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Determinants of Physical Therapy Use by Compensated Workers with Musculoskeletal Disorders

Janneke Berecki-Gisolf · Alex Collie · Roderick J. McClure

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Abstract *Purpose* The study aim was to quantify physiotherapy service distribution among compensated workers with musculoskeletal disorders, and identify risk factors for under- and overuse. Andersen and Newman's model of service use determinants was adapted for a compensated population, to provide a conceptual basis for the analyses. *Methods* WorkSafe Victoria (Australia) workers' compensation claims were analysed retrospectively. Workers with musculoskeletal disorders resulting in at least 10 days off work were included if their claim commenced between 1-1-2001 and 1-1-2005 ($n = 36{,}995$). Physiotherapy use over 4 years of follow-up was determined from service payment data. Regression models were used relating individual level predictors, regional physiotherapist supply and the role of individual physiotherapists to service use. *Results* Physiotherapy was used by 26,026 (70 %) workers. Young age, male gender, working as a labourer, disorders of the joints, and not being hospitalised were associated with non-use. Use above the 90th percentile (>125 sessions over 4 years) was considered 'high use': high users accounted for 41 % of all use. Age 50–60, female gender, working as tradespersons, and substantial hospital costs were associated with high use. For workers living in the most disadvantaged areas, use was positively associated with supply. Negative binomial modelling of the role of physiotherapists indicated that service providers were associated with the number of sessions used. *Conclusions* Physiotherapy services were not underused, but a small group of patients had very high use. Recommendations to limit overuse should be aimed at physiotherapists, and these could include effective monitoring of adherence to proposed treatment plans.

Keywords Physiotherapy · Workers' compensation · Health service use · Musculoskeletal disorders

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Introduction

Work-related injury and illness constitute a substantial societal burden in terms of personal, social and economic costs. In Australia in 2009–2010, about 640,700 (5.3 %) of the 12 million people who were employed at some time during the preceding year experienced a work-related injury or illness [1]. The total amount paid by universal, no fault workers' compensation schemes in Australia in 2008–2009 was $6.9 billion, consisting of $3.8 billion of direct payments (incapacity benefits such as income replacement, permanent impairment lump sum entitlements and legal costs), $1.6 billion in medical and other services including rehabilitation and $1.5 billion insurance operational and administration costs [2].

The most common condition for which Australian workers' compensation claims are lodged are musculoskeletal disorders, (i.e., approximately 43 % of injury and disease-related claims [3]) and physiotherapy is the allied health service contributing to the largest portion of medical costs (approximately 17 % [4]). The role of physiotherapy in the management of musculoskeletal disorders is to help reduce pain, restore function and educate patients about how to manage their condition.

Optimal use of allied health services requires that they are provided to those who need them, and discontinued when the services no longer contribute to recovery. Perhaps the most widely cited, developed and discussed behavioural model of health services use was first presented by Andersen and Newman in 1973 [5, 6]. However, as this model was designed to facilitate equitable distribution of health services in the United States, the applicability of the original model to health service use behaviour in an Australian compensated workforce may be limited.

In Australia all jurisdictions have 'no-fault' workers' compensation schemes providing income replacement and coverage of medical costs to injured workers. Because under these schemes the injured worker does not have substantial out of pocket costs it would be expected that enabling factors such as household income contained in the Anderson and Newman model would be less likely to be an important driver of service use. Drivers not included in the original model are likely to be found within the definitions and regulations of the compensation scheme policy itself, i.e., boundaries regarding eligibility, choice of provider, and duration and intensity of use are set by the scheme. The interaction between the insurance schemes and health care providers may also play a role in service uptake and continued use as full medical coverage may provide an incentive for some health care providers to seek workers' compensation patients and to protract the services they provide [7]. Previous studies have shown that receiving workers' compensation was positively associated with physiotherapy use by individuals with lower back pain [8, 9], and that the cost per episode of care was higher for workers' compensation patients than for patients with other insurance sources [7]. Together, these findings suggest that determinants of service use for workers' compensation patients are distinct from those of other patients; service use drivers in this population need to be assessed in order to achieve equity in service use and optimal injury outcomes for workers.

The aims of this study were to quantify the distribution of physiotherapy services among compensated workers with musculoskeletal disorders, identifying non-users as well as over-users. Andersen and Newman's model of service use determinants was extended for application in a fully compensated population, and this was used as a conceptual basis for studying determinants of physiotherapy uptake and overuse. We hypothesised that despite reimbursement of the cost, physiotherapy services are not equitably distributed among compensated workers, and that service uptake is determined by individual level factors such as type and severity of the injury, but also by health service characteristics, such as supply of physiotherapists in the region. Furthermore we hypothesised that the health service provider plays a role in determining the intensity of physiotherapy use. In addressing the study aims, we provide insight into opportunities to prevent unwanted variation of physiotherapy services among compensated workers with musculoskeletal disorders.

Methods

Conceptual Model

In 1973, Andersen and Newman proposed a theoretical framework for health service uptake in the United States. The purpose of the model was to explain patterns in use that might assist the design of interventions to achieve equitable distribution of services [5]. The framework consists of societal determinants (including new technologies), health services system, and individual determinants of health services utilisation. Various uses for and additions to the model by others have been discussed by Andersen in 1995 [6]. In a fully compensated workforce, however, financial barriers to allied health service use are removed, under conditions set by the compensation system. We therefore suggest that for application in this particular setting the following additions would need to be made to the Andersen and Newman model.

