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Association between workers' compensation claim processing times and work disability duration: Analysis of population level claims data

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ABSTRACT

Delays in workers' compensation claim processing (CP) times have been associated with reduced recovery and delayed return-to-work. This study aimed to (1) determine the injury, worker, and workplace factors associated with CP delays and (2) investigate whether CP delays are associated with longer disability duration after adjusting for these factors. Retrospective cohort analysis of Australian workers' compensation claims was conducted from 1st July 2009 to 30th June 2016 for objective (1) and to 30th June 2014 for objective (2). CP times were derived by calculating differences in days between: injury and lodgement dates (lodgement); lodgement and decision dates (decision) and; injury and decision dates (total). All CP times were shorter for younger workers and those with fractures or traumatic injury, and longer for those with neurological or mental health conditions, and other diseases. Claims from self-insured employers had shorter decision times. With increasing lodgement, decision and total time there was significantly higher hazard of longer disability duration. Findings suggest the need for more efficient claims management to ensure fewer barriers to claim lodgement or approval. This in turn should reduce disability duration and ensure improved return-to-work outcomes.

1. Introduction

There is an interaction between systems that administer health-related services and benefits, such as workers' compensation (WC), and health status [1]. Health can be influenced both by the nature of the services and benefits provided and the way those services and benefits are administered. Systems for supporting people with work-related injury and illness can be characterised as cause-based or disability-based. Cause-based systems typically require a link between work circumstances and the resulting injury. Disability-based systems provide benefits and services regardless of cause [2]. Both approaches involve administrative decision-making by a government authority or an organisation acting on its behalf.

In order to access the Australian cause-based WC systems, injured workers must first notify their employer of their injury. The employer is then required to lodge the claim with an insurer, who will then assess the claim and make a decision regarding whether the claim should be accepted and benefits provided. In some cases, the insurer can commence payment of income benefits or healthcare whilst a decision is being made on the claim, known as provisional liability.

Delays in the time taken during this process (herein referred to as claim processing times) may contribute to negative health and work outcomes [3,4]. Such delays have been associated with chronic disability among workers with a low back pain condition [3] and longer disability durations [5,6]. Additionally, stress from these delays has been linked to greater disability, higher incidence of anxiety and depression, and lower quality of life up to six years post-injury among traumatically-injured individuals [4].

It is likely that both claim processing times and return-to-work (RTW) outcomes are affected by the characteristics of the worker, their workplace and their injury. For example, more complex conditions or those less obviously related to the circumstances of work may require a longer period for claim decision making, and may also have longer periods of work absence (such as mental health conditions) [7]. The employer and workplace also have important roles to play, both prior to making a claim, and during the claim [8,9]. Workers with strong workplace supports may find both that their employers lodge claims quickly (affecting the time from injury to insurer decision) and that they are offered workplace accommodations (affecting RTW) [10,11]. Injured workers who did not have concerns about making a WC claim had odds of RTW up to 3.1 times that of those with concerns [8]. Similarly, lack of collaboration and

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understanding from the employer, including lack of provision of modified duties and/or work environments, can be an obstacle for RTW [12,13]. Ongoing encouraging contact from colleagues has also been identified as an important facilitator to RTW [9].

Older workers may have a greater number of comorbid health conditions that complicate the claim decision making process, because insurers may need to differentiate between pre-existing conditions and injury/illness acquired at work [14]. Those same comorbidities can contribute to delayed recovery periods and longer periods of time off work [14,15]. Other factors that have been shown to affect disability duration include level of education, sex, occupation, and industry [16–18].

In our study, we are initially interested in what factors are associated with claim processing delays. Furthermore, it is important to determine whether claim processing delays and disability durations are related. Unlike prior studies which have examined the relationship between this exposure and outcome, this study incorporates analysis of the psychosocial confounders that are known to impact on work disability duration.

Therefore, the first objective for this study is to determine what injury, worker, and workplace factors are associated with claim processing delays. The second is to investigate whether claim processing delays are associated with longer disability duration after adjusting for these factors.

2. Methods

2.1. Setting

In July 2009, the start point for this study, Australia had a labour force of approximately 10.8 million workers [19]. The vast majority were covered by compulsory WC insurance regulated by state, territory and Commonwealth government authorities. Eight of the eleven major Australian WC systems are included in this study, including New South Wales (NSW), Victoria (VIC), Queensland (QLD), South Australia (SA), Western Australia (WA), Tasmania (TAS), the Northern Territory (NT) and the Australian Capital Territory private (ACT). Three Commonwealth schemes for federal government employees, maritime workers and defence services personnel were not included. All of the included jurisdictions share the objective of returning injured and ill workers to work at minimal cost to society. However, each of the included jurisdictions differ with respect to the types of injuries/illnesses for which benefits will be provided, and the nature of benefits and services available, summarised previously [20].

At the time of this study, the process of making a work-related injury claim is largely consistent between jurisdictions. Workers who have incurred an injury at work and are intending to claim must provide their employer and/or their insurer, information about their injury. This information, captured on a claim form, must be accompanied by a medical certificate from a qualified medical practitioner (e.g. general practitioner). The employer must then notify the claims management organisation within a specified time. The claims management organisation usually has a period of time to accept or deny the claim in line with the legislation. In some jurisdictions it is possible for claims to be lodged and approved over the phone [21]. The claims management organisation may be the government regulatory authority, or more commonly is a private sector insurer acting as an agent for the government regulator.

