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Variation in General Practice Services Provided to Australian Workers with Low Back Pain: A Cross-Jurisdictional Comparative Study

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Abstract

Purpose: To compare the frequency of General Practitioner (GP) services and the time between first and last GP services (service duration) provided to workers with low back pain (LBP) between four Australian workers' compensation jurisdictions. *Methods*: Retrospective cohort study using service level data collated from the Australian states of Western Australia, South Australia, Victoria and Queensland. Negative binomial regression was used to compare GP service volume between jurisdictions in workers with accepted LBP compensation claims. Quantile regression was used to compare GP service duration. Models were adjusted for sociodemographic factors and occupation. Analyses were repeated in four cohorts with progressively more restrictive cohort definitions to account for the influence of jurisdictional policy variation in employer excess, service delivery and maximum time-loss benefit duration. *Results*: The study sample included 47,185 time-loss claims accepted between July 2010 and June 2015, that were linked with 452,391 GP services. Workers with LBP in Queensland recorded significantly fewer GP services funded and recorded significantly shorter average service duration than in other states. This pattern of jurisdictional variation was evident in all four cohorts, but was attenuated when cohorts excluded short- and long duration claims. In the final, most restricted cohort statistically significant adjusted incidence rate ratios of 1.47–1.60 were observed in Victoria, South Australia and Western Australia, while these states recorded additional service duration of 4.3–20.7 weeks at the median. *Conclusion*: There is significant variation in provision of GP services to injured workers with LBP between four Australian workers' compensation jurisdictions. Administrative requirements for time-based provision of work capacity certificates by medical practitioners may be contributing to service variation.

Keywords Low back pain · General practice · Workers' compensation · Health service use · Comparative study

Introduction

General Practitioners (GPs) play multiple important roles in the care of workers who become ill or injured at work. The GP plays a role in diagnosis, facilitating and co-ordinating treatment and rehabilitation, and in providing advice to workers and other parties involved in recovery and the return to work process. Within cause-based workers' compensation schemes such as those operated by Australian states and territories, GPs have a number of additional administrative and regulatory roles. These include responsibility for certifying the work-relatedness of injury or illness (i.e. medical certification), and the capacity of workers to engage in work (i.e. functional capacity assessment) [1].

There is now substantial evidence describing how the interplay of clinical and administrative responsibilities can influence GP practices including approaches to medical certification [1] and willingness to provide treatment to injured workers [2], and also how GP/worker interactions can affect the health and return to work of injured workers [3, 4]. General Practitioners are typically the first point of contact with the healthcare system for injured workers in cause-based compensation schemes. One study in the Australian state of Victoria observed that GPs write more than 94% of initial medical certificates among workers making compensation claims involving time lost from work [5].

Low back pain (LBP) is a leading cause of disability, particularly among people of working age [6] [7]. Loss of work due to LBP has substantial social, economic and personal consequences [8]. In most people LBP resolves within

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weeks, however a subset of workers experience longer-term symptoms, and this can contribute to longer periods of time off work [9]. Low back pain is the most common musculoskeletal condition seen by GPs in Australia [10], and one of the most common conditions leading to workers' compensation claims [11].

General practitioners play a central role in the delivery of care to people with LBP in Australia. This is recognised in existing models of care which broadly replicate global evidence-based care standards for LBP as outlined in numerous international clinical practice guidelines [12]. This involves taking a biopsychosocial approach to assessment, risk stratification and management, including patient education, emphasis on continuing to participate in daily activities including work, and non-pharmacologic management. Some diagnostic procedures and treatments are not recommended unless certain clinical features suggest serious pathology. The knowledge of Australian GPs of these evidence-based standards has been reported to be low [13]. Despite the central role of GPs in workers' compensation schemes and in the management of LBP, as well as the high prevalence of LBP in workers, there have been few quantitative studies examining the delivery of GP care to injured workers with accepted workers' compensation claims for LBP. Quantitative studies of injured workers have examined patterns of medical certification [5, 14], and more recently the continuity of care provided by GPs [15]. There remain substantial gaps in our knowledge of some fundamental concepts, such as the frequency and duration of services provision by GPs to workers with LBP.

While clinical practice guidelines emphasise the role of GPs in the management of LBP [16], service provision in a workers' compensation environment may be influenced by non-clinical factors, such as the administrative and regulatory standards required of healthcare practitioners including GPs. Cross-jurisdictional comparative studies provide a unique opportunity to understand the impact of these factors on service provision. For example, where compensation scheme policy requires the injured worker to produce evidence of functional capacity limitations on a regular basis (e.g. every 28 days) in order to continue receiving benefits, we might expect to observe a higher number of GP services than in jurisdictions without such requirements. Conversely, we might expect to observe a lower number of GP services in jurisdictions that allow other healthcare practitioners to provide certificates of capacity.

In this exploratory study we present analysis from a recently developed service level database including data captured in multiple Australian workers' compensation jurisdictions. The study seeks to compare the frequency of GP services, and the time between first and last service (herein referred to as service duration), provided to injured workers with LBP between four Australian workers' compensation jurisdictions. We interpret findings with respect to the policy variation between jurisdictions, and how this variation may affect access to, frequency and duration of service use.