1. *Compensation System* The key addition is the compensation system: eligibility for service reimbursement, service provider choices, duration and frequency of visits, and reimbursement caps are all determined by compensation scheme policy.
2. *Regulator* The compensation scheme (in Australia) as well as the health services system are regulated by the government: for example, WorkSafe's statutory obligations are spelt out in several acts of parliament such as the Accident Compensation Act 1985 [10] and the Accident Compensation (WorkCover Insurance) Act 1993 [11].
3. *Provider Incentives* A subset of compensated patients within a population of partially or non-compensated patients may create provider incentives of service utilisation: this theoretical component is added to the health services system
4. *Individual Incentives* Compensation scheme policy may give rise to novel service use incentives for the individual. For example, within the WorkSafe Victoria scheme, a Certificate of Capacity is needed if the injured workers has time off work or needs to work modified duties. The initial certificate needs to be completed by a medical practitioner, but an ongoing Certificate of Capacity can be completed by a physiotherapist, chiropractor or osteopath [12]: this may provide an individual incentive for allied health service use. Pending common law claims may also provide an incentive to continue treatment for the injury.

Thus we have developed a model (Fig. 1) based on Andersen and Newman's framework enhanced with proposed drivers specific to a compensation environment, to explain allied health service use in a compensated population of injured workers. In this study, the proposed model serves as a conceptual aid for analysing physiotherapist use among compensated workers with musculoskeletal disorders. Only parts of the model are applied to the data, and it is not the purpose of this study to validate the full model. It is anticipated that other parts of the conceptual model will be tested in other studies using different data sets. For example, the impact of compensation scheme factors can be analysed in future studies with a mixed dataset of compensated and non-compensated patients and societal influence can be later explored by looking at changes in uptake over the time period in which technology and societal norm transitions took place.

In this study, drivers of allied health service use are examined (Fig. 1). The *type* of allied health service is physiotherapy, and the *unit of analysis* is the number of sessions. No distinction is made based on the type of therapy offered or the practice site, other than that the study is limited to practices within the state of Victoria, Australia. The model determinants explored in this study are *need* and *predisposing factors* (individual level determinants), and physiotherapy supply as a measure of *resources* (health service system). The role of physiotherapists in the uptake of services is also examined, to gain insight into the possible effects of *provider incentives* (health service system); i.e., is the total number of services used dependent on the choice of provider.

Study Population and Setting

WorkSafe Victoria provides workers' compensation insurance for employers. Following a workplace injury or disease, workers may be eligible to receive income replacement, and medical and rehabilitation expenses, regardless of who was at fault. For medical and like expenses, an excess of around AU$630 must be paid by the employer and further costs are paid by WorkSafe. Approximately 85 % of the Victorian workforce receive workers' compensation from WorkSafe Victoria. The other 15 % are either sole traders (who do not need to register for workers' compensation in Victoria), employees of self-insurers, or workers covered under the Comcare workers' compensation scheme (mainly federal government employees).

Data Sources

This study was based on the Compensation Research Database (CRD) held by the Institute for Safety, Compensation and Recovery Research in Melbourne, Australia. The CRD contains WorkSafe workers' compensation administrative claims data with information on the occupation and industry, worker demographics, injury type, claim cost and records of payments made. The payments data include details of every WorkSafe reimbursed health

