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RESEARCH ARTICLE

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Intensity of physical therapy services: Association with work and health outcomes in injured workers with back pain in Washington State

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Abstract

Background: Associations between the intensity of physical therapy (PT) treatments and health outcomes among individuals with back pain have been examined in the general population; however, few studies have explored these associations in injured workers. Our study objective was to examine whether intensity of PT treatments is positively associated with work and health outcomes in injured workers with back pain.

Methods: We conducted a secondary analysis of prospective data collected from the Washington State Workers' Compensation (WC) Disability Risk Identification Study Cohort (D-RISC). D-RISC combined survey results with WC data from the Washington State Department of Labor and Industries. Workers with a State Fund WC claim for back injuries between June 2002 and April 2004 and who received PT services within the first year of injury were eligible. Intensity of PT treatment was measured as the type and amount of PT services within 28 days from the first PT visit. Outcome measures included work disability and self-reported measures for working for pay, pain intensity, and functional status at 1-year follow-up. We conducted linear and logistic regression models to test associations.

Results: We identified 662 eligible workers. In adjusted models, although the intensity of PT treatment was not significantly associated with work disability at 1-year follow-up, it was associated with lower odds of working for pay, decreased pain intensity, and improved functional status.

Conclusions: Our findings suggest that there may be small benefits from receiving active PT, manual therapy, and frequent PT treatments within 28 days of initiating PT care.

KEYWORDS

back pain, functional status, physical therapy, return to work, workers' compensation

1 | BACKGROUND

Low back pain (LBP) is a major health problem for the working population. The economic burden of total direct and indirect costs attributable to LBP in the United States (US) is estimated to be greater than $200 billion dollars annually, of which two-thirds is due to lost wages and reduced productivity.[1–4] While most individuals who have acute LBP are expected to recover within 4 weeks of onset,[5,6] workers with chronic LBP experience a longer duration of disability and are more prone to become permanently disabled.[7]

To manage LBP cases, clinical guidelines recommend the use of nonpharmacological and noninvasive services over prescription pain medications as first-line treatment options for patients experiencing LBP.[6,8] One approach is physical therapy (PT) care, which consists of various PT interventions that have been shown to restore, maintain, and improve functional status and quality of life.[6,8] This rehabilitative strategy consists of various types of PT services conducted at varying frequencies over the entire course of patient care. LBP guidelines recommend that PT providers prioritize active interventions such as exercise therapy, activity training, and manual therapy techniques over other passive strategies including electrical stimulation, hot and cold therapies, and massage for treatment of both acute and chronic back pain.[9,10] In the United States, national and state-based population studies showed that less than a third of patients with chronic LBP sought a PT provider within the first year of injury and that there was little to no change in PT utilization from 1997 to 2006 for individuals experiencing back pain.[11–13] While PT use in the form of active exercise, manual therapy, and other modalities are recommended for treatment of acute and chronic LBP,[9] the use of PT services is often dependent on the patient's current clinical prognosis, which can impact health outcomes like pain intensity, functional capacity, and duration of disability.

Previous studies have examined the associations between health outcomes and the intensity of PT services among individuals with back pain in the general population; however, few studies have explored these associations among an injured worker population. In one prospective cohort study of older adults with back pain, researchers found that greater amounts of active PT interventions were associated with improvement in pain intensity but found no statistical difference when examining the association with disability outcomes.[14] Another study that examined injured workers with knee pain found that a greater amount of passive PT interventions was associated with longer duration of disability compared to non-users; however, the researchers also found no difference in the length of disability between users receiving active PT interventions and non-active PT users.[15] Evidence has also shown that patients with back pain who received a combination of early and active PT interventions were more likely to experience positive improvements in pain and function outcomes.[16–19] In this study, our primary study objective was to examine whether intensity of PT treatments during the first 4 weeks (28 days) of PT care is positively associated with work and health outcomes in injured workers with back pain including work disability and self-reported measures for working for pay, pain intensity, and functional status at 1-year follow-up.

2 | MATERIALS AND METHODS

2.1 | Data source

We conducted a secondary analysis of prospective data collected from the Washington State Workers' Compensation Disability Risk Identification Study Cohort (D-RISC), which has been described in prior studies.[20,21] We linked self-reported survey results from D-RISC with administrative claims and medical billing data from the Washington State Department of Labor and Industries (L&I) state fund. The L&I state fund covers over two-thirds (70%) of all nonfederal Washington workers. The remaining 30% of all nonfederal WA workers is covered by self-insured employers, for which data were not available.

