e., total covered workers) were not available. The log of the total number of covered workers was used as an offset in Poisson regression [19]. Results were expressed as unadjusted and adjusted relative risk (ARR), with 95% confidence intervals (CI).

Descriptive statistics were used to determine the median and inter-quartile range (IQR) of time loss for LBP and the comparator conditions for all covariates. A Schoenfeld residual test indicated that all conditions significantly violated the proportional hazards assumption [32, 33]. A Cox proportional hazards model could therefore not be used to compare time loss between workers with LBP and the comparator conditions. However, to visualise the time loss differences between conditions a multivariate Cox model was created with the conditions as strata. This model included all covariates. This model was plotted as a survival curve, and demonstrated that workers with LBP and LFs appeared to have a fluctuating likelihood of cessation of time loss (i.e., a return to work) relative to one another (i.e., they were not proportional).

Quantile regression enabled a statistical comparison of time loss between LBP and the comparator conditions. A commonly used statistical method in econometrics, quantile regression performs regression within each of *tau* quantiles of the dependent variable, rather than across the entire dependent variable [34, 35]. This method is ideal for analyses where the outcome variable is highly skewed and outliers may substantially affect the mean [34, 35]. Both this analysis and other analyses of workers' compensation data have consistently described the skewed nature of time loss as an outcome [26, 36]. Quantile regression enables determination of how many weeks difference in time loss there are between quantiles, and has also previously been used with this type of data [36]. All covariates were included in the quantile regression model.

Based on visualisation of time loss in the survival curves, the 10th, 25th, 50th 75th, and 90th quantiles were selected a priori. Analyses were performed with the entire imputed dataset, with all covariates included, in R 3.5 (Vienna, Austria) [37], compiled in Microsoft Visual Studio 2017 (Redmond, USA) [38].

Ethics

This study received ethics approval from the Monash University Human Research Ethics Committee (MUHREC) (Approval No. CF14/2995–2014001663, January 2019).

Results

Incidence

There were a greater number of claims for LBP (n = 56,102) than LF (n = 42,957) and NSLC (n = 18,249) (see Table 1 and Fig. 1). The incidence of claims for LBP was also higher than both comparator conditions at 9.37 per 10,000 covered workers (7.17 per 10,000 covered workers for LF, and 3.05 per 10,000 covered workers for NSLC). The relative risk of a claim for LBP was significantly greater than for LF (RR 1.31, 95% CI 1.29–1.32, $p < 0.001$), and remained significant after adjustment for covariates (ARR 1.30, 95% CI 1.29–1.32, $p < 0.001$; ARR 0.43, 95% CI 0.42–0.44 for NSLC).

The incidence of claims was greater for males than females for LBP and LF claims, but there was a relatively small difference between sexes for NSLC claims. The incidence of claims in all three condition groups generally increased with age, but the trend was most noticeable in LBP claims. More physically demanding occupations had a significantly greater incidence of claims for all conditions, and increased relative risk in the adjusted model. This was most notable for LBP claims, with *Machinery Operators and Drivers* and *Labourers* claiming for LBP at a rate of 23.6 and 22.7 per 10,000 covered workers, respectively.

The highest incidence of claims per jurisdiction was for LBP in Queensland (12.2 per 10,000 covered workers). However, other jurisdictions had relatively similar rates of LBP claims at 8.8 to 11.3 per 10,000 covered workers. The incidence of claims for LF and NSLC were lower, with NSLC claims as low as 0.6 per 10,000 covered workers in Western Australia (WA).