Each jurisdiction has legislative provisions that describe expectations for aspects of claim processing. Summarised in Appendix 1 in Supplementary materials [22], they usually include:

1 a limit on the time between date of injury and the worker notifying the employer that an injury has occurred (herein referred to as worker reporting time);
2 a limit on the time between an employer being notified by the worker of their injury and the employer lodging a claim with the insurer (employer reporting time); and
3 a limit on the time between an insurer receiving notification of a claim by the employer and the insurer making a decision to accept or deny liability for the claim (insurer decision time).

These legislative provisions are intended to ensure that workers access system benefits and services within timeframes that support RTW and recovery, while providing sufficient time for insurers to make informed decisions regarding liability.

2.2. Data source

Australian WC authorities contribute case-level claims data to the National Data Set for Compensation-based Statistics (NDS) every year, standardised for national-level comparability [20]. At the time of analysis, this dataset contained 4,363,267 cases from 1st July 2004 to 30th June 2016. The NDS includes information pertaining to the workers' compensation claim such as worker characteristics (e.g. age, sex, injury type), workplace characteristics (e.g. occupation, self-insurer status) and claim characteristics (e.g. number of hours compensated, jurisdiction). Each entry represents one claim.

2.3. Selection criteria

To address the research aims, we established two cohorts. The first cohort, used to address the first aim, consisted of all claims lodged and accepted from 1st July 2009 to 30th June 2016 including both medical expense-only claims (those that were only compensated for medical/other expenses) and time loss claims (those cases in which compensation had been provided for at least 1 day of income support for working time lost and medical/other expenses). Claims were restricted to those from workers aged 15–80 years. Claims prior to 1st July 2009 were excluded as there were inconsistencies with coding standards between jurisdictions.

The second cohort, used to address the second aim, was a subset of the first, restricted to time loss claims lodged from 1st July 2009 to 30th June 2014, providing a minimum of two years' follow-up of for every claim. In both cohorts, cases missing outcome or predictor information were removed.

2.4. Outcomes

The first cohort outcome was claim processing times. The NDS provides three key dates related to the claim lodgement and initial decision making process: date of accident (or injury/illness onset); date of claim lodgement; and date of insurer decision. Claim processing time variables were derived by calculating the number of days between these three dates: lodgement time (accident to claim lodgement), insurer decision time (claim lodgement to decision) and total time (accident to decision) variables (see Appendix 2 in Supplementary materials). These were the outcomes of interest for the first study aim and have been used previously [5,23]. Worker reporting time and employer reporting time could not be analysed as date of report to employer was not consistently recorded across jurisdictions.

For the second cohort, the outcome was cumulative compensated time loss, or disability duration, measured as the cumulative number of weeks of compensation paid. Cumulative compensated time loss has been demonstrated to be the most reliable estimate of the duration of work disability when using administrative data [24].

This was calculated by dividing the number of hours compensated by the pre-injury weekly working hours, producing the number of compensated weeks [20]. Pre-injury weekly working hours are usually the average hours over the previous 52 weeks, however if employed for less than one year these are calculated based on the amount of time employed in that role.

2.5. Predictors and confounders

The predictors for the first cohort, where the outcomes were claim processing times, were biopsychosocial factors that were in the NDS, described below. In the second cohort, where the outcomes were disability duration, these became confounders. Workers were grouped into ten-year age brackets from 15 to 54 and a group from 55 to 80 years, based on age at the time of claim lodgement. Occupation was classified into one of the nine major groups defined by the Australian and New Zealand Standard Classification of Occupations [25]. Industry was classified according to the Australian and New Zealand Standard Industrial Classification [26]. Condition type used a modified version of the Type of Occurrence Classification Systems version 3.1 in order to account for within and between jurisdiction coding changes and differences [27]. Variables were derived for remoteness and socio-economic status using postcode of residence, applying the Australian Statistical Geography Standard and Index of Relative Socio-economic Advantage and Disadvantage respectively [28,29]. A full-time work status indicated the claimant worked at least 35 h per week pre-injury. Jurisdiction indicated the compensation system in which the worker lodged a claim. An employer was considered a self-insurer if flagged as such in the dataset. For analysis of the first cohort, claims were categorised as either medical only or time loss claims.

For analysis of the second cohort, each of the claim processing times (lodgement time, decision time and total time) were included as predictors of disability duration, and were the main exposures of interest. Based on inspection of the data, each was categorised into less than five days, five to nine days, 10–19 days, 20–29 days and more than 30 days.

2.6. Analysis

2.6.1. Cohort one (claim processing times as outcome)

Injured worker and claim characteristics were summarised using frequencies and proportions. Median claim processing times were reported with interquartile ranges. Predictor variables were tested for association with claim processing times using Mann-Whitney U for dichotomous variables, Kruskal-Wallis for categorical variables (>2 categories) and Spearman rank for ordered categorical variables. There was no evidence of multicollinearity when it was assessed using Variance Inflation Factor (threshold of 2.5). All predictors were significantly associated with claim processing times in univariate analyses and hence were included in all Cox regression models. Due to non-independence of observations within each jurisdiction, standard errors in the regression models were adjusted for clustering (using the clustered sandwich estimator in Stata 15.1) to account for intragroup correlation. Three models were calculated for each claim processing time (lodgement, insurer decision, and total). Results were presented as hazard ratios with p-values < 0.01 considered significant.