2.2 | Study population

The study sampling frame included 4354 potential participants in the D-RISC that had an accepted or provisional (pending decision) L&I workers' compensation (WC) claim for back injury between June 2002 and April 2004. Workers who received wage-replacement benefits for temporary total disability (four or more days off work) due to injury were eligible for this study. Of the potential participants, 2147 (49.3%) agreed to participate in the initial screening. The remaining respondents were classified as non-participants because they could not be contacted after injury, declined enrollment into the study, or were unable to complete the telephone interview in English or Spanish (Figure 1). Furthermore, we excluded 262 participants because they did not receive compensation within the first year of injury, were hospitalized for injury in the first 30 days, had missing data on age, or did not have a back injury after medical review (Figure 1). Among the remaining 1885 enrolled participants, we used medical billing information to identify the 942 participants who received PT services from a PT provider within the first year after injury; those with no PT services were ineligible. Additionally, we excluded participants who did not complete the follow-up interview 1 year after injury ($n = 260$) and who only received PT services after surgery ($n = 20$); therefore, our final study sample included 662 participants who received PT services and completed the follow-up interview within the first year of injury.

2.3 | Measures

2.3.1 | Intensity of PT

The primary exposure variable for this study was the intensity of PT treatment within 28 days of the first PT visit, which was defined in three ways. First, we measured intensity of PT treatment by type of PT treatment (active PT, passive PT, or manual therapy). For each injured worker, we calculated the total number of active, passive, and manual therapy procedures that

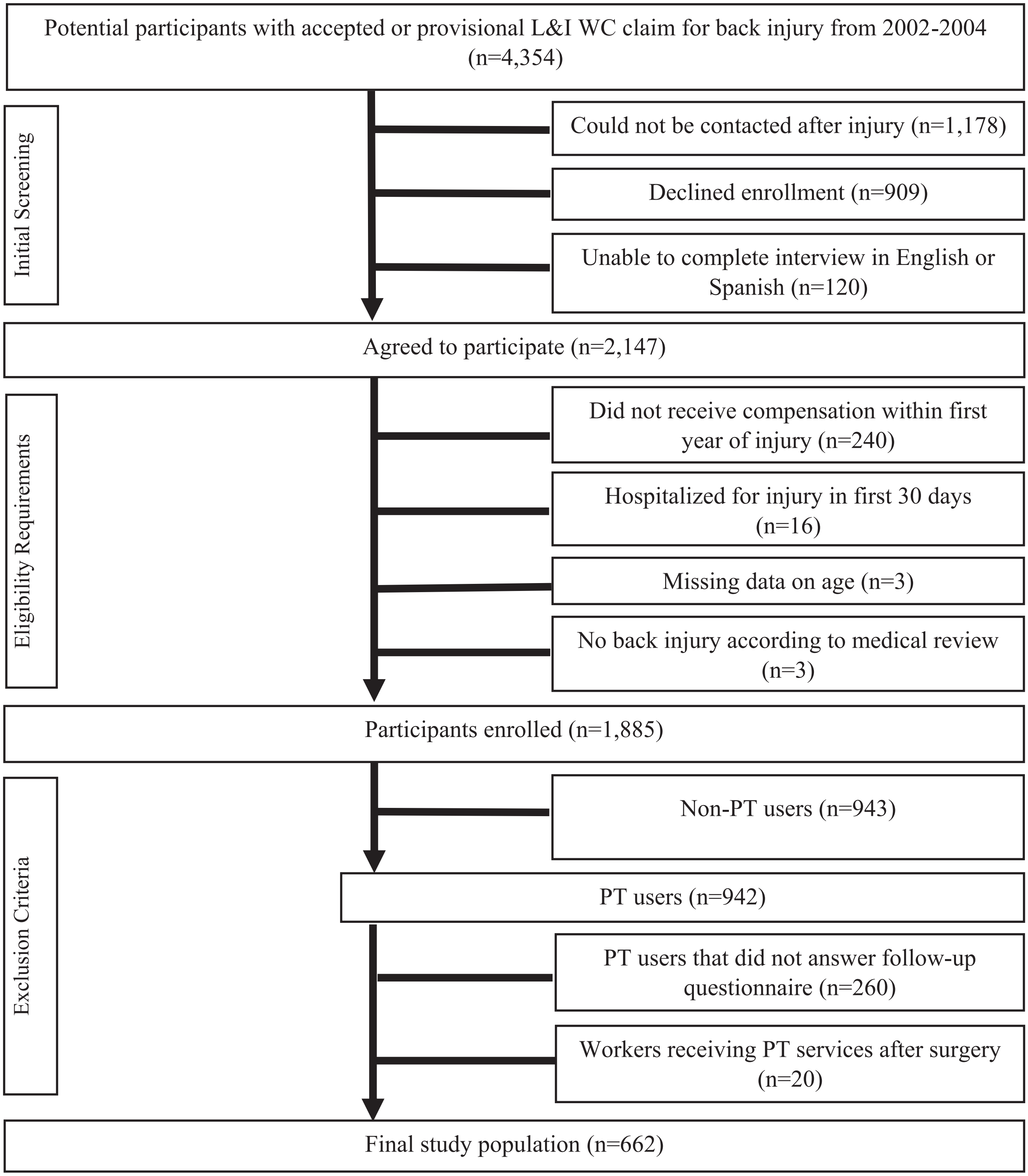

FIGURE 1 Disability Risk Identification Cohort Study (D-RISC) Recruitment Flow Chart