Table 1 Incidence and relative risk of claims for included conditions between 01 July 2010 and 30 June 2015

Parameter	Low back pain		Limb fracture		Non-specific limb condition		Covered workers[b]	Adjusted relative risk model		
	n	Rate[a]	n	Rate	N	Rate		ARR[c]	95%CI	p
Condition										
Limb fracture	–	–	42,957	7.17	–	–	59,888,198	1.00	–	Reference
Low back pain	56,102	9.37	–	–	–	–	59,888,198	1.30	1.29–1.32	p < 0.001
Non-specific limb condition	–	–	–	–	18,249	3.05	59,888,198	0.43	0.42–0.44	p < 0.001
Sex										
Female	20,881	7.26	13,989	4.86	8559	2.98	28,760,088	1.00	-	Reference
Male	35,221	11.31	28,968	9.31	9690	3.11	31,128,110	1.13	1.12–1.15	p < 0.001
Age Group										
15–24 years	5430	4.91	6728	6.08	945	0.85	11,061,004	1.00	-	Reference
25–34 years	12,378	8.80	8808	6.26	2325	1.65	14,069,862	1.76	1.72–1.79	p < 0.001
35–44 years	14,587	11.13	8405	6.41	4366	3.33	13,107,972	2.27	2.23–2.32	p < 0.001
45–55 years	14,740	11.80	9591	7.68	6256	5.01	12,488,294	2.57	2.52–2.63	p < 0.001
55 + years	8967	9.79	9425	10.29	4357	4.76	9,161,066	2.53	2.48–2.59	p < 0.001
Occupation (n = 453 missing)										
Managers	2286	3.42	2275	3.41	664	0.99	6,679,548	1.00	-	Reference
Professionals	5203	3.89	4210	3.15	1645	1.23	13,370,711	1.12	1.08–1.16	p < 0.001
Technicians and trades workers	9114	11.35	8912	11.10	2859	3.56	8,028,117	3.66	3.55–3.78	p < 0.001
Community and personal service workers	10,148	15.73	4949	7.67	2648	4.11	6,450,526	4.20	4.07–4.34	p < 0.001
Clerical and administrative workers	2055	2.32	2293	2.58	1035	1.17	8,875,079	0.85	0.82–0.88	p < 0.001
Sales workers	3689	5.81	2122	3.34	1564	2.46	6,352,551	1.99	1.92–2.07	p < 0.001
Machinery operators and drivers	9298	23.63	6791	17.26	2558	6.50	3,934,029	5.93	5.75–6.12	p < 0.001
Labourers	14,068	22.70	11,266	18.18	5203	8.40	6,197,637	7.09	6.89–7.3	p < 0.001
Jurisdiction										
New South Wales	14,071	7.49	12,697	6.76	3030	1.61	18,777,437	1.00	-	Reference
Victoria	13,460	8.79	8440	5.51	8561	5.59	15,308,654	1.25	1.23–1.27	p < 0.001
Queensland	14,512	12.22	11,332	9.54	4133	3.48	11,876,742	1.46	1.44–1.48	p < 0.001
South Australia	4849	11.31	2618	6.11	1518	3.54	4,287,409	1.24	1.21–1.27	p < 0.001
Western Australia	6790	9.76	5707	8.20	429	0.62	6,956,567	1.10	1.08–1.13	p < 0.001
Tasmania	1380	11.03	926	7.40	245	1.96	1,251,057	1.15	1.11–1.2	p < 0.001
Northern Territory	465	6.48	771	10.75	74	1.03	717,458	1.18	1.12–1.25	p < 0.001
Australian Capital Territory Private	575	8.07	466	6.54	259	3.63	712,874	1.36	1.29–1.44	p < 0.001
SES (n = 10,016 missing)										
Middle three quintiles	8887		6560		2845					
Most advantaged quintile	33,706		25,484		10,292					
Most disadvantaged quintile	8800		8025		2693					
Remoteness (n = 9,886 missing)										
Major cities of Australia	34,550		26,457		10,829					
Inner regional Australia	10,798		8177		3554					
Outer regional Australia	5316		4297		1329					
Remote Australia	571		769		90					
Very remote Australia	211		428		46					
Employment status										
Full-time	42,081		33,447		13,192					
Part-time	14,021		9510		5057					

[a]Rate per 10,000 covered workers

[b]Total covered workers during the study period (01 July 2010–30 June 2015)

[c]ARR = Adjusted Relative Risk, adjusted for sex, age group, occupation, and jurisdiction