Methods

Setting

Australian workers who incur a work-related injury or illness and who require time off work for treatment and recovery are eligible to apply for income support, medical treatment and rehabilitation benefits through one of the nation's geographically defined workers' compensation schemes. There are eleven major workers' compensation schemes in Australia. Eight of these are operated by the state and territory governments and provide coverage for the majority of workers within each state/territory. There are also three national schemes that cover federal government workers, large interstate employers, the military, and maritime workers. While all workers' compensation schemes provide income replacement benefits and fund healthcare services, there are differences between each scheme with respect to eligibility for benefits and services, and the nature and duration of benefits paid to workers and services funded on behalf of workers. We have described the similarities and differences between the Australian workers' compensation schemes in detail elsewhere [17], including jurisdictional variation in benefit duration, and these differences are also summarised by the Australian government agency Safe Work Australia in a document updated annually [18]. One notable difference is with respect to the waiting period, sometimes also called the employer excess period, between injury onset and eligibility for accessing income support benefits. In the states of Victoria and South Australia during the study period, most workers were able to access income support after a period of two weeks of lost working time, whereas in other states the waiting period is one day. In practice this means that workers with more 'severe' work-related injury or those with longer-term functional impairment enter the Victorian or South Australian schemes than in other schemes. There are also jurisdictional differences with respect to the duration for which income benefits can be paid. In Queensland benefits reduce substantially after 104 weeks, and at this time point it is possible for insurers to pay future remaining benefits as a single lump sum to finalise the claim. In Victoria benefit periods end for all except the most seriously injured workers at 130 weeks. In Western Australia and South Australia (during the period of this study), benefits ceased at the age of eligibility for the aged pension.

In all of the Australian schemes, access to workers' compensation benefits requires certification from a medical doctor. In almost all injured workers except a small proportion

whose injuries result in acute hospital admission, these certificates are provided by GPs. The vast majority of workers' compensation claims resolve with a return to work within weeks post injury. Some workers may seek access to income support, treatment and rehabilitation for longer periods of time. In these cases, workers' compensation insurers may require additional evidence of lost work capacity, in the form of certificates of capacity. Rules regarding which healthcare practitioners can provide such certificates, and the time interval between certificates, vary between jurisdictions [18].

Data Source

This study uses the Monash University Multi-Jurisdictional Workers' Compensation Database. This database contains de-identified administrative claims and medical payment data from workers with accepted musculoskeletal disorder claims. For this study data are provided by scheme administrators from three jurisdictions (Victoria, South Australia, Western Australia) and one large insurer with approximately 80% state coverage (Queensland). Included claims from Queensland have a date of claim acceptance from July 1st 2010 to June 30th 2015, while those from other jurisdictions have a date of injury ranging from July 1st 2010 to June 30th 2015. Conceptually, the database incorporates two main datasets that are linked with a claim level linkage key. First, the claim level dataset includes information about the injured worker (e.g. age, sex, nature of injury), their claim (date of claim lodgement, date of acceptance, working time loss), working circumstances (e.g. occupation, employer size, industry) and their socio-economic characteristics derived from postcode level data (e.g. remoteness index, index of relative advantage/disadvantage). The claim level data has one record for each workers' compensation claim made by a worker in the five-year inclusion period. Second, the service level dataset includes information about each episode of medical or rehabilitation services, and income payments, made by the compensation scheme during the course of each claim. For medical services, this includes information about the service provider (i.e. medical specialty of provider, de-identified provider number and provider postcode), the date of service (i.e. start date, end date), and the nature of service being provided (e.g. professional consultation, imaging, report). The database has been previously described [19].

General Practitioner services were classified as either 'patient interaction' or 'other' services. 'Patient interaction' services were defined as services in which there is direct interaction between the GP and the worker. This included both in-person, in-clinic appointments and telemedicine or remote appointments. 'Other' services included report writing, review of reports or programs, prescription dispensing, or payments for patient non-attendance at a scheduled appointment or examination.

Inclusion Criteria

For this study, we included cases of LBP resulting in an accepted time loss claim (i.e. those involving at least one day of compensated time off work) from the workers' compensation schemes in the states of Queensland, Victoria, Western Australia and South Australia. These four states represent 63% of the national labour force [20]. Low back pain conditions were defined using Nature of Injury and Location of Injury codes from the national standard Type of Occurrence Classification System (TOOCS; Supplementary Table 1). Medical-only claims (i.e. those involving only reimbursement for medical expenses) were excluded as records were not provided in two of the four jurisdictions. For this analysis, we included only GP/patient interaction services, and only GP services that occurred between 3 months before and 24 months after claim acceptance, noting that in some Australian jurisdictions funding for healthcare services can precede claim acceptance, or service payments incurred by workers or employers can be reimbursed retrospectively upon claim acceptance.

In previous studies we have described the impact that differences in policy between jurisdictions may have on claim outcomes, such as disability duration [21, 22]. Common policy differences include the medical excess (i.e. the amount of medical care that needs to be incurred before the scheme assumes financial responsibility), the services payment period (i.e. the duration for which the scheme will fund medical services), the employer excess (i.e. the number of lost time days for which the employer is responsible for providing income support) and the maximum time loss benefit period (i.e. the duration for which workers can receive time loss benefits). Detailed policy variations between Australian workers' compensation schemes are described elsewhere [18]. Medical services not paid for by the scheme (i.e. those within the medical excess amount) are not recorded in the data and cannot be adjusted for. However, the duration of service provision, employer excess and time loss benefit periods can be controlled through cohort selection. To investigate the influence of these policy differences on GP service use outcomes, we examine four cohorts each with a modified and increasingly more restrictive and standardised cohort definition:

(1) Cohort 1 includes claims with at least one day of recorded income support payment within the study period. For each claim all GP services occurring from 3 months prior to 24 months after claim acceptance (i.e. standardisation of service period).