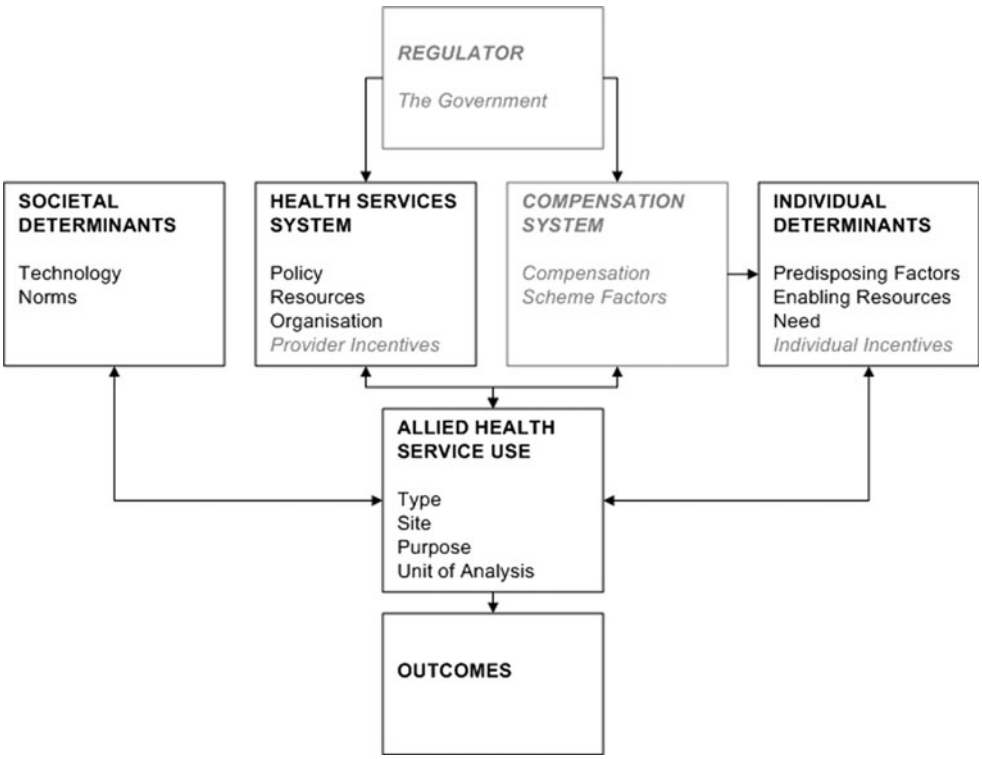

Fig. 1 Proposed adaptation of Andersen and Newman's health care utilisation framework: additions for determinants of allied health service uptake in a compensated population are indicated in *grey Italics*

service payment, including the service date. The medical expenses excess paid by employers was not included in the dataset. Prior to the data being made available to researchers, the records were stripped of identifying information including claim numbers and claimant name and contact details. Non-identifying claim ID numbers were assigned to each claim in the database. Institutional ethics approval was gained from Monash University Human Research Ethics Committee for use and disclosure of the claims information.

From the CRD, a retrospective cohort was defined and followed for a period of 4 years.

Study Sample

The study sample consisted of men and women with work-related musculoskeletal disorders resulting in ten or more days off work, for which they received income replacement with a first weekly payment dating between 1st January 2001 and 31st December 2004 ($n = 36{,}995$). Musculoskeletal disorders consisted of sprains/strains of joints and adjacent muscles (54 %), dorsopathies, disorders of the vertebrae and discs (24 %), disorders of muscle, tendons and soft tissues (10 %), synovitis, tenosynovitis, bursitis, occupational overuse syndrome or repetitive strain injury (9 %), and arthropathies, disorders of the joints (2 %).

Variables

Outcomes

Physiotherapy use was determined from the CRD payment records of physiotherapy sessions. All types of physiotherapy services were included; the most common were standard consultations, long consultations, group consultations, initial consultations, and hydrotherapy. Physiotherapy services are reimbursed by WorkSafe if the service provider is registered with WorkSafe as well as the Physiotherapy Board of Australia. Physiotherapy is considered to be a primary contact service, and referral is not required. Reasonable costs are covered, up to a specified maximum amount [12]. Physiotherapy, osteopathic and chiropractic treatment are considered by WorkSafe to be similar, and these treatments are not reimbursed simultaneously. For this reason, persons who did not use physiotherapy but used osteopathy or chiropractic services instead were excluded from the modelling of physiotherapy uptake (*any* vs. *none*).

Only payments made within 4 years from the start of the claim were taken into account; i.e., the follow-up period was limited to 4 years. Most of the claim activity can be expected in the first year, but the follow-up was extended to 4 years in order to capture a potential long right tail in service use. Repeat injuries are likely to result in a new claim; extensive physiotherapy use per claim is therefore unlikely to result from repeat injuries. Repeat claims by the same claimant are common and repeat claims can be for the same affliction and bodily location [13].

For each claim, the number of physiotherapy sessions was determined. 'High use' of physiotherapy was defined as the top 10 % of users. The 90th percentile of physiotherapy visits over 4 years was at 125 visits: this was set as the threshold for 'high use'.

Individual Level Determinants

Occupational and demographic details (age and sex) were derived from the claims data. Age refers to claimant age at the time of injury/illness. Occupation was categorised into nine occupation group codes using the Australian and New Zealand Standard Classification of Occupations (ANZSCO) [14].

Health Care System

The number of physiotherapists per local government area in Victoria in 2006 [15] was combined with the Australian Bureau of Statistics estimated resident population per local government area in 2006 [16] to derive the number of physiotherapists per capita. Workers' postal codes were converted to Local Government Area codes and for each worker, the number of physiotherapists per capita in their residential area was calculated. Physiotherapists per capita were categorised as low, medium, high and very high based on the distribution in quartiles (<p25, p25–50, p50–75 and >p75, respectively).

The WorkSafe service payments data contained a unique dummy identifier for each physiotherapist; this is referred to as the Service Provider ID and used to analyse the impact of service providers on physiotherapy uptake. Because many service providers had multiple WorkSafe patients in their practice, service use differences between service providers could be analysed.

Statistical Analysis

The data for this paper were analysed using SAS software, Version 9.2 (SAS Institute Inc., Cary, NC, USA: 2008).

Modelling of Individual Level Factors

The association between individual factors and service use was tested in two models: a logistic regression model relating any uptake versus no uptake to individual predictors (Model 1), and a logistic regression model relating high use (>p90) vesus 'normal' use to individual predictors (Model 2). For Model 2, only persons with one or more

physiotherapy visits were included. Both models were adjusted for all listed *predisposing* and *need* variables.

Modelling of Physiotherapists Per Capita

Similar models were constructed to test the association between physiotherapists per capita and physiotherapy uptake (Models 3 and 4): both models were adjusted for individual-level determinants (*need* and *predisposing* factors). To separate the effect of physiotherapists per region from the effect of regional differences in socioeconomic status, models were run separately on datasets grouped by socio-economic index for area (SEIFA) derived from indicators of relative advantage or disadvantage such as income, education, employment occupation and housing within patients' residential postcodes [17]. For this study, deciles for SEIFA ranking within Victoria were used [17]: the lowest 10 % of areas are given a decile number of one and the highest 10 % of areas are given a 10.