2.6.2. Cohort two (disability duration as outcome)

The frequencies and proportions of the characteristics of injured workers were calculated. Median disability durations including interquartile ranges were also calculated. Using Mann-Whitney U, Kruskal-Wallis and Spearman rank tests, predictor variables were tested for their association with disability duration. Multicollinearity was also examined but not observed. Four Cox regression models were run: model 1 included only lodgement time as a predictor; model 2 decision time and; model 3 total time. To determine which claim processing time had the greater effect on disability duration, both lodgement and decision time categories were included in Model 4. Worker and claim-related predictors with significant associations in any univariate analyses were included in all regression models, which took into account clustering by jurisdiction, as detailed earlier.

2.7. Ethics

This study received ethics approval from Monash University Human Research Ethics Committee on 8 October 2014 (CF14/2995 – 2014001663).

3. Results

There were 1,668,928 claims included in cohort one and 751,424 claims in cohort two. Consistent with previous studies, in both cohorts males were overrepresented and the most common condition type was musculoskeletal (Table 1) [30]. The majority of claimants were from major cities and around 90% were claims managed by government regulators or their agents. In cohort one, 60.8% of claims resulted in some compensated time loss.

Neurological conditions, mental health conditions and other diseases had the longest median claim processing times. Managers, professionals and clerical and administrative workers consistently had longer claim processing times. Scheme-managed claims had longer median lodgement and decision times than self-insured claims. Claims processed in the state of Victoria had the longest median lodgement time, yet one of the shortest decision times. Queensland had the shortest median total time.

Table 2 describes the results from three separate multivariate Cox regression models with each claim processing time as the outcome (lodgement, decision and total time). To determine which factors were significantly associated with claim processing times, all variables were included. Hazard ratios greater than one indicate that claim processing times are more likely to be less than the reference group, and vice versa. Younger workers and those with fractures or traumatic injuries had shorter claim processing times, while neurological, mental health, and other disease conditions were predictive of longer claim processing for all times. Education and Training, Health Care and Social Assistance, Public Administration and Safety, and Transport, Post and Warehousing industries had the longest lodgement and total times. 'White collar' occupations of managers, professionals and clerical and administrative workers had longer lodgement and decision times than labourers.

Medical-only claims had significantly longer lodgement times (HR 0.73 [0.63, 0.85]), while self-insurers had significantly faster insurer decision times (HR 1.06 [1.00, 1.13]).

Table 3 shows results from four distinct multivariate Cox regression models to determine the association of claim processing times with the outcome of disability duration, for each of the three claim processing times as well as a fourth model incorporating both lodgement and decision time. Hazard ratios greater than one indicate disability duration is likely less than the reference group. All models were adjusted for all other variables and are detailed in Appendix 3 in Supplementary materials. Survival curves for the first three models are displayed in Appendix 4 in Supplementary materials.

With increasing lodgement, decision and total time there was significantly higher hazard of longer time loss. For model 4 that controlled for both lodgement and decision time, the same pattern was

Table 1
Characteristics of each cohort, claim processing times and time loss duration.