(2) Cohort 2 includes only those claims with at least 2 weeks of time loss. Claims from Victoria and South Australia with any income support payments were considered to have met this criterion as the first two weeks' time loss are paid by the employer and so do not appear in the administrative data. Western Australia and Queensland do not have employer excess periods, so claims with 2 weeks or less income support payments were excluded from Cohort 2 in these jurisdictions. For each claim GP services occurring from 3 months prior to 24 months after claim acceptance were included (i.e. standardisation of employer excess and service period).
(3) Cohort 3 includes the same claims as Cohort 2, but excludes GP services that occurred before 2 weeks of time loss were accrued. This approach seeks to further standardise the counting of GP services to the beginning of the time loss period.
(4) Cohort 4 further restricts the claims included in Cohort 3 to those in which time loss benefits have ceased within the 104-week follow-up period. This removes very long duration claims (those > 104 weeks) that may be associated with a higher number of services due to the length of claim or duration of ongoing pain symptoms [23].

Outcomes

As this is an exploratory study we defined two high level indicators of service provision in order to assess the volume of services provided to workers with LBP and the duration for which workers with LBP were receiving GP services during the course of the workers' compensation claim.

(1) Service Volume. This was calculated as the count of patient interaction GP services funded by the workers' compensation scheme for each claim.
(2) Service Duration. This was calculated as the time (in weeks) between the first and last patient interaction GP service funded by the workers' compensation scheme for each claim. This was only calculated for claims with more than one GP service record.

Covariates

Estimates were adjusted for a number of covariates that have been shown to influence work disability outcomes and health service provision in prior studies. Sex was available as male or female only. Age was categorised into 10-year age bands. Occupation was classified using the Major Groups of the Australian and New Zealand Standard Classification of Occupations [24]. Postcode of residence was mapped to the Index of Relative Socio-economic Advantage and Disadvantage [25] to measure socioeconomic quintile and to the Accessibility and Remoteness Index of Australia [26] to measure remoteness.

Data Analysis

Outcomes were described using the mean, standard deviation and quartiles for each jurisdiction and for all jurisdictions combined, in each of the four cohorts. Differences in service volume per claim between jurisdictions were analysed using negative binomial models, with outcomes reported as Incidence Rate Ratio (IRR) with 95% confidence intervals. Differences in service duration between jurisdictions were analysed using quantile regression. The outcome for quantile regression models was defined as duration of service at the 25th, 50th and 75th percentiles. The coefficient values from the quantile regression reflect the additional weeks service duration in that jurisdiction compared to the reference jurisdiction. Covariates (as defined above) were chosen from the variables available in the administrative data set that were hypothesised to confound the relationship between jurisdiction and GP service use, and were available in the harmonised administrative database. Separate models were calculated for each of the three cohorts. Queensland was defined as the reference jurisdiction for all models, as it was the jurisdiction with the largest volume of included cases. All statistical analysis was performed using Stata 16 [27].

Results

General Practitioner Service Volume

Figure 1 shows the count of workers by volume of services in each of the four cohorts. This demonstrates visually the impact of our cohort standardisation approaches on service volume. All cohorts display a long tail, with a small number of claims having a high volume of services. Cohort 1 includes a large number of claims with none or low service volumes. In Cohort 2 the number of claims with low service volumes is reduced. In Cohort 3 the overall volume of services is reduced, but there are a large number of claims with zero services, an increased number with 1–3 services and a smaller number with 50 + services. The pattern for Cohort 4 reflects Cohort 3 however the number of claims with very high service volumes (> 50) is reduced.

Table 1 provides a descriptive summary of GP service volume for each jurisdiction and for all jurisdictions combined. The results of negative binomial models are also shown in this table.