occurred within 28 days of the first PT visit. Second, we assessed intensity of PT treatment using the total number of PT codes that were billed by a physical therapist within 28 days of the first PT visit for each injured worker. Lastly, we examined intensity of PT treatment as the total number of PT days within 28 days of the first PT visit. A PT day was counted if an injured worker received any PT code by a physical therapist within 28 days of the first PT visit. We determined that a period of 28 days from the first PT visit would be an appropriate time frame for analysis to reduce confounding by indication, where the amount of PT treatments would be greater for injured workers with prolonged symptoms and disability.

2.3.2 | PT codes

We defined a PT user as a worker that had at least one billed PT-related Current Procedural Terminology (CPT) code from a physical therapist within the first year after injury. We selected PT codes using the CPT codes for active PT, passive PT, and manual therapy interventions (Appendix A). Active PT codes generally consisted of exercise therapy and activity training codes, while passive PT codes included modalities such as biofeedback, electrical stimulation, hot and cold therapies, and massage therapy. We created a third category for manual therapy interventions, typically comprised of skilled spinal manipulation, spinal mobilization, and manual traction procedures, which is considered different than nonspecific therapeutic massage in research and practice.

2.3.3 | Outcome variables

We examined four outcome variables (work disability, working for pay, pain intensity, and functional status) at 1-year follow-up. Work disability was defined as a binary variable (yes or no) for workers receiving wage replacement benefits 1 year after their claim submission. Working for pay was defined as a self-reported binary variable (yes or no) for individuals who received employment-related monetary compensation in the previous week before the interview survey. Continuous measures for self-reported scores of pain intensity in the past week and functional status were assessed using a 0–10 pain numerical rating scale[22] and the Roland Morris Disability Questionnaire (RMDQ) score, a 0–24 scale,[23] respectively, with higher values indicating greater pain intensity and worse functional status. We reported frequencies and percentages for binary outcomes and means and SDs for continuous outcomes.

2.3.4 | Covariates

To account for potential confounding between the intensity of PT treatment and each of the outcome measures, baseline covariates were selected a priori from five domains (demographic, pain and function, psychosocial, clinical, and employment-related)[20] and included in each of the statistical models (Table 1). We constructed a variable to address potential time-varying differences from the onset of injury to when the injured worker first received PT care; time to PT care was defined as the total number of days between the worker's injury date and the first PT visit date. All baseline variables are described in further detail in Table 1.

2.4 | Data analysis

We used descriptive statistics to characterize the study sample. We conducted a total of 12 regression models for this study. Six logistic regression models (unadjusted and adjusted) were conducted to test the associations between each of the three measures for intensity of PT treatments within 28 days of first PT visit and the two binary outcomes for work disability and working for pay at 1-year follow-up. Additionally, we conducted six linear regression models (unadjusted and adjusted) to examine the associations between intensity of PT treatments within 28 days of first PT visit and the continuous outcome measures for self-reported pain intensity in the past week and functional status at 1-year follow-up. For the statistical models that examined intensity of PT treatment by PT type, we adjusted for the other two PT types as well as a variable for the total number of PT evaluation codes for each worker to account for co-occurring PT treatments that the worker received within the first 28 days after their first PT visit. Unadjusted and adjusted odds ratios with 95% confidence intervals were calculated for the logistic regression models and unadjusted and adjusted β coefficients were reported for the multiple linear models. Additionally, we conducted a sensitivity analysis to assess the impact of a possible interaction between timing and intensity of PT treatments. We classified timing as a binary variable for early (4 weeks or less) or late PT (greater than 4 weeks) PT from date of injury. We found that our interaction term comparing timing of PT and intensity of PT was not statistically significant in all models; therefore, we did not include it in the final adjusted analyses. All variables included in the adjusted models had a missing rate of 3.6% or less, which is considered inconsequential.[24,25] Based on a small amount of missing data, our sample size after casewise deletion for each of the 12 regression models consisted of 86.5% of the total study sample ($n = 574$). All statistical analyses were performed using StataCorp SE, version 14 (College Station)[26] with a two-tailed significance level set at $\alpha = 0.05$.