	COHORT ONE (all claims)								COHORT TWO (time loss claims only)			
	N	Col %	Lodgement time (days)		Decision time (days)		Total time (days)		N	Col %	Disability duration (weeks)	
			Mdn	IQR	Mdn	IQR	Mdn	IQR			Mdn	IQR
Age group												
15-24 years	246887	14.8%	7	(2-16)	5	(2-9)	14	(8-32)	113651	15.1%	1.3	(0.6-4.8)
25-34 years	344185	20.6%	7	(3-20)	6	(2-13)	16	(8-42)	155323	20.7%	2.0	(0.6-7.8)
35-44 years	368322	22.1%	9	(3-23)	6	(2-20)	20	(9-56)	172116	22.9%	2.8	(0.8-11.6)
45-54 years	409967	24.6%	10	(4-28)	6	(2-24)	22	(10-70)	186631	24.8%	3.3	(0.9-13.4)
55-80 years	299567	17.9%	12	(4-35)	7	(2-27)	27	(11-85)	123703	16.5%	4.0	(1.0-15.0)
Sex												
Female	573927	34.4%	9	(4-25)	6	(2-22)	21	(10-60)	269832	35.9%	2.5	(0.8-11.6)
Male	1095001	65.6%	8	(3-23)	6	(2-15)	18	(8-53)	481592	64.1%	2.4	(0.8-9.8)
Condition type												
Fractures	105581	6.3%	7	(3-17)	5	(2-11)	16	(8-36)	59214	7.9%	6.8	(2.4-16.0)
Musculoskeletal	911088	54.6%	9	(4-24)	6	(2-19)	20	(9-55)	435783	58.0%	2.7	(0.8-11.8)
Neurological	67349	4.0%	56	(9-730)	10	(1-65)	129	(28-730)	13292	1.8%	4.0	(0.7-14.8)
Mental health conditions	76156	4.6%	21	(8-63)	27	(9-79)	74	(35-174)	35382	4.7%	12.1	(3.6-39.9)
Other traumatic	455757	27.3%	6	(2-16)	5	(1-8)	13	(7-29)	182676	24.3%	1.0	(0.4-3.4)
Other diseases	44714	2.7%	20	(7-59)	7	(3-34)	43	(17-116)	22037	2.9%	4.2	(1.9-8.0)
Other claims	8283	0.5%	6	(2-18)	6	(2-14)	16	(7-48)	3040	0.4%	1.5	(0.6-5.9)
Occupation												
Managers	81618	4.9%	12	(4-34)	7	(2-26)	26	(11-80)	33413	4.4%	3.2	(0.8-12.9)
Professionals	177523	10.6%	11	(4-28)	7	(3-24)	24	(11-68)	75425	10.0%	2.1	(0.6-9.6)
Technicians and Trade Workers	336625	20.2%	8	(3-24)	5	(2-13)	18	(8-50)	148127	19.7%	2.2	(0.6-8.6)
Community and Personal Service Workers	238527	14.3%	8	(3-21)	6	(2-20)	19	(9-51)	113829	15.1%	2.5	(0.8-10.6)
Clerical and Administrative Workers	87192	5.2%	11	(4-29)	7	(2-26)	24	(10-76)	39526	5.3%	2.4	(0.7-11.2)
Sales Workers	98836	5.9%	9	(4-23)	6	(2-15)	18	(9-50)	42930	5.7%	2.2	(0.7-9.2)
Machinery Operators and Drivers	244508	14.7%	8	(3-23)	6	(2-18)	18	(8-56)	109210	14.5%	3.1	(0.9-12.4)
Labourers	404099	24.2%	8	(3-22)	6	(2-15)	18	(8-50)	188964	25.1%	2.5	(0.8-10.3)
Remoteness												
Major cities of Australia	1136053	68.1%	8	(3-24)	6	(2-20)	20	(9-57)	512719	68.2%	2.4	(0.8-10.2)
Inner/outer regional Australia	500294	30.0%	9	(3-23)	6	(2-15)	19	(9-51)	225783	30.0%	2.7	(0.8-10.6)
Remote/very remote Australia	32581	2.0%	12	(5-28)	6	(2-13)	21	(11-52)	12922	1.7%	2.8	(1.0-10.0)
Socioeconomic status												
Least advantaged (IRSAD deciles 1-3)	419418	25.1%	8	(3-22)	6	(2-20)	19	(9-56)	190202	25.3%	2.7	(0.8-11.2)
Middle (IRSAD deciles 4-7)	753080	45.1%	9	(3-24)	6	(2-18)	19	(9-55)	340508	45.3%	2.5	(0.8-10.4)
Most advantaged (IRSAD deciles 8-10)	496430	29.7%	10	(4-26)	6	(2-17)	20	(9-56)	220714	29.4%	2.2	(0.7-9.4)
Employment status												
Part time	725842	43.5%	11	(4-29)	6	(1-18)	21	(10-62)	194748	25.9%	1.8	(0.7-8.0)
Full time	943086	56.5%	8	(3-21)	6	(2-18)	18	(9-50)	556676	74.1%	2.8	(0.8-11.0)
Self-insurer status												
Self-insurer	166962	10.0%	7	(3-18)	4	(1-13)	15	(7-41)	65413	8.7%	1.8	(0.6-6.4)
Scheme managed	1501966	90.0%	9	(3-25)	6	(2-19)	20	(9-57)	686011	91.3%	2.6	(0.8-10.8)
Industry group												
Secondary industries[1]	441961	28.0%	8	(3-25)	6	(2-15)	19	(8-56)	193666	27.1%	2.6	(0.8-10.4)
Primary industries[2]	91586	5.8%	10	(4-27)	6	(2-16)	20	(9-61)	37104	5.2%	4.2	(1.2-13.8)
Public administration and safety	115256	7.3%	8	(3-22)	6	(1-22)	19	(8-57)	49043	6.9%	2.3	(0.8-9.4)
Transport, postal and warehousing	121219	7.7%	8	(3-21)	6	(2-19)	18	(8-50)	59729	8.4%	3.0	(0.9-12.0)
Wholesale trade, retail trade and hospitality[3]	315159	20.0%	8	(3-23)	6	(2-15)	18	(9-50)	144243	20.2%	2.1	(0.7-9.0)

Table 1 (*Continued*)

	COHORT ONE (all claims)								COHORT TWO (time loss claims only)			
	N	Col %	Lodgement time (days)		Decision time (days)		Total time (days)		N	Col %	Disability duration (weeks)	
			Mdn	IQR	Mdn	IQR	Mdn	IQR			Mdn	IQR
Education and training	104712	6.6%	11	(4-27)	7	(2-23)	23	(11-65)	42725	6.0%	1.5	(0.6-7.2)
Health care and social assistance	216016	13.7%	9	(3-22)	7	(3-22)	21	(10-54)	107746	15.1%	2.7	(0.8-11.6)
Other services[4]	172551	10.9%	8	(3-25)	6	(2-20)	20	(9-59)	79100	11.1%	2.2	(0.7-10.2)
Type of claim												
Medical only	654595	39.2%	12	(4-36)	6	(2-17)	22	(10-73)				
Time loss	1014333	60.8%	7	(3-19)	6	(2-18)	18	(9-46)				
Jurisdiction												
New South Wales	667952	40.0%	5	(2-13)	7	(3-28)	14	(8-62)	275259	36.6%	2.0	(0.6-8.2)
Victoria	305296	18.3%	25	(14-55)	4	(0-23)	36	(20-82)	123669	16.5%	5.4	(1.2-19.8)
Queensland	312294	18.7%	6	(2-13)	4	(1-9)	12	(7-23)	219313	29.2%	2.0	(0.6-7.8)
South Australia	114052	6.8%	7	(3-22)	8	(5-43)	25	(11-83)	39571	5.3%	4.6	(1.2-17.8)
Western Australia	198422	11.9%	14	(7-30)	5	(2-12)	24	(13-60)	70975	9.4%	2.7	(0.8-12.1)
Tasmania	49277	3.0%	10	(4-21)	4	(1-11)	17	(9-43)	15116	2.0%	3.0	(1.0-9.0)
Northern Territory	17085	1.0%	15	(7-35)	6	(2-10)	23	(14-46)	6660	0.9%	4.2	(1.2-14.0)
Australian Capital Territory	4550	0.3%	7	(2-21)	5	(0-20)	18	(7-48)	861	0.1%	4.2	(1.0-15.8)