Modelling of the Physiotherapy Provider Role

Statistical modelling of the role of physiotherapists in determining service use was complicated by the large number of physiotherapists in the dataset, some of whom had only one or two WorkSafe patients in their practice. In the dataset there were 1957 physiotherapists for 26,026 patients: 484 physiotherapists saw only one WorkSafe patient; 174 saw only two; and 771(39 %) physiotherapists saw ten or more.

To facilitate analysis of the physiotherapist role in service overuse, several data subsamples were created. Sampling was used to reduce the number of categories in the physiotherapy provider variable: samples were limited to physiotherapists with multiple WorkSafe patients. First, from therapists seeing 10 or more WorkSafe patients, a random selection of 51 was made (every 15th physiotherapist was selected after sorting the data by dummy client ID). The data was reshuffled and two more random subsamples from this group were created. Second, this process was repeated, this time sampling from physiotherapists who saw at least 5 patients. Third, the process was repeated, but sampling from therapists who saw at least 20 patients. Finally, another four data sets were created by dividing all data from physiotherapists who saw at least 10 patients, into the four categories of regional physiotherapists per capita: low, medium, high and very high.

A regression model relating uptake to Provider ID was constructed. A Poisson distribution was tested but because of over-dispersion of the data, a negative binomial regression model was used (Model 5). Individual-level factors were included in the model to account for differences in practitioners' case mix (i.e., in terms of patients' injury severity and patient demographics) that might explain potential differences in the average patient use per practitioner. The null model (without Provider ID) and the full model were run on all data subsets. To test whether the service provider contributes to the overall number of physiotherapy sessions, the fit of the baseline model was compared with that of the full model, using the log likelihood ratio test.

Results

Of the 36,995 persons with musculoskeletal disorders, 26,026 (70 %) did and 10,969 (30 %) did not seek reimbursement for physiotherapy services during the 4-year follow-up period. Of those who did not use physiotherapy services, 404 (4 %) used osteopathic services and 1,089 (10 %) used chiropractic services. One in four persons with work-related musculoskeletal disorders did not make use of either physiotherapy, osteopathy or chiropractic services. The median number of visits among those who received physical therapy was 25 [25–75th percentile: 10–62] in 4 years. A histogram of the number of physiotherapy visits is given in Fig. 2: the distribution of the data has a long right tail with a maximum of 714. Claimants in the 'high use' category (number of visits above 125 in 4 years, the 90th percentile) accounted for 41 % of all physiotherapy visits. Among those with 'high use', 90 % still used physiotherapy in the third year of follow-up and 69 % used physiotherapy in the fourth year of follow-up. Of the combined number of sessions used by 'high users', 36 % took place in the first year, 32 % in the second year, 20 % in the third year and 12 % in the fourth year of follow-up.

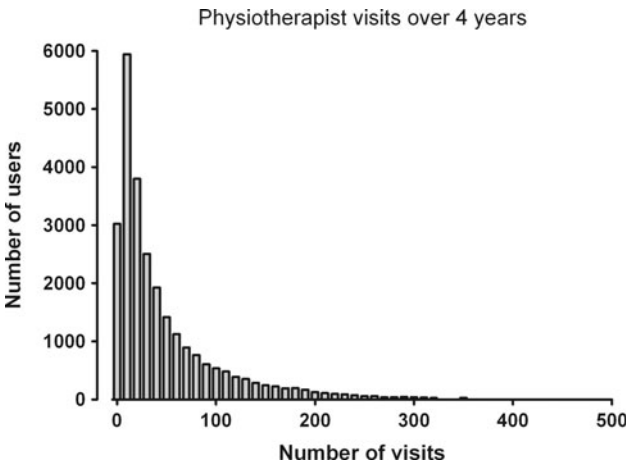

Fig. 2 Histogram of the number of physiotherapist sessions over 4 years, by compensated workers with musculoskeletal disorders

Individual Level Factors

Physiotherapy underuse was modelled as no use versus use (Table 1: Model 1). Younger workers, particularly those under 20, men, and labourers were most likely to not use physiotherapy services. Workers with arthropathies (disorders of the joints), and those without hospital stay were also more likely to not use physiotherapy. High use (above the 90th percentile for use; more than 126 services over four years) was more common with increasing age, with a maximum for those aged in their late 50 s. High use was also more common among women, and among