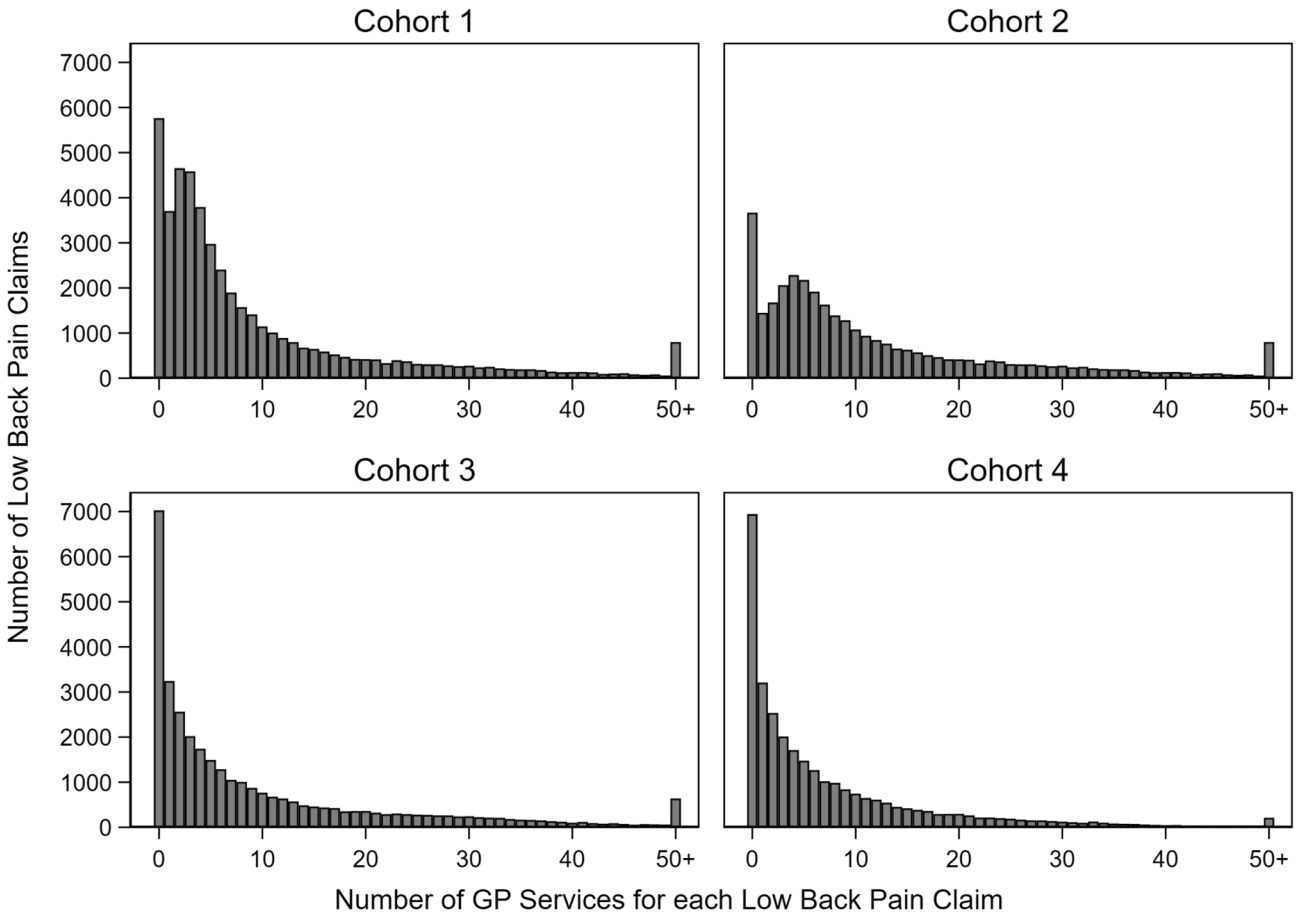

Fig. 1 Number of GP services for each low back pain claim, by cohort

Cohort 1

A total of 47,185 time-loss claims were included across all four jurisdictions. These claims were linked with 452,391 GP services. Across all four included jurisdictions, the mean (standard deviation) number of GP services was 10 [12], the median was 5 with quartiles of 2 and 12. We observe large variation between jurisdictions in service volume, with means ranging from 6 in Queensland to 15 in South Australia. In the negative binomial model, South Australia (IRR 2.51, 95% CI: 2.42–2.61), Victoria (IRR 2.30, 95% CI: 2.24–2.36), and Western Australia (IRR 1.93, 95% CI: 1.88–1.98) all recorded significantly greater service volumes relative to Queensland.

Cohort 2

There were 33,601 claims in this cohort and an associated 414,268 GP services. Restricting the cohort to claims of at least two weeks' time-loss increased the mean service volume in all jurisdictions. Across all four included jurisdictions, the mean (standard deviation) number of GP services was 12 [14], the median was 7 with quartiles of 3 and 17. There remains significant variation between jurisdictions, ranging from a mean of 9 in Queensland to a mean of 15 in South Australia. In the negative binomial model, the IRR of service volume were lower than those observed in Cohort 1, but remained significantly larger in Western Australia (1.65, 95% CI: 1.60–1.71), South Australia (1.63, 95% CI: 1.56–1.70) and Victoria (1.49, 95% CI: 1.45–1.54) relative to Queensland.

Cohort 3

There were 33,601 claims in this cohort, and 337,434 GP services included in analyses. When services occurring more than two weeks after the claim acceptance date were excluded the mean number of GP services per claim overall reduced to 10, with a median of 5 and quartiles of 1 and 14. As per Cohort 1 and Cohort 2, we observed large variation between jurisdictions, ranging from a mean of 6 in Queensland to means of 13 in Victoria and South Australia. In the negative binomial model, the IRR increased from that observed in Cohort 2, with significantly larger IRR in

Table 1 Descriptive summary and results of negative binomial model for General Practitioner service volume

GP Service Volume per Claim	Descriptive Statistics							Negative Binomial Models[a]			
Cohort 1	N claims	N services	Mean	SD	p25	p50	p75	IRR	LCI	UCI	p
All Jurisdictions	47,185	452,391	9.6	12.4	2	5	12				
Queensland	19,683	109,423	5.6	6.7	2	3	7	1.00 (ref)			
Victoria	11,714	156,799	13.4	15.9	1	7	22	2.30	2.24	2.36	< 0.001
South Australia	4425	66,518	15.0	16.2	4	9	21	2.51	2.42	2.61	< 0.001
Western Australia	11,333	119,651	10.6	11.7	3	6	14	1.93	1.88	1.98	< 0.001
Cohort 2	N	N services	Mean	SD	p25	p50	p75	IRR	LCI	UCI	p
All Jurisdictions	33,601	414,268	12.3	13.6	3	7	17				
Queensland	9975	85,723	8.6	8.1	4	6	11	1.00 (ref)			
Victoria	11,714	156,799	13.4	15.9	1	7	22	1.49	1.45	1.54	< 0.001
South Australia	4425	66,518	15.0	16.2	4	9	21	1.63	1.56	1.70	< 0.001
Western Australia	7457	105,228	14.1	12.9	5	9	20	1.65	1.60	1.71	< 0.001
Cohort 3	N	N services	Mean	SD	p25	p50	p75	IRR	LCI	UCI	p
All Jurisdictions	33,601	337,434	10.0	13.3	1	5	14				
Queensland	9975	56,755	5.7	7.5	1	3	8	1.00 (ref)			
Victoria	11,714	149,549	12.7	15.6	0	6	21	2.15	2.07	2.23	< 0.001
South Australia	4425	55,629	12.6	15.8	1	6	18	2.03	1.93	2.14	< 0.001
Western Australia	7457	75,501	10.1	12.3	1	5	15	1.80	1.72	1.88	< 0.001
Cohort 4	N	N services	Mean	SD	p25	p50	p75	IRR	LCI	UCI	p
All Jurisdictions	30,185	228,772	7.6	10.2	1	4	10				
Queensland	9882	54,333	5.5	7.1	1	3	8	1.00 (ref)			
Victoria	9568	81,082	8.5	11.6	0	4	12	1.48	1.43	1.54	< 0.001
South Australia	3730	32,165	8.6	11.6	1	4	12	1.47	1.39	1.55	< 0.001
Western Australia	7005	61,192	8.7	10.7	1	5	13	1.60	1.53	1.67	< 0.001