Note: [1] includes Manufacturing & Construction industries; [2] includes Agriculture, Forestry and Fishing & Mining Industries; [3] includes Wholesale Trade & Retail Trade & Accommodation and Food Service Industries; [4] includes Electricity, Gas, Water and Waste Services & Information Media and Telecommunications & Financial and Insurance Services & Rental, Hiring and Real Estate Services & Professional, Scientific and Technical Services & Administrative and Support Services & Arts and Recreation Services & Other Service Industries. Mdn is median, IQR is interquartile range.

Table 2
Regression results using claim processing times as the outcome (cohort one).

	Lodgement time			Decision time			Total time		
	HR	95% CI	p-value	HR	95% CI	p-value	HR	95% CI	p-value
Age group									
15-24 years	1.28	(1.19-1.36)	<0.001	1.23	(1.19-1.28)	<0.001	1.34	(1.27-1.40)	<0.001
25-34 years	1.19	(1.16-1.22)	<0.001	1.14	(1.12-1.17)	<0.001	1.22	(1.19-1.25)	<0.001
35-44 years	1.08	(1.07-1.09)	<0.001	1.06	(1.05-1.07)	<0.001	1.08	(1.07-1.09)	<0.001
45-54 years	Ref			Ref			Ref		
55-100 years	0.96	(0.95-0.97)	<0.001	0.95	(0.93-0.97)	<0.001	0.95	(0.92-0.97)	<0.001
Sex									
Male	Ref			Ref			Ref		
Female	0.96	(0.94-0.97)	<0.001	0.97	(0.95-0.98)	<0.001	0.94	(0.92-0.96)	<0.001
Condition type									
Fractures	1.20	(1.14-1.27)	<0.001	1.17	(1.02-1.35)	0.024	1.23	(1.10-1.36)	<0.001
Musculoskeletal	Ref			Ref			Ref		
Neurological	0.36	(0.26-0.50)	<0.001	0.66	(0.53-0.82)	<0.001	0.37	(0.26-0.53)	<0.001
Mental health conditions	0.60	(0.56-0.65)	<0.001	0.59	(0.45-0.76)	<0.001	0.52	(0.44-0.62)	<0.001
Other traumatic	1.30	(1.23-1.38)	<0.001	1.34	(1.25-1.43)	<0.001	1.43	(1.35-1.51)	<0.001
Other diseases	0.62	(0.57-0.68)	<0.001	0.84	(0.80-0.88)	<0.001	0.66	(0.63-0.70)	<0.001
Other claims	1.16	(1.02-1.31)	0.022	1.11	(1.02-1.20)	0.018	1.13	(1.06-1.21)	<0.001
Occupation									
Managers	0.93	(0.85-1.03)	0.154	0.93	(0.88-0.97)	0.003	0.91	(0.84-0.99)	0.036
Professionals	0.97	(0.88-1.07)	0.559	0.92	(0.87-0.98)	0.008	0.92	(0.84-1.01)	0.070
Technicians and Trade Workers	0.95	(0.92-0.98)	0.005	1.01	(0.98-1.04)	0.642	0.97	(0.92-1.01)	0.130
Community and Personal Service Workers	1.03	(0.98-1.07)	0.252	0.97	(0.92-1.01)	0.109	0.97	(0.91-1.03)	0.298
Clerical and Administrative Workers	0.96	(0.90-1.02)	0.188	0.95	(0.93-0.97)	<0.001	0.93	(0.89-0.98)	0.003
Sales Workers	1.00	(0.94-1.07)	0.912	1.01	(0.96-1.06)	0.738	0.97	(0.91-1.04)	0.399
Machine Operators and Drivers	1.02	(1.00-1.05)	0.096	0.99	(0.97-1.00)	0.141	1.00	(0.97-1.04)	0.807
Labourers	Ref			Ref			Ref		
Remoteness									
Major cities of Australia	Ref			Ref			Ref		
Inner/outer regional Australia	0.98	(0.92-1.04)	0.527	1.08	(1.04-1.12)	<0.001	1.05	(1.02-1.07)	<0.001
Remote/very remote Australia	0.85	(0.70-1.04)	0.116	1.15	(0.97-1.36)	0.101	0.97	(0.85-1.12)	0.712
Socioeconomic status									
Least advantaged (IRSAD deciles 1-3)	1.04	(0.99-1.09)	0.083	0.96	(0.93-0.98)	0.000	1.00	(0.96-1.04)	0.904
Middle (IRSAD deciles 4-7)	Ref			Ref			Ref		
Most advantaged (IRSAD deciles 8-10)	0.96	(0.91-1.01)	0.141	1.03	(1.01-1.04)	0.001	0.99	(0.96-1.02)	0.636
Self-insurer status									
Self-insurer	1.19	(0.88-1.61)	0.246	1.06	(1.00-1.13)	0.037	1.27	(1.07-1.50)	0.007
Scheme managed	Ref			Ref			Ref		
Employment status									
Part time	0.93	(0.73-1.18)	0.564	1.00	(0.95-1.06)	0.916	1.00	(0.88-1.14)	0.997
Full time	Ref			Ref			Ref		
Type of claim									
Medical only	0.73	(0.63-0.85)	<0.001	1.01	(0.74-1.39)	0.940	0.82	(0.61-1.09)	0.176
Time loss	Ref			Ref			Ref		
Industry group									
Secondary Industries[1]	Ref			Ref			Ref		
Primary Industries[2]	0.98	(0.85-1.14)	0.820	0.92	(0.85-1.00)	0.051	0.92	(0.82-1.03)	0.152
Public Administration and Safety	1.13	(1.02-1.25)	0.024	1.02	(0.96-1.08)	0.572	1.12	(1.07-1.18)	<0.001
Transport, Post and Warehousing	1.11	(1.04-1.17)	0.001	1.02	(1.00-1.05)	0.073	1.06	(1.00-1.13)	0.045
Wholesale Trade, Retail Trade and Hospitality[3]	1.03	(0.96-1.11)	0.368	1.02	(1.00-1.03)	0.061	1.02	(0.96-1.07)	0.580
Education and Training	1.14	(1.08-1.21)	<0.001	1.03	(0.93-1.13)	0.592	1.12	(1.05-1.19)	0.001
Health Care and Social Assistance	1.17	(1.10-1.24)	<0.001	1.07	(1.04-1.11)	<0.001	1.15	(1.07-1.23)	<0.001
Other Services[4]	1.05	(0.99-1.12)	0.104	0.99	(0.98-1.01)	0.316	1.03	(0.98-1.08)	0.301