Time Loss

Median time loss for LBP (9.39 weeks, IQR 3.95–30.2) and LFs (9.22 weeks, IQR 5.07–19.30) were similar, despite a more right-skewed 75th percentile for LBP (see Table 2). The median time loss for NSLC claims was greater at 14.40 weeks (IQR 5.92–40.4). A relatively large proportion of claims for LBP had a short duration of time loss (see Fig. 2). However, a large proportion of claims lasted for a greater duration, extending the 75th percentile. Time loss for LF claims appeared to cluster closer to the median, with only a relatively small proportion of outliers. The distribution of time loss for NSLC claims did not appear to follow a specific trend.

Median time loss was higher for males (9.60 weeks) than females (9.00 weeks) only for LBP. There did not appear to be an effect of age on time loss for LBP claims, nor were there substantial differences in time loss between occupations (see Table 2). Median time loss for LBP claims was highly varied between jurisdictions; claims in NSW lasted a median of 6.77 weeks, compared to 18.80 weeks in Victoria. This same inter-jurisdictional variability was apparent for NSLC, but less so for LF. There did not appear to be substantial differences in time loss for LBP claims between IRSAD. However, median time loss was up to 3.40 weeks greater for cases with missing socioeconomic status. LBP claims in major cities tended to have greater median time loss than in more remote areas.

Survival curves plotted based on the Cox model (see Fig. 2) demonstrated that a larger time loss for LBP claims were more likely to cease than LF claims in approximately the first six weeks. However, this trend reverses after approximately six weeks, with time loss for LF claims more likely to cease after this time period. NSLC claims displayed the most shallow survival curve.

Quantile regression confirmed the patterns observed in the Cox model (see Table 3). LBP claims had approximately one week less time loss than LF claims in the 25th quantile of time loss (coef − 1.12, 95% CI − 1.20, − 1.05). With all covariates set at reference values, claims for LF at the 50th quantile of time loss were modelled to last 7.46 weeks. There was no significant difference in time loss between LBP and LF claims in the 50th quantile (coef − 0.14, 95% CI − 0.31, 0.03). At the 90th quantile time loss claims for LBP were 15.62 weeks greater than for LFs (95% CI 14.31, 16.94).

Discussion

This study aimed to determine the incidence and duration of working time loss due to work-related LBP in Australia and to compare it with LF and NSLC. There was a greater incidence of workers' compensation time loss claims for LBP compared to claims for LF and NSLC. The relative risk of claiming for LBP was greater than claims for LF even after adjustment for demographic, occupational and geographic characteristics. Although median time loss for LBP and LF claims was similar, different distinct patterns of time loss were observed. The first 10% of LBP claims to resolve did so significantly faster than the first 10% of claims for LF. However, the final 25% of LBP claims resolved significantly slower than the final 25% of LF claims.

Overall, time loss associated with LBP claims was relatively short. Work-related LBP cases appear to follow expected recovery patterns for the majority of LBP cases—a typically positive prognosis and short-term disability. However, at least 25% of LBP claims resolved significantly more slowly than claims for LF, which may in part be due in part to psychosocial factors unique to LBP. LBP is often recurrent, with fluctuating symptoms [25]. Those with LBP describe an associated stigma particularly in proving the legitimacy of their pain; some individuals may even "amplify" their symptoms in an effort to prove their suffering [7, 25]. Proving disability associated with LBP may be particularly pertinent in a cause-based workers' compensation system, such as those in Australia. General interaction with a workers' compensation system has been found to negatively affect return to work in workers with chronic LBP, as has attorney involvement [15]. LBP sufferers may also experience anxiety and fear avoidance of future pain in periods when they are not directly experiencing pain [25]. Workers with LBP have also demonstrated fear of losing their jobs due to requests for work modification. Co-workers are also reported to be a source of the aforementioned stigma associated with the legitimacy of LBP symptoms [7]. This array of biopsychosocial factors makes LBP a complex condition, particularly for those who have experienced prolonged symptoms, and may contribute to the lower likelihood of claim resolution in the later phase.