Table 1 Individual determinants of physiotherapy use

Variable	No use $N = 10{,}969$ %	'Normal' use $N = 23{,}434$ %	High use $N = 2{,}592$ %	Model 1 No use versus use OR [95 % CI]	Model 2 High versus 'normal' use OR [95 % CI]
Predisposing factors					
Age					
Under 20	4	2	1	1.4 [1.2–1.7]	0.6 [0.4–1.2]
20–24	9	6	3	1 REF	1 REF
25–29	10	9	7	0.7 [0.7–0.8]	1.5 [1.1–1.9]
30–34	12	12	9	0.7 [0.6–0.8]	1.5 [1.2–2.0]
35–39	12	14	12	0.7 [0.6–0.8]	1.7 [1.3–2.2]
40–44	14	16	18	0.7 [0.6–0.8]	2.0 [1.6–2.6]
45–49	14	15	18	0.7 [0.7–0.8]	2.2 [1.7–2.9]
50–54	13	14	17	0.8 [0.7–0.8]	2.3 [1.7–2.9]
55–59	8	8	12	0.7 [0.7–0.8]	2.7 [2.1–3.5]
60–64	4	4	4	0.8 [0.7–0.9]	2.3 [1.7–3.2]
65+	1	1	1	0.7 [0.5–1.0]	1.7 [0.9–3.0]
Sex					
Male	69	62	56	1.6 [1.5–1.7]	0.6 [0.6–0.7]
Female	31	38	44	1 REF	1 REF
Occupation					
Managers and administrators	2	2	2	1.0 [0.9–1.2]	0.8 [0.6–1.1]
Professionals	9	11	10	1.0 [0.9–1.1]	0.7 [0.6–0.8]
Associate professionals	7	7	6	0.9 [0.8–1.0]	0.7 [0.6–0.9]
Tradespersons and related workers	21	19	18	1 REF	1 REF
Advanced clerical and service workers	1	1	1	1.0 [0.8–1.3]	0.9 [0.6–1.4]
Intermediate clerical, sales & service workers	9	11	10	1.0 [0.9–1.1]	0.7 [0.6–0.9]
Intermed.production & transport workers	20	21	23	0.9 [0.8–0.9]	1.1 [1.0–1.2]
Elementary clerical, sales & service workers	4	4	3	0.9 [0.8–1.1]	0.6 [0.5–0.8]
Labourers and related workers	27	24	27	1.1 [1.0–1.2]	1.0 [0.9–1.2]
Need					
Affliction					
Sprains/strains of joints/muscles	53	54	62	1 REF	1 REF
Arthropathies	3	2	1	1.7 [1.5–2.0]	0.4 [0.3–0.5]
Dorsopathies	23	25	22	0.7 [0.7–0.8]	0.8 [0.7–0.9]
Disorders of muscle/tendons/soft tissues	11	10	8	1.2 [1.1–1.3]	0.7 [0.6–0.8]
Synovitis, tenosynovitis, bursitis, OOS or RSI	9	9	7	1.2 [1.1–1.3]	0.6 [0.5–0.7]
Hospital amount					
None	73	52	32	1 REF	1 REF
<2,500	22	29	27	0.5 [0.5–0.5]	1.5 [1.3–1.6]
≥2,500	5	19	41	0.2 [0.1–0.2]	3.5 [3.1–3.8]

In modelling no use versus use of physiotherapy services, those who did not use physiotherapy but used osteopathy or chiropractic services instead were excluded. Model 1 and Model 2 contain all listed *predisposing* and *need* factors

tradespersons and intermediate production and transport workers. Workers with sprains/strains of joints/muscles were most likely to have high physiotherapy service use, as were those with high hospital bills.

Physiotherapists Per Capita

The supply of physiotherapists per local government area ranged from zero to 3.4 physiotherapists per 1,000 capita. The majority of patients (90 %) lived in an area with at least 0.09 physiotherapists per 1,000 capita; the median was 0.5. There was no clear pattern of association with service use (Table 2: Model 3) or with high service use (Model 4). Although statistically significant in the models ($p < 0.0001$ for both models), the resulting odds ratios for regions with low, median, high and very high number of physiotherapists per capita are difficult to interpret. To separate the effect of socioeconomic status from the supply of physiotherapists, Model 3 and 4 were re-run on data of those living in regions with SEIFA deciles 1–2, 3–4, 5–6, 7–8 and 9–10 (Fig. 3). For the lowest SEIFA deciles, greater supply is associated with less 'none use' and more 'high use', but this pattern does not include the 'very high' physiotherapy supply category. Because very high numbers of physiotherapists per region are generally found in densely populated urban areas, it might not be possible to fully separate accessibility of services from other, individual-level drivers of service uptake. For the SEIFA deciles 3–10, the results do not show a consistent pattern.

Provider ID

The role of service providers in physiotherapy uptake was tested using a fully adjusted negative binomial model, run on a number of data subsets (Table 3). Service provider was a significant predictor of the number of sessions, in all data subsets (log likelihood ratio test $p < 0.0001$). Across physiotherapists with ≥ 5, ≥ 10, and ≥ 20 WorkSafe patients in the dataset, provider ID was associated with service use; this association held true across each of the four levels of physiotherapists per capita.

Discussion

Among compensated workers with musculoskeletal disorders resulting in time off work, 70 % used physiotherapy services in relation to their injury/illness at least once during the 4 years following the start of their workers' compensation claim. Non-use was more common among men, among workers aged under 25 years and among those without hospital costs. Those with the top 10 % of physiotherapy visits accounted for over 40 % of all visits: these persons were categorised as high users. High users were more likely to be in their late 50 s, more likely to be female, and to work as tradespersons; high use was also positively associated with hospital costs. Service use was not associated with physiotherapists supply in a dose–response manner, except for areas with relative socio-economic disadvantage where greater supply was associated with less 'non use' and more 'high use'. Service use was distributed differentially across physiotherapists, which suggests service providers themselves play a role in determining the number of services used by workers' compensation patients.