Note: [1] includes Manufacturing & Construction industries; [2] includes Agriculture, Forestry and Fishing & Mining Industries; [3] includes Wholesale Trade & Retail Trade & Accommodation and Food Service Industries; [4] includes Electricity, Gas, Water and Waste Services & Information Media and Telecommunications & Financial and Insurance Services & Rental, Hiring and Real Estate Services & Professional, Scientific and Technical Services & Administrative and Support Services & Arts and Recreation Services & Other Service Industries. HR is hazard ratio, CI is confidence interval. HR < 1 indicates more time. HR > 1 indicates less time.

seen, where longer claim processing was associated with longer duration of time loss (decreasing HR with increasing lodgement and decision times). Inclusion of both exposures in model 4 had minimal attenuating effects on the hazard ratios demonstrated in separate exposure analyses in models 1 and 2. In the fully-adjusted model, hazard ratios were for the most part larger among decision times when comparing equivalent durations.

4. Discussion

This study found that a range of worker, workplace and injury factors predict both WC claim processing times and disability duration. These findings provide evidence that administrative processes that occur in response to an injury (in this case represented as WC claim processing) have a strong, independent association with

Table 3
Descriptive characteristics for claim processing times and regression results using disability duration as the outcome (cohort two).

	Model 1					Model 2					Model 3					Model 4		
	N (%)	Mdn (IQR)	AHR	95% CI	p	N (%)	Mdn (IQR)	AHR	95% CI	p	N (%)	Mdn (IQR)	AHR	95% CI	p	AHR	95% CI	p
Lodgement time																		
Up to 5 days	254222 (33.8%)	1.5 (0.6-6.0)	Ref													Ref		
5-9 days	166225 (22.1%)	2.0 (0.6-7.6)	0.91	(0.86-0.96)	0.001											0.89	(0.85-0.94)	<0.001
10-19 days	141251 (18.8%)	2.9 (0.9-11.0)	0.78	(0.72-0.84)	<0.001											0.76	(0.69-0.84)	<0.001
20-29 days	67655 (9.0%)	4.0 (1.0-14.4)	0.70	(0.64-0.76)	<0.001											0.68	(0.61-0.77)	<0.001
30+ days	122071 (16.2%)	7.6 (2.0-26.8)	0.56	(0.50-0.63)	<0.001											0.58	(0.51-0.67)	<0.001
Decision time																		
Up to 5 days						309531 (41.2%)	1.7 (0.6-6.7)	Ref								Ref		
5-9 days						193650 (25.8%)	1.8 (0.6-6.6)	1.00	(0.95-1.05)	0.927						0.98	(0.94-1.01)	0.139
10-19 days						69967 (9.3%)	2.3 (0.8-9.0)	0.90	(0.84-0.97)	0.003						0.89	(0.82-0.97)	0.009
20-29 days						48766 (6.5%)	6.2 (1.4-23.2)	0.64	(0.54-0.77)	<0.001						0.70	(0.59-0.82)	<0.001
30+ days						129510 (17.2%)	8.6 (2.4-28.2)	0.56	(0.48-0.67)	<0.001						0.57	(0.48-0.67)	<0.001
Total time																		
Up to 5 days											61784 (8.2%)	1.2 (0.5-4.2)	Ref					
5-9 days											154155 (20.5%)	1.2 (0.5-4.4)	0.99	(0.97-1.01)	0.466			
10-19 days											183280 (24.4%)	1.7 (0.6-6.2)	0.85	(0.77-0.94)	0.001			
20-29 days											93436 (12.4%)	2.4 (0.8-9.0)	0.72	(0.61-0.84)	<0.001			
30+ days											258769 (34.4%)	6.8 (1.8-23.6)	0.50	(0.42-0.58)	<0.001			