LF is a fundamentally different condition to LBP; a LF occurs, it is treated, it is clearly visible to others, and it has a forecasted point of resolution. Claims for LF may be more likely to resolve than claims for LBP in the later phase as a worker's fracture has sufficiently healed to resume activities. Fracture healing is typically expected to take 6 to 8 weeks [22]. Although the LFs category itself is quite broad, this recovery timeline is supported by other observations within the data. Firstly, there were substantially less long-term outliers of time loss for LF claims compared to both LBP and NSLC claims. The majority of LF claims also clustered around the median when claims were distributed by time loss. Secondly, there was limited inter-jurisdictional variability in time loss for LF claims. Limited variability in time loss for LF claims reflects a relatively standard recovery trajectory, and therefore supports the theory that fracture

Table 2 Time loss and factors affecting time loss

Variable	Low back pain		Limb fracture		Non-specific limb condition	
	Median (weeks)	IQR	Median (weeks)	IQR	Median (weeks)	IQR
Condition						
Limb fracture	–	–	9.21	5.07–19.30	–	–
Low back pain	9.39	3.95–30.20	–	–	–	–
Non-specific limb condition	–	–	–	–	14.40	5.92–40.40
Sex						
Female	9.00	4.00–26.38	9.43	5.19–19.17	15.40	6.20–43.20
Male	9.60	3.80–32.8	9.20	5.03–19.4	13.80	5.60–38.60
Age Group						
15–24 years	7.00	3.39–19.14	7.30	4.40–13.20	8.80	4.00–23.81
25–34 years	9.39	4.00–29.21	8.39	4.80–16.40	11.00	4.82–31.79
35–44 years	10.00	4.00–34.00	9.59	5.00–20.59	13.79	5.71–40.60
45–55 years	9.80	4.00–31.40	10.20	5.40–22.51	15.60	6.40–43.79
55 + years	9.50	3.80–31.80	11.14	6.00–23.60	17.20	7.00–44.80
Occupation						
Managers	10.60	4.39–37.55	8.82	4.94–18.47	14.70	6.77–45.58
Professionals	9.00	4.00–24.00	8.20	4.59–16.00	11.85	5.00–30.00
Technicians and trades workers	10.40	4.00–35.81	9.00	5.00–19.40	16.33	6.20–46.79
Community and personal service workers	7.70	3.55–21.94	9.39	5.12–18.50	12.00	5.00–31.60
Clerical and administrative workers	8.75	3.60–25.95	8.80	4.61–17.00	12.40	5.45–29.40
Sales workers	10.4	4.00–38.40	9.00	4.81–19.00	20.83	7.80–76.80
Machinery operators and drivers	10.31	4.00–35.80	10.2	5.60–22.00	15.20	6.19–42.21
Labourers	9.60	4.00–32.20	9.79	5.40–20.40	14.79	5.80–41.46
Missing (n = 453)	9.40	4.00–17.80	7.00	4.20–15.20	8.83	5.60–24.92
Jurisdiction						
New South Wales	6.77	3.20–21.00	8.60	4.60–17.60	9.80	4.04–25.00
Victoria	18.80	6.39–76.80	10.79	6.19–23.40	22.39	8.60–66.40
Queensland	7.80	3.60–19.00	8.88	5.00–18.00	10.25	4.53–23.00
South Australia	8.86	4.00–33.60	8.80	5.00–17.40	12.20	5.00–37.65
Western Australia	9.99	3.80–38.63	10.00	5.40–22.00	16.42	6.00–47.11
Tasmania	6.83	3.20–17.91	8.40	4.99–16.55	6.33	3.70–14.30
Northern Territory	11.33	4.20–34.60	9.80	4.80–21.27	16.90	5.85–32.55
Australian capital territory private	6.80	3.44–18.21	9.86	5.20–21.40	9.68	4.19–23.92
IRSAD						
Middle three quintiles	9.60	4.00–31.80	9.61	5.20–20.60	14.20	5.39–41.21
Most advantaged quintile	9.20	3.81–28.80	9.32	5.06–19.20	13.40	5.50–35.33
Most disadvantaged quintile	8.40	3.79–24.80	8.80	5.00–17.39	12.21	5.00–32.50
Missing (n = 10,016)	13.00	4.60–55.35	10.00	5.23–23.00	30.40	10.24–100.00
Remoteness						
Major Cities of Australia	9.32	3.95–29.10	9.20	5.00–19.20	13.60	5.6.0–36.39
Inner regional Australia	9.00	3.80–28.49	9.20	5.12–18.80	12.80	5.00–34.00
Outer regional Australia	8.39	3.76–26.00	9.30	5.17–19.60	13.00	5.00–36.20
Remote Australia	6.45	3.20–18.63	9.40	5.06–18.93	12.59	5.65–31.66
Very remote Australia	8.00	3.49–27.22	9.47	4.80–17.40	11.00	3.89–30.03
Missing (n = 9,886)	13.00	4.60–55.45	10.00	5.20–23.13	30.89	10.40–100.00
Employment status						
Full-time	9.58	4.00–30.40	9.20	5.00–19.00	13.60	5.79–36.00
Part-time	9.00	3.75–29.40	9.60	5.30–20.00	18.08	6.25–55.00