[a]Regression models also adjusted for sex, age, occupation, socioeconomic quintile, and remoteness

Cohort 1 = all time loss claims

Cohort 2 = claims with at least two weeks' time loss

Cohort 3 = claims with at least two weeks' time loss with services restricted to those more than 2 weeks after claim acceptance

Cohort 4 = claims with at least two weeks but less than 104 weeks time loss with services restricted to those more than two weeks after claim acceptance

SD standard deviation, *p25* 25th percentile of distribution, *p50* median or 50th percentile of distribution, *p75* 75th percentile of distribution, *IRR* Incidence Rate Ratio, *LCI* lower confidence interval, *UCI* upper confidence interval

Victoria (2.15, 95% CI: 2.07–2.23), South Australia (2.03, 95% CI: 1.93–2.14) and Western Australia (1.80, 95% CI: 1.72–1.88) relative to Queensland.

Cohort 4

There were 30,185 claims in this cohort, and 228,772 services included in analyses. When claims with benefit durations exceeding 104 weeks were excluded, the mean number of GP services per claim overall reduced to 8, with a median of 4 and quartiles of 1 and 10. As per the first three Cohorts, we observed significant variation in GP service volume between jurisdictions, although regression models demonstrate that these differences were attenuated. We observe that the IRR was significantly larger in Western Australia (1.60, 95% CI: 1.53–1.67), Victoria (1.48, 95% CI: 1.43–1.54) and South Australia (1.47, 95% CI: 1.39–1.55) compared with Queensland.

In Supplementary Figs. 1–4 we present histograms of service volume for each Cohort by each of the four jurisdictions. The shape of the service distribution becomes increasingly similar between jurisdictions from Cohort 1 to Cohort 4, as the cohort standardisation methods are progressively applied. Queensland records a shorter tail in the service distribution across all of the Cohorts, with the other states recording long-tailed distributions. Supplementary Fig. 1 demonstrates the impact of claim eligibility and benefit duration policy on service volumes. The states of Victoria and South Australia record 3.3% and 5.0% claims as having 50 or more GP services, respectively, whereas Queensland has a negligible number of claims with 50 or more GP services.

Table 2 Descriptive summary of General Practitioner service duration overall, and for each jurisdiction

GP Service Duration (weeks)	Descriptive Statistics						
Cohort 1	N claims	N services	Mean	SD	p25	p50	p75
All Jurisdictions	37,717	448,687	29.3	34.7	4	12	45
Queensland	14,898	107,061	13.5	18.5	2	6	17
Victoria	8307	156,093	55.1	38.0	17	52	96
South Australia	4087	66,347	38.2	39.2	5	18	76
Western Australia	10,425	119,186	28.0	32.4	4	12	44
Cohort 2	N	N services	Mean	SD	p25	p50	p75
All Jurisdictions	28,484	412,820	36.9	35.6	7	21	63
Queensland	8946	85,286	19.4	20.8	5	12	26
Victoria	8307	156,093	55.1	38.0	17	52	96
South Australia	4087	66,347	38.2	39.2	5	18	76
Western Australia	7144	105,094	37.0	34.3	8	23	61
Cohort 3	N	N services	Mean	SD	p25	p50	p75
All Jurisdictions	23,335	334,193	39.9	35.3	9	27	72
Queensland	6690	55,503	19.9	21.0	5	12	27
Victoria	7992	148,805	55.0	37.1	18	54	95
South Australia	3287	55,193	43.3	38.6	8	27	88
Western Australia	5366	74,692	40.3	32.7	11	32	67
Cohort 4	N	N services	Mean	SD	p25	p50	p75
All Jurisdictions	20,036	225,565	31.4	29.9	7	20	49
Queensland	6600	53,084	19.0	19.5	5	12	26
Victoria	5906	80,367	42.5	33.7	12	33	72
South Australia	2611	31,730	29.9	30.9	6	16	48
Western Australia	4919	60,384	35.5	29.6	10	27	56

Claims with at least two GP services included only

Cohort 1 = all time loss claims

Cohort 2 = claims with at least two weeks' time loss

Cohort 3 = claims with at least two weeks' time loss with services restricted to those less than 2 weeks prior to claim acceptance

Cohort 4 = claims with at least two weeks but less than 104 weeks time loss with services restricted to those more than two weeks after claim acceptance