Underuse

This study is based on WorkSafe payments for medical and like expenses; an employer-paid excess of around AU$630 must be reached first. Non-use as presented here is therefore an underestimate of non-use, as physiotherapy sessions may have been captured in the employer-paid medical excess. Physiotherapy use in this compensated worker sample was much more common than has been reported in other studies. Freburger et al. [18] reported physiotherapy referral rates around 20 % for patients with musculoskeletal conditions (including fractures) in the US; in a US study by Carter et al., outpatient physiotherapy use by persons with these conditions was 7 % [19]. Among workers compensated for back injury in Quebec, 18 % were referred for physiotherapy by their physician [20]. In a population of patients with acute lower back pain in North Carolina, physiotherapy use was reported by 13 % [9]; these patients were either referred by a provider or self-referred. Among patients with chronic

Table 2 Supply of physiotherapists. In modelling no use versus use of physiotherapy services, those who did not use physiotherapy but used osteopathy or chiropractic services instead were excluded

Models were adjusted for *need* factors (affliction type, bodily location, hospital amount)

Variable	No use %	'Normal' use %	High use %	Model 3 No use versus use OR [95 % CI]	Model 4 High versus 'normal' use OR [95 % CI]
Physiotherapists per capita					
Low	25	26	27	1 REF	1 REF
Median	25	23	21	1.2 [1.1–1.3]	0.9 [0.8–1.0]
High	26	28	31	1.0 [0.9–1.1]	1.1 [1.0–1.3]
Very high	23	24	21	1.1 [1.0–1.1]	0.9 [0.8–1.0]

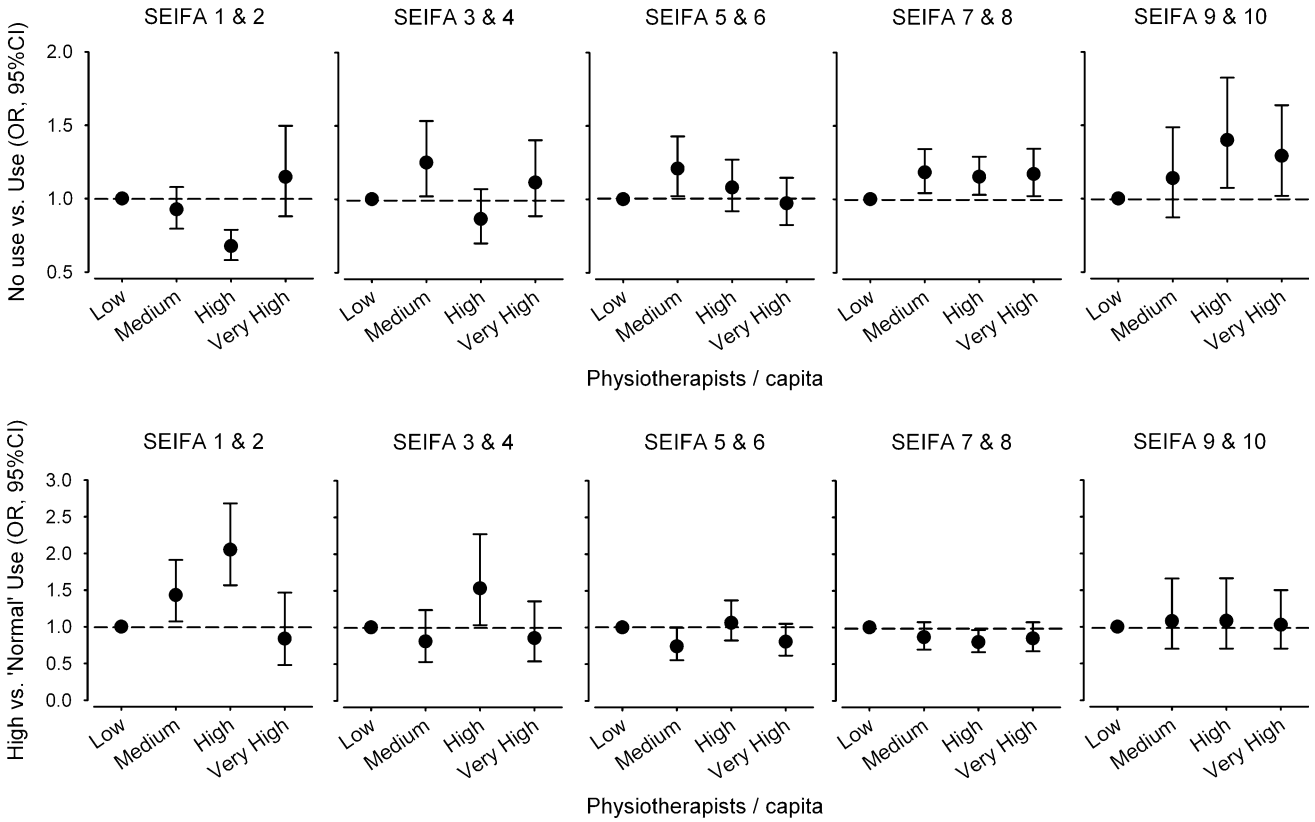

Fig. 3 Health service use uptake by physiotherapists per capita: logistic regression models were run separately per SEIFA state deciles (1–2 are the most disadvantaged, 9–10 are the most advantaged), to separate physiotherapists per region from socioeconomic status of the region. *Left* any physiotherapist use versus none; *right* high uptake versus 'normal' uptake of physiotherapist services. All models were fully adjusted for individual-level factors