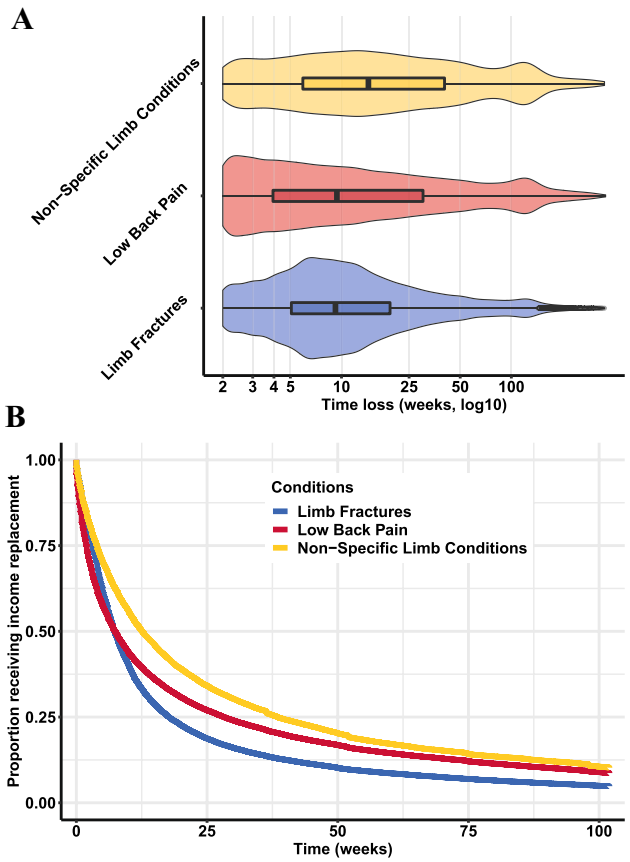

Fig. 2 Visual representations of work-related time loss. **a** Violin and box plots demonstrating the distribution of claims by time loss, and median and IQR or time loss, by condition, and; **b** cumulative survival curve of time loss (conditions are strata)

healing time contributes to the change in likelihood of claim resolution observed in the analysis.

Other observed patterns of time loss may be explained by policy factors. For example, there was a notable distribution of claims for LBP and NSLC of approximately 100 weeks' time loss. This is likely due to the cessation of benefits at two years (104 weeks) in several workers' compensation schemes. These "short-tail" schemes do not offer benefits beyond a set period unless a workers' claimed condition renders them sufficiently impaired [10]. Inter-jurisdictional differences in time loss were reflected in all conditions. These differences align with previous research that provides several policy-level explanations. For example, some jurisdictions require employers to pay up to the first 10 business days of a workers' claim [9, 10, 26]. This analysis excluded claims of less than two weeks duration to standardise the time loss periods, which may have skewed the median time loss for all conditions to a longer duration. Finally, workers' compensation schemes may take longer to determine the eligibility of claims for LBP compared to claims for more physically apparent conditions, such as LF. Increased time taken to process and approve claims may have therefore affected time loss duration. [39].