SD standard deviation, *p25* 25th percentile of distribution, *p50* median or 50th percentile of distribution, *p75* 75th percentile of distribution

General Practitioner Service Duration

Cohort 1

A total of 37,717 time-loss claims with at least two GP services were included in this cohort. These claims were linked with 448,687 GP services (Table 2). Across all four jurisdictions, the mean service duration was 29 weeks, with a median of 12 weeks and quartiles of 4 and 45 weeks. Between jurisdictions the mean service duration ranged from 13 weeks in Queensland to 55 weeks in Victoria. Quantile regression identified that service duration was significantly shorter in Queensland than in the other jurisdictions at all quartiles (Table 3). At the median the state of Victoria recorded an estimated 45.4 additional (95% CI: 43.2–47.6) weeks service duration relative to Queensland, South Australia an additional 10.7 weeks (95% CI: 9.0–12.4), and Western Australia an additional 6.3 weeks (95% CI: 5.6–7.0).

Cohort 2

There were 28,484 claims and 412,820 GP services included in this cohort overall. Restricting the cohort to claims of at least two weeks' time-loss increased the service duration overall and in each jurisdiction. Across all jurisdictions, the mean service duration was 37 weeks, a median of 21 weeks and quartiles of 7 and 63 weeks (Table 2). The mean service duration ranged from 19 weeks in Queensland to 55 weeks in Victoria. Quantile regression identified that service duration was significantly shorter in Queensland than the other three jurisdictions at all quartiles, with the exception of q25 in South Australia (Table 3). At the median the state of Victoria

Table 3 Difference in General Practitioner service duration between jurisdictions as estimated from quantile regression

Quantile	Queensland	Victoria		South Australia		Western Australia	
	Weeks[a]	Coef[b] (95% CI)	p Value	Coef[b] (95% CI)	p Value	Coef[b] (95% CI)	p Value
Cohort 1							
q25	2.2	14.5 (13.7, 15.3)	< 0.001	2.6 (2.2, 3.0)	< 0.001	1.8 (1.6, 2.0)	< 0.001
q50	6.0	45.4 (43.2, 47.6)	< 0.001	10.7 (9.0, 12.4)	< 0.001	6.3 (5.6, 7.0)	< 0.001
q75	18.4	77.0 (76.2, 77.8)	< 0.001	54.4 (48.4, 60.5)	< 0.001	27.7 (25.6, 29.7)	< 0.001
Cohort 2							
q25	5.1	11.6 (10.6, 12.6)	< 0.001	− 0.1 (− 0.5, 0.2)	0.50	2.8 (2.4, 3.2)	< 0.001
q50	12.3	39.6 (37.7, 41.6)	< 0.001	5.2 (4.1, 6.4)	< 0.001	12.3 (11.0, 13.5)	< 0.001
q75	28.2	68.2 (67.3, 69.0)	< 0.001	46.0 (41.6, 50.3)	< 0.001	35.6 (33.5, 37.7)	< 0.001
Cohort 3							
q25	5.1	12.5 (11.6, 13.4)	< 0.001	2.5 (1.8, 3.2)	< 0.001	5.9 (5.0, 6.9)	< 0.001
q50	13.4	40.7 (39.0, 42.4)	< 0.001	12.9 (10.8, 14.9)	< 0.001	20.1 (18.3, 22.0)	< 0.001
q75	30.4	66.0 (65.0, 67.0)	< 0.001	55.6 (50.9, 60.3)	< 0.001	40.1 (37.8, 42.4)	< 0.001
Cohort 4							
q25	4.8	7.3 (6.6, 7.9)	< 0.001	1.0 (0.4, 1.5)	< 0.001	4.9 (4.4, 5.4)	< 0.001
q50	11.4	20.7 (18.7, 22.8)	< 0.001	4.3 (3.1, 5.4)	< 0.001	15.7 (14.1, 17.3)	< 0.001
q75	27.0	44.9 (42.0, 47.7)	< 0.001	19.3 (16.9, 21.7)	< 0.001	30.9 (29.0, 32.8)	< 0.001

[a]Weeks lost at this percentile calculated at the reference value of categorical variables (male, 36–45 years, labourer, middle socioeconomic quintile, major city)

[b]Coefficient refers to difference in duration of care (in weeks) compared to those from Queensland

Cohort 1 = all time loss claims

Cohort 2 = claims with at least two weeks' time loss

Cohort 3 = claims with at least two weeks' time loss with services restricted to those less than 2 weeks prior to claim acceptance

Cohort 4 = claims with at least two weeks but less than 104 weeks time loss with services restricted to those more than two weeks after claim acceptance

Models were adjusted for sex, age, occupation, socioeconomic quintile, and remoteness

had an estimated 39.6 additional (95% CI: 37.7–41.6) weeks service duration, Western Australia an additional 12.3 weeks (95% CI: 11.0–13.5) and South Australia an additional 5.2 weeks (95% CI: 4.1–6.4), relative to Queensland.

Cohort 3

There were 23,335 claims with a total of 334,193 GP services included in this cohort. Relative to Cohort 2, when services occurring more than two weeks prior to the claim acceptance date were excluded, the mean service duration across all jurisdictions increased slightly to 40 weeks, with a median of 27 weeks and quartiles of 9 and 72 weeks (Table 2). The mean service duration ranged from 20 weeks in Queensland to 55 weeks in Victoria. Quantile regression identified that service duration was significantly shorter in the state of Queensland than the other three jurisdictions at all quartiles (Table 3). At the median Victoria had an estimated 40.7 additional (95% CI: 39.0–42.4) weeks service duration relative to Queensland, Western Australia an additional 20.1 weeks (95% CI: 18.3–22.0) and South Australia an additional 12.9 weeks (95% CI: 10.8–14.9).