Table 3 Service provider determinants

	WorkSafe patients per provider	Supply of physio-therapists	Data sampling ratio	Patients Providers		Full model: individual predictors and provider ID		Null model: individual predictors only		Log Likelihood ratio test Full versus Basic model
	N			*N*	*N*	Deviance	DF	Deviance	DF	*p* value
Subsample 1	≥10	All regions	1:15	1,781	51	2,005	1703	2,037	1753	<0.0001
Subsample 2	≥10	All regions	1:15	1,583	51	1,780	*1505*	*1,810*	1555	<0.0001
Subsample 3	≥10	All regions	1:15	1,636	51	1,854	1558	1,885	1608	<0.0001
Subsample 4	≥5	All regions	1:20	1,008	54	1,135	927	1,150	980	<0.0001
Subsample 5	≥20	All regions	1:8	2,129	55	2,407	2047	2,442	2101	<0.0001
Subsample 6	≥10	Low	1:1	5,734	634	6,389	5073	6,550	5706	<0.0001
Subsample 7	≥10	Medium	1:1	4,906	576	5,477	4302	5,626	4877	<0.0001
Subsample 8	≥10	High	1:1	5,999	575	6,718	5397	6,890	5971	<0.0001
Subsample 9	≥10	Very High	1:1	4,534	571	5,047	3936	5,198	4506	<0.0001

To enable modelling of the effect of service providers on uptake, only physiotherapists with a minimum number of WorkSafe patients in the database were selected (data sub-sampling details are given below)

Negative binomial regression models were used to test the associations between the number of physiotherapy sessions and service providers. Models were adjusted for all individual predictors (listed in Table 1)

lower back pain in another North Carolina study, 30 % had seen a physiotherapist in the previous year [8]. In a population- based Canadian study of health care utilisation, physiotherapy use was reported by 17.2 % of persons with a lower back disorder versus 6.6 % of persons without a lower back disorder [21].

The difference in physiotherapy utilisation reported in our study compared to previous studies can be partly attributed to differences in (i) patient population and (ii) health care system. Different populations could be expected in that studies have respectively considered *referral rates*, and *utilisation rates*. Referral implies that patients have already sought care, which introduces a (severity-related) patient inclusion criterion. Additionally, our patient population consisted of persons with at least 2 weeks off work because of their injury and might therefore be considered to have more severe injuries than the total population of injured workers. The fact that our study was limited to a demographic eligible for workers' compensation may also help explain the higher physiotherapy rates reported in our study, as the literature suggests that persons above retirement age (who were not in our study) are less likely to use physiotherapy [19, 21]. Possibly a more important reason, however, for the dramatic difference in numbers of physiotherapy visits in our study population related to the fact that these visits did not require a doctor referral and were reimbursed by workers' compensation. This eliminated two barriers to service use: out of pocket costs, and the need for a physician referral.

The merits of physiotherapy as first-contact care for musculoskeletal conditions has been discussed by Overman et al. [22] and they concluded that for lower back pain, physiotherapists can provide safe, effective and efficient first-contact care in an organised outpatient setting. In this study population non-use of physiotherapy was relatively rare: only one in four persons did not receive physiotherapy, osteopathy or chiropractic services. Men were more likely than women to not use physiotherapy, which is consistent with previous reports of women being more likely than men to use physiotherapy services [19, 21]. Within this working-age population, non-use of physiotherapy was also common among those aged under 25. The results indicated a tendency for physiotherapy supply to limit service use only for workers living in areas with relative socio-economic disadvantage. Overall, these results therefore suggest that among patients with costs reimbursed by workers' compensation, adequate physiotherapy supply and no requirement for referrals, physiotherapy services are not *underused*. The present results indicate that these services are well utilised in a workers' compensation population: how physiotherapy impacts outcomes in terms of disability, pain and return to work is yet to be explored in future studies.

Overuse

The mean number of services used by individuals with at least one physiotherapy session was 49, but these highly skewed data are better described by the median: 25 visits. To compare our results to literature, the number of visits for those with affliction location coded as 'lower back' (29 % of cases) were calculated: mean 50 and median 27 visits. This is much higher than previous reports for lower back pain: a mean of 15.6 visits was reported by Freburger et al. [8]; Jette et al. [7] reported a median of 11 and a mean of 8 visits; and Mielenz et al. [9] reported a mean of 8.5 visits. The result closest to our study was an average of 24.5 actual treatment days during a 2-years follow-up of Quebec workers' compensation recipients, reported by Ehrman-Feldman et al. [20]. This suggests a role of workers' compensation in leading to an elevated average number of sessions per patient: this is further supported by the reported 36 % increase in cost per episode of care for patients with workers' compensation compared to episodes charged to other insurance carriers [7].