The higher rate of LBP in older workers aligns with previous research [40]. However, the incidence of claims for work-related LBP does not necessarily reflect the incidence of work-related LBP. For example, lower claim rates in one jurisdiction do not necessarily mean that it is safer, and may instead indicate differences in system eligibility criteria, cultural or local norms, or health literacy [26]. The higher rate of claims for LBP in more physically demanding occupations may indicate a link between physically demanding work and LBP. However, this link has previously been debated elsewhere [41]. It may be that workers are more likely to lodge a claim for LBP if they have a physically demanding occupation because LBP limits their ability to perform their normal duties.

Strengths and Limitations

This study benefited from a large, population-wide sample, and data that incorporated standardised coding systems (ANZSCO and TOOCS) that have been validated in multiple prior studies [9, 19, 20, 39, 42, 43]. The use of quantile regression provides new insights into time loss in this population. The analytic techniques used provide new prognostic insight in the compensated time loss setting, by understanding the likelihood of time loss duration associated

Table 3 Quantile regression analysis

Quantile	Limb Fracture	Low Back Pain[b]			Non-Specific Limb Condition		
	Weeks[a]	Coef (weeks)[c]	95%CI	p	Coef (weeks)	95%CI	p
10th	2.75	− 0.59	(− 0.63, − 0.55)	0.00	− 0.19	(− 0.28, − 0.11)	0.00
25th	4.48	− 1.12	(− 1.20, − 1.05)	0.00	0.22	(0.06, 0.38)	0.01
50th	7.46	− 0.14	(− 0.31, 0.03)	0.12	3.18	(2.80, 3.55)	0.00
75th	16.22	7.02	(6.42, 7.61)	0.00	9.63	(8.60, 10.65)	0.00
90th	48.53	15.62	(14.31, 16.94)	0.00	12.29	(10.87, 13.71)	0.00

[a]Calculated with all covariates set at reference values

[b]Adjusted for sex, age group, occupation, jurisdiction, SES, remoteness, and employment status

[c]Coefficient and confidence interval are interpreted as additional/less weeks' time loss

with each of the three included conditions at different times, rather than simply the pooled likelihood of time loss duration. There were also several limitations to this study. Firstly, there was missing data for some variables, and denominator data for all variables was not available. Despite extensive data cleaning and quality assurance, the NDS may contain errors. Furthermore, multiple claims for one worker could not be detected, comorbidities are not collected in the dataset, and it was possible that some conditions included in the data were misclassified. Injury classification (such as nature or location) is performed by workers' compensation schemes, and may be subject to data entry errors. Several implausible conditions (e.g., tennis elbow in the hip) were identified and removed during data cleaning. Higher-level TOOCS codes (e.g., muscle and tendon diseases) were used to absorb this possible misclassification. However, this may have led to a cohort definition that was too clinically broad; an upper LF and lower LF are likely to have different effects on a person's mobility. However, we believe that even with such limitations the analyses captured the overall important trends.

Conclusion

As in the general population, LBP is also a prevalent musculoskeletal symptom in compensated Australian workers. Compared to LF and NSLCs, the risk of a claim for LBP is greater and LBP claims have a higher likelihood of a longer duration claim when workers are away from work for more than seven weeks. The findings of this study should reiterate to clinicians, claims managers, and workers' compensation schemes the importance of returning a worker claiming for LBP to work as soon as possible, to reduce the risk of chronicity and the challenges this poses. Published literature has previously reported estimates of predictors of working time loss and disability duration averaged over an entire study period. This study has clearly demonstrated that future research involving working time loss would benefit from using time-dependent models such as quantile regression. Additional studies determining whether predictors of time loss other than claimed condition vary in effect over time would also be beneficial [36, 40].

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Compliance with ethical standards

Conflict of interests The authors declare no competing interests.

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