Note: AHR means that all hazard ratios are adjusted for age group, sex, condition type, occupation, industry, remoteness, socioeconomic status, employment status, self-insurer status and jurisdiction. A full model with HRs for all variables can be found in Appendix 3. Mdn is median, IQR is interquartile range. p is the p-value. CI is confidence interval. HR < 1 indicates more time. HR > 1 indicates less time.

injury outcomes, in this case measured as disability duration, even after accounting for a number of confounders.

The findings add further weight to a growing evidence base describing the impact of insurance claims handling practices on worker health and RTW outcomes. For example, a systematic review of qualitative studies of interactions between injured workers and insurers identified that insurer processes can exacerbate or generate psychological symptoms, and that this can negatively affect the workers' re-integration into the workforce [1]. An Australian cohort study reported that stressful claims experiences and delays in insurer decision are associated with greater incidence of disability, depression and anxiety in traumatically injured claimants six years after the claim [4]. A Swedish study identified that helpful encounters between workers and insurance claims managers can facilitate RTW [31]. Another systematic review identified that specific insurance processes and events including delays in decision making can influence worker health and RTW outcomes [32]. Our findings also assist in moving this field from the now well-established finding that 'compensation is bad for health' [33] towards identifying the mechanisms underlying this effect. Specifically, there appear to be opportunities to improve worker outcomes and reduce disability duration through more efficient claim processing by workers, employers and insurers.

Examining each aspect of the claim lodgement and decision process provides a more nuanced understanding of this phenomenon. With respect to claim lodgement, claims from self-insured employers were not significantly different in lodgement time, yet required significantly less time to make a decision, and had shorter disability durations. Given that self-insurers are generally large employers that satisfy particular financial requirements, it is possible they have more capability to return injured workers to alternative roles or on modified duties, or have more experienced RTW and rehabilitation service providers than smaller employers. Medical-only claims took longer to lodge than time loss claims, yet a faster claim decision was made. It is possible medical-only claimants were unaware they could claim when work is not interrupted, and hence delayed claim lodgement. Alternatively, they may not be able to claim until they have passed the medical excess thresholds that exist in most Australian WC jurisdictions, providing a structural impediment to claiming.

Claim lodgement times may be delayed due to the worker questioning whether to lodge a claim, whether their claim would be accepted or whether their condition was severe enough or due to lack of awareness of eligibility [34,35]. Additionally, injured workers may not be provided with adequate information on how to make a claim [36], or may be reluctant to report an injury depending on benefit generosity, reporting obligations, and injury-related factors [37], contributing to stress and/or anxiety which can complicate the claims process and prolong work absence. Having concerns about making a claim has been significantly associated with lower odds of RTW, and workers claiming for a mental health condition are significantly more likely to have concerns [8]. In some jurisdictions, employers have incentives to report injuries to insurers faster, which may have had moderate success [23].

Delays in insurer decision time may be due to investigation of the claim, including seeking the opinion of an independent medical examiner (IME), unavailability of all necessary information, or disputes. Seeking IMEs are more likely to occur in people with complex conditions who are also more likely to have longer disability duration. An Ombudsman report found that insurers were intentionally delaying decisions to improve claim numbers by hoping claimants give up on the claims due to the drawn out decision [7]. Qualitative findings suggest that insurer decisions are biased towards accepting independent medical examinations that they have commissioned, rather than those commissioned by a worker or their representative, which can contribute to greater distress in the injured worker [7]. Experiencing delays to insurer decision-making within compensation systems has been shown to be a stressful process that can impair both physical and mental health, and can lead to ongoing and long-term chronic disability, mental health issues, and lower quality of life [3,4]. Early intervention such as medical treatment can mitigate the negative consequences of work injury, such as claim costs, time off work, and health outcomes [6,38,39]. Barring the availability of provisional liability, a drawn-out insurer decision can delay access to treatment, prolonging recovery and duration of disability. Allowing some treatment provision during claim decision, particularly for complex cases, may reduce disability duration in accepted claims.

Provisional liability grants injured workers access to treatment and compensated time off work prior to claim acceptance, if claim lodgement or acceptance are not conducted within a set time period. Three jurisdictions had provisional liability in the study period: New South Wales, South Australia, and Tasmania. This has the potential to alter the results. However, it is uncertain how many workers were actually affected, much less what the effect would be. Early intervention with injured workers is accepted as an effective means of improving injured worker outcomes [40], but it may also relax decision-making on the part of insurers [23,41]. Even where provisional liability provides early intervention, it does not preclude the negative effects of treatment and time off work being provided on a precarious basis, as they may be suddenly withdrawn if the claim is rejected, which may inhibit recovery and RTW. Regardless, it would be worthwhile within those jurisdictions that allow provisional liability to undertake analyses to determine how many cases are affected and its effect on disability duration and decision time.