The distribution of physiotherapy service use was highly skewed with a small percentage of patients (10 %) responsible for a large percentage of use (41 %). On a population level, a skewed distribution of health care expenditure has been described previously: in the US, five percent of the population accounts for the majority of health expenditures [23]. This phenomenon can be partly explained by differences in health care *needs* across the population (the highest users could have greater health care needs; those with low health care use may simply be in good health), and differences in insurance status (medical expenditures of the top users in the insured group were considerably higher than those of top users in the uninsured group). The skewed distribution in the current study, however, is more difficult to interpret. All had musculoskeletal conditions resulting in work disability (therefore setting a threshold in 'need') and all received reimbursement for injury-related health services, removing any utilisation differences driven by out-of-pocket payments. In our study, high users were more likely to be in their late 50 s, to be female, to work as tradespersons, to have had substantial hospital costs (which is likely a reflection of injury severity). In previous studies women have been associated with increased health care utilisation [24, 25]. Part of the gender difference in service use is explained by chronic health conditions, pregnancy and birth [24] (and therefore a difference in need). Whether the gender difference in physiotherapy use for work-related musculoskeletal is due to differences in injury severity, prevalence of chronic conditions complicating recovery, or predisposing factors, remains to be investigated.

To our knowledge, this is the first study to assess not only individual predictors and supply, but to include the role of physiotherapists in determining drivers of utilisation and overuse. Physiotherapy providers were statistically significantly associated with the number of sessions used, which indicates that high use is not only a product of

individual need, predisposing and enabling factors. Because service provider information in our data was limited to a de-identified provider ID, providers could not be grouped by practice type and size, available equipment, or expertise: this information may help to clarify practitioner differences. The results from this study do show that service use is skewed and that efforts to limit overuse should focus not only on *high-end users*, but also on physiotherapists *providing high-end use*.

Conceptual Model

In this study we present a framework of (allied) health service use drivers, based on the model by Andersen and Newman [5]. This model has provided a useful guide to exploring underuse and overuse of physiotherapy by compensated workers, but this study has by no means validated the model or touched upon every aspect of it. The role of the model in this study was to place the analysis in a greater context. Future studies to clarify the role of the compensation system in service uptake and injury outcomes could include analysing system changes and time trends; analysing the impact of service use on injury outcomes (in terms of return to work, return to health, quality of life); and studying the interactions between the health care system and the compensation system. The effect of societal norms on injury outcomes can be studied by examining time trends, such as the transition in attitudes toward repetitive strain injury [26].

Study Limitations

The main limitation of this study is that it is entirely based on administrative claims records. Because of the absence of other linked administrative data sources and survey data, information on several important health service use drivers was missing: (1) Physical functioning. Because the participants all had two or more weeks off work, work ability was limited in all participants, but we did not measure physical functioning. (2) Depression. Among high utilisers of medical care in the US, depression has been associated with higher resource utilisation [27]. (3) Health service use prior to injury: this is reported to be increased in injured compared to non-injured persons in Manitoba, Canada [28]. Previous health service use can provide insight into *predisposing factors* driving allied health service use: e.g., those who have previously attended a chiropractor might be more likely to do so again after an injury. (4) Health service use other than that reimbursed with workers' compensation health benefits. Among hospital workers with work-related musculoskeletal disorders in British Columbia, publicly funded health care use increased before and after injury, compared with non-injured workers, even though they received workers compensation health benefits [29]. Furthermore, the results presented in our study do not include the medical expenses excess paid by employers. The workers' compensation reimbursed physiotherapy use reported in our study is therefore an underestimate of all physiotherapy use by the study subjects.

Policy Recommendations

Service overuse places a strain on resources that is not likely to be justified by better injury outcomes; inappropriate and unjust treatments may have a negative impact on recovery. It is in the interest of workers, employers and workers' compensation authorities to prevent overuse of services. The results of this study support a *physiotherapist-based* approach to policy recommendations for limiting service use.

Under the current WorkSafe Physiotherapy guidelines, physiotherapists are required to submit a physiotherapy management plan by the fifth consultation [12]. The management plan includes a section asking for specific goals relating to work and function, with an estimated date of achievement; it also asks for a proposed total number of services and an estimated discharge date. Very high use could be managed by effective monitoring (1) the reasonableness of the proposed goals and required number of sessions; (2) adherence to the treatment plan; and (3) the requirement for a new treatment plan after the patient has exceeded a set number of sessions, with a justification of how additional physiotherapy will contribute to recovery.

A more general approach would include additional training for therapists treating work-related injuries and illness. Although a Canadian knowledge translation initiative, aimed to provide physiotherapists with best practice information regarding work disability prevention, did not substantially alter self-reported clinical practice and outcomes [30], a mandatory training for WorkSafe-registered physiotherapists followed by provision of support for good practice as well as accountability may help to improve outcomes for work-related injuries. An effective way to ensure application of the information in practice would be to implement an outcomes-based quality assurance process for analysis of provider performance, as is used by the Workers' Compensation Board of Alberta.

Conclusions

Among workers with musculoskeletal disorders resulting in time off work, physiotherapy services were not underused. There was, however, a small group of users with very high use: this was more common among persons in their late 50 s, women, tradespersons, and those with substantial

hospital costs. Physiotherapy supply was associated with use only among workers living in the least socio-economically advantaged areas. Individual physiotherapists played a role in service use: the results indicated that the total number of sessions attended was partly determined by the choice of service provider. Recommendations to limit overuse should target physiotherapists, and these could include a mandatory training program for treating work-related injuries. Monitoring of adherence to proposed treatment plans and overall practice statistics may also help to prevent service overuse and improve injury outcomes.

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