Cohort 4

There were 20,036 claims with a total of 225,565 GP services included in this cohort. Compared with Cohorts 2 and 3, the duration of GP services per claim overall was shorter at 31.4 weeks, with a median of 20 weeks and quartiles of 7 and 49 weeks. The mean ranged from 19 weeks in Queensland to 43 weeks in Victoria (Table 2). As per the first three Cohorts, we observed significant variation in GP service duration between jurisdictions, although quantile regression models demonstrate that these differences were attenuated (Table 3). At the median Victoria had an estimated 20.7 additional (95% CI: 18.7–22.8) weeks service duration relative to Queensland, Western Australia an additional 15.7 weeks (95% CI: 14.1–17.3) and South Australia an additional 4.3 weeks (95% CI: 3.1–5.4).

Discussion

In this exploratory study conducted in four Australian workers' compensation jurisdictions, we observed large and significant inter-jurisdictional variation in two indicators of medical service provision to injured workers, after accounting for demographic, occupational and socioeconomic confounders that have been associated with service use and work disability outcomes. We consistently observe that workers with accepted workers' compensation claims for LBP in the state of Queensland had fewer GP services funded, and reported a shorter average service duration than workers with equivalent claims in the states of South Australia, Victoria and Western Australia. This pattern of jurisdictional variation was evident in each of four cohorts, defined with modified inclusion criteria in order to minimise the impact of policy-related cohort selection biases. The degree of inter-jurisdictional variation was attenuated by standardising the cohort to include only claims with at least two weeks' time loss (Cohort 2) and further attenuated by excluding claims with very long duration of time loss (Cohort 4), however large and significant jurisdictional variation persisted even with this standardisation.

There are multiple potential explanations for our findings. The inter-jurisdictional differences could reflect policy or practice variation between jurisdictions, methodological factors, some combination of these. It is possible that there are between jurisdiction differences that occur after claim acceptance that contribute to the observed differences in service provision (i.e. how the system treats workers). Examining the policy of the included workers' compensation jurisdictions with respect to GP service provision provides some support for this interpretation. For example, in the states of Victoria, Western Australia and South Australia, workers claiming time loss benefits are obligated to produce a certificate of capacity demonstrating ongoing work capacity limitations after 14 days for the first certificate of capacity, and every 28 days for subsequent certificates [28, 29]. In contrast, in the state of Queensland there is no time-limit on certificates of capacity provided by a medical practitioner, but doctors are required to nominate a timeframe for clinical review of the worker [30]. Thus, it is feasible that the administrative requirement for time-based medical certification is contributing to higher service volumes in the states of Victoria, South Australia and Western Australia.

Another possible explanation is that we have not fully adjusted for jurisdictional differences in claims eligibility (i.e. who is compensated). In prior studies we have reported that the 'severity' of injuries (as measured by the duration of time off work) in some Australian workers' compensation jurisdictions is greater because these jurisdictions do not accept workers with conditions that lead to time loss of less than 10 days duration [21]. To address this known issue, in this study we defined multiple cohorts with increasingly restrictive inclusion criteria to minimise biases introduced by cohort selection effects related to claims eligibility and benefit duration policy. We observe persistent and large inter-jurisdictional variation in cohorts to which we apply different censoring approaches.

Prior research has demonstrated a positive association between duration of pain experience and health service use [23]. Thus, one alternative explanation for our findings is that the LBP cohorts in some workers' compensation jurisdictions include workers' whose claims on average involve more severe and longer pain experiences. We addressed this by examining GP service use in standardised cohorts in which we remove both short-duration (i.e. less than 2 weeks' time loss) and very long-duration (i.e. > 104 weeks' time loss) claims (Cohort 4). Our observation that significant jurisdictional variation in service use remains even after applying this cohort standardisation suggests other factors are affecting service use.

Variation in service volumes and duration may also reflect differences in treatment and rehabilitation practices between jurisdictions. That is, better quality care may result in lower volume and duration care. While not a focus of the current study, it may be possible to derive indicators of care quality from administrative datasets that include service level data. For example, we have recently described the relatively high prevalence of diagnostic imaging among compensated Australian workers with LBP [19]. Prior studies have described how inappropriate diagnostic imaging may trigger unnecessary additional tests and treatments, which can complicate recovery [31]. Incorporating these indicators in future analyses may shed light on the impact of service quality on patterns of service use.

It is also possible that there is some uncontrolled confounding in our analyses, for example variations in the delivery of GP services between Australian states. This is a less likely explanation given that GP services are funded nationally and delivered locally: states and territories do not play a major role in primary care in the Australian setting.

General Practitioners have an important role in Australian workers' compensation schemes, and in the care of people with musculoskeletal conditions such as LBP. Most of the extant quantitative literature on GPs in workers' compensation schemes has focussed on their role in sickness certification, [e.g. [5, 14]]. To our knowledge, this is the first study examining the volume and duration of GP provided services to injured Australian workers with workers' compensation claims, and one of few internationally. Prior studies have observed higher prevalence of healthcare utilisation in compensated workers than in workers with LBP not receiving compensation [23]. However, knowledge of the relationship between the 'dose' of GP service provision

and worker and compensation scheme relevant outcomes such as injury recovery and return to work is very limited. In this context it is difficult to determine whether our findings indicate a high, moderate or low volume and duration of GP service use. On average, each worker in our sample had a GP service funded by the workers' compensation insurer on ten occasions during the course of their claim (Cohort 1). We also report a sample with a skewed distribution. Workers in the top 25% of claims (upper quartile) in our data for Cohort 1 had at least twelve GP services funded during the course of their workers' compensation claim (Table 1), and for these cases we observed a duration of service provision of at least 45 weeks (Table 2). This pattern of a small proportion of high-volume service users is consistent with studies of physiotherapy service use in Australian workers' compensation schemes [32].