Some prior studies support our finding of a relationship between claim processing and disability duration [42]. For example, among a large cohort of injured workers in Victoria, Australia, Cocker et al. [5] found delays to claims lodgement and decision were predictive of greater likelihood of having at least one year of compensated time loss [5]. Sinnott [3] studied claims from workers with low back pain and found that administrative delays over 2 weeks, in particular claim acceptance, were associated with higher odds of the worker developing chronic disability [3].

Three condition-related factors were more associated with delays to both lodgement and decision time than any other worker or workplace factors: neurological conditions, mental health conditions, and other diseases. Claims for these conditions present complexities for insurers in that they can be both difficult to diagnose and to attribute to circumstances of work, particularly if there is evidence of pre-existing conditions or if there are conflicting opinions. Such cases tend to comprise a small proportion of all claims, yet account for a substantial portion of insurer liability and burden of disability [7]. Furthermore, it can be difficult to pinpoint a date of injury among these conditions as well as some musculoskeletal disorders, as their causes are often the result of repeated or chronic exposures to hazardous conditions or harmful substances. The recorded injury date may be subject to recall bias, or represent the date that the individual first sought medical attention for their condition. Such delays to claim processing will also possibly contribute to disability in these complex claims, thus exacerbating an already complex and prolonged recovery.

Our findings suggest that many of the same factors predict delays in both claim lodgement and decision time. While this suggests they are different manifestations of the same unmeasured construct, e.g., claim complexity, we found that delays in either time period were independent predictors of disability duration when including both types of delays in the same model and predictors of those delays themselves. This suggests that there may be benefits from interventions that target any of the parties involved in the claims lodgement process: workers, employers and insurers.

There are few studies of interventions to shorten the claims process. One exception is an evaluation of legislated employer incentives to notify insurers of a claim within a few days of being notified, introduced in the states of SA and TAS in 2009 and 2010 respectively, that found significant reductions in claim lodgement time in both jurisdictions [23]. However, there was also a significant increase to decision time in TAS and evidence of a similar effect in SA, possibly due to an increased administrative burden, resulting in a minimal change to total time.

The major strength of this study was that it utilised a large national dataset that includes all major state and territory-based WC jurisdictions in Australia. This dataset records multiple worker, injury, demographic, claim and employer factors that were included in regression models, allowing for adjustment of factors known to affect disability duration.

Further, these study findings extend existing conceptual models of work disability. For example, the Loisel [43] model is widely accepted as a model for work disability, yet lacks a time-based element [43]. This study shows that at least the insurance/compensation parts of this model are both independent and temporally distinct from other factors. Awareness of all aspects of work disability is necessary for full understanding of the factors that affect this, and hence this study provides a useful extension of this model and advances understanding.

There are some limitations associated with this study. Whilst a valuable source of data, administrative datasets are not collected for the purposes of research and hence carry some limitations [24]. Calculation of claim processing times were reliant on the accuracy of recorded dates. Furthermore, lodgement time is the sum of both worker reporting time (to the employer) and employer reporting time (to the insurer), thus we could not distinguish where delays were occurring. Lastly, we were unable to account for other potential contributors to disability duration such as injury/illness severity, comorbidities, bodily location, and healthcare, as the NDS does not routinely collect this information. Such factors could conceivably drive both longer claim processing times and disability duration. However, we would expect such omitted confounders to be common causes of delays in both lodgement and decision times, particularly if they increase claim complexity. With such unmeasured confounders, we would expect collinearity between lodgement and decision time. The result would be that the model including both as predictors of disability duration would exhibit substantial attenuation in effects and increased error in estimates compared to those that evaluated them separately. This is not what we found. Both lodgement and decision time effects were robust in terms of significance, size, and width of confidence intervals, though there was some attenuation of effect among the longest delays. This suggests that some common causes of delay at the extremes are plausibly attributable to case complexity. Otherwise, the effects were robust, indicating strong independent associations of lodgement and decision time on disability duration. Another unmeasured potential confounder is injury severity. However, this is unlikely to have a major effect. The most severe injuries are generally reported [44] and likely processed more quickly, which would mean a dampening of the effect since the association would run the opposite way: more severe injury leads to earlier lodgement/decision leads to longer disability duration. Further, previous research has found that the effects of decision delay on disability duration are robust to adjustment for injury severity [3].

5. Conclusion

To our knowledge, this is the first study to describe the factors that are associated with claim processing delays in WC systems, as well as demonstrate that claim processing delays are independent predictors of disability duration. The magnitude of the relationship between claim processing times and disability duration was as large as, or larger than, that observed for other factors that have been shown to affect disability duration.

Findings from this study suggest the need for targeted management of claims so that claims likely to experience claim processing delays (e.g. mental health or neurological claims) are prioritised for greater focus in claims management systems than "simpler" claims in which there are fewer barriers to claim lodgement or approval (e.g. younger workers, traumatic injury). Claim processing times are modifiable [23] and therefore reducing these times could reduce the disability arising from work-related injury supporting earlier returns to work.

Ethics

Ethics approval was obtained from the Monash University Human Research Ethics Committee on 8 October 2014 (CF14/2995 – 2014001663).

CRediT authorship contribution statement

Shannon E. Gray: Conceptualization, Methodology, Formal analysis, Data curation, Writing - original draft, Writing - review & editing. **Tyler J. Lane:** Conceptualization, Writing - review & editing. **Luke Sheehan:** Conceptualization, Writing - review & editing. **Alex Collie:** Conceptualization, Methodology, Supervision, Writing - review & editing, Funding acquisition.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.healthpol.2019.06.010.

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