An implication of our findings, though not directly tested, is that the total cost of general practice care provided to workers compensation claimants with LBP is lower in some jurisdictions than others. Australia's jurisdictional workers' compensation regulators set standard fee schedules for common medical services, including GP services. These fees are similar between jurisdictions. For example as at 1 July 2021 the reimbursed fee for a brief GP consultation was AUD$42 in Queensland and AUD$41.50 in South Australia. The lower service volume we observe in Queensland suggests that total expenditure on GP care in that state will be lower than in the other included jurisdictions.

As well as increasing the costs of care, too much medical service may present barriers to recovery and return to work. For example, we recently reported that injured workers with high GP service volume experienced lower continuity of care, and that lower continuity of care is associated with longer duration of work disability [15]. When injured workers with LBP consult multiple, different GPs during the course of their claim, they may be required to describe their pain experience repeatedly, and to justify the need for ongoing income support by demonstrating loss of functional capacity [8]. Evidence suggests that this can lead some workers to adopt a 'sick-role' that may contribute to delayed recovery [8, 33]. Considering the reported low adherence to best-practice guidance for management of LBP [34, 35], receiving care from multiple GPs may also increase the likelihood of receiving advice which is contrary to best-practice and this may delay or complicate recovery. There is a need for further research examining the relationship between GP service delivery and injured worker outcomes in the context of work disability schemes such as workers' compensation. This should include examination of factors contributing to service provision and service seeking, and the effectiveness of GP services in supporting return to work and injury recovery.

Our findings confirm that cohort selection has a large impact on estimates of injured worker service use, and thus that attempts to minimise the impact of policy-related selection biases are an important feature of cross-jurisdictional comparative research in work disability systems. Our findings also demonstrate that significant jurisdictional variations in service use persist despite attempts to minimise these biases through both cohort definition and by adjusting estimates for the effect of confounders.

Strengths and Limitations

In this study we analysed a large, novel data set incorporating both claim-level and service-level data, from multiple Australian workers' compensation jurisdictions. With these detailed service level data it was possible to examine outcomes that have not been previously described in Australian workers' compensation systems—specifically the volume and duration of GP service provision. Our study focuses on a group of workers with a well-defined condition whom account for a very large number of claims in cause-based workers' compensation schemes and whom may experience prolonged periods of disability following injury. Our study includes five years of data, enabling greater confidence in assessing outcomes and in our estimates, and includes national standardised definitions for key variables including nature of injury, occupation, industry, remoteness and advantage/disadvantage. We applied sophisticated regression models to our data to assess inter-jurisdictional variations, and estimated models in three different cohorts to evaluate and reduce the impact of cohort selection affects related to variations in jurisdictional eligibility policy. A key limitation is that our database only includes services funded by workers' compensation. This means that GP services funded by the worker or by other sources (e.g. employer) were unable to be included in analysis. Our covariates were limited to those available in the administrative claims data sets recorded by the jurisdictional workers' compensation regulators. There are likely a range of other factors that would influence service delivery, but which we are unable to assess. For example, what a GP service involved beyond simply an interaction with the patient. Harmonisation of datasets across multiple jurisdictions was a significant undertaking as described previously [19]. Substantial effort has been taken to reduce the influence of data entry error, missing or mislabelled data, however we cannot discount the potential influence of these factors on our estimates. Future studies of workers with LBP should also examine services other than those provided by GPs. It is likely that there is also a high volume of physical therapy and related services in these workers, and inclusion of this service data will provide a more comprehensive picture of healthcare delivery in Australian workers' compensation schemes.

Conclusion

This exploratory comparative study identifies significant variation in provision of GP services to injured workers with LBP between four Australian workers' compensation jurisdictions. This variation is attenuated when the cohort is standardised to account for cohort selection effects related to differences in workers' compensation eligibility policy and benefit duration settings, but remains large and statistically significant. Administrative requirements for time-based provision of work capacity certificates may be contributing to the higher volume and longer duration of GP services observed in three states compared to Queensland, where no such requirement exists. These findings warrant further investigation. Future studies should examine the relationship between the volume, timing, duration and quality of GP services and worker outcomes such as return to work and ongoing pain symptoms.

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Authors' Contributions AC conceived the study. LS and MDD contributed to study design. MDD, AC and LS conducted data cleaning and harmonisation. AC and LS developed the analysis strategy. LS conducted statistical analysis. AC drafted the manuscript. LS and MDD critically reviewed the manuscript. All authors approved the manuscript prior to submission.

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Data Availability Data used in this paper are not available for distribution by the authors.

Declarations

Conflict of interest Authors Alex Collie, Luke Sheehan and Michael Di Donato declare that they have no conflict of interest.

Ethical Approval This study received ethics approval from the Monash University Human Research Ethics Committee (MUHREC) (Project ID 17267, November 2018).

Consent to Participate All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Participant data were de-identified. Consent for use of data for research purposes is assumed when entering each of the workers' compensation schemes.

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