3 | RESULTS

We identified 662 (35.1%) workers who received PT services within the first year of injury. The baseline characteristics for this study population are displayed in Table 2. Among the 662 workers who received any PT care, most were male (62.7%), White non-Hispanic/Latino (74.9%), and married (55.1%). Most workers had a high school education or greater (89.0%), had an annual household income of $45,000 or more (74.1%), and lived in an urban residential area (59.1%). The mean age for these workers was 40.4 years (SD = 10.7). Medical record reviews showed that workers had injuries that caused a mild sprain or strain (42.6%), major sprain or strain (23.9%), or evidence of radiculopathy (28.3%). Although a little more than half (52.6%) of workers had very high recovery expectations, more than half (56.3%) agreed that their work might harm or cause pain to be worse, which was measured using the work-fear avoidance composite score.

Table 3 presents the distribution of the intensity of PT treatments within 28 days of the first PT visit among back-injured workers receiving PT services. Among the 662 workers, the mean and median number of days between injury date and the first PT visit were 47 and 21 days, respectively. The median total number of days that injured workers received PT services was 7 days. Our results also showed that workers received a greater number of active PT treatments than passive PT treatments or manual therapy.

TABLE 1 Baseline covariates from each of the five domains and time to PT care used for the adjusted models

Baseline factors	Data source	Categories or scores for each measure
Socio-demographic		
Age	Claims	18–24; 25–34; 35–44; 45–54; 55+ (categorical; reference = 35–44)
Gender	Claims	Men (0), Women (1) (binary)
Race/ethnicity	Survey	White non-Hispanic/Latino; Hispanic/Latino; other non-Hispanic/Latino (categorical; reference = White non-Hispanic/Latino)
Marital status	Survey	Married; living with a partner; divorced/widowed/separated; single (categorical; reference = married)
Education	Survey	Less than high school degree; high school degree or GED; vocational or some college; college graduate (categorical; reference = high school degree or GED)
Annual household income	Survey	<$30,000; $30,000–$44,999; $45,000–$69,999; ≥$70,000 (categorical; reference = <$30,000)
Location of worker residence[a]	Claims	Urban (≥50,000 people); suburban (10,000–49,999 people); large town (2500–9,999 people); rural (≤2499 people) by ZIP code (categorical; reference = Urban)
Pain and function		
Pain intensity in the past week (0–10 scale)	Survey	0 = no pain; 10 = pain as bad as can be (continuous)
RMDQ score (0–24 scale)	Survey	Higher scores indicate greater disability (continuous)
Injury severity	Medical review	Mild sprain/strain; major sprain/strain; evidence of radiculopathy; severe immobility including loss of reflexes, bladder complaints, and motor abnormalities; (categorical; reference = mild sprain/strain)
Psychosocial		
Catastrophizing (0–4 scale)	Survey	0 = no thoughts about pain; 4 = thinking about pain all the time; (categorical; reference = no thoughts about pain)
Recovery expectations[b] (0–10 scale)	Survey	Very high (10); high (7–9); low (0–6) (categorical; reference = very high)
Work-fear avoidance composite score[c] (0–6 scale)	Survey	Disagree (0–1.9); neutral (2–3.9); agree (4–6) (categorical; reference = agree)
SF-36v2 mental health score in the past week (0–100 scale)	Survey	Higher scores indicate better psychological status (continuous)
Clinical		
Body mass index (kg/m^2)	Survey	Underweight (<18.5); normal (18.5–24.9); overweight (25–29.9); obese (≥30) (categorical; reference = normal)
First provider seen for injury	Claims	Primary care; occupational medicine; physical medicine and rehabilitation; chiropractor; other (categorical; reference = primary care)
Current health status	Survey	Excellent; very good; good; fair/poor (categorical; reference = excellent)
Employment-related		
Hectic job	Survey	Strongly disagree/disagree; agree; strongly agree (categorical; reference = strongly agree)
Part-time work	Survey	Part-time (0), full-time (1) (binary)
Employer offered accommodations	Survey	Yes (0); no (1) (binary)
Time to PT care[d]	Claims	Number of calendar days between injury date and initial PT visit (continuous)

Abbreviations: AUDIT-C, Alcohol Use Disorders Identification Test—Concise; GED, General Education Development; NORA, National Institute for Occupational Safety and Health National Occupational Research Agenda; PT, physical therapy; RMDQ, Roland Morris Disability Questionnaire; SF-36v2, The Short Form Health Survey version-2.0; WC, workers' compensation.

[a]By residential ZIP code, using the Washington State Rural/Urban guidelines classifications (https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx).

[b]Recovery expectations is a measure used to indicate certainty for returning to the job in 6 months of injury date with higher scores indicating greater certainty for returning to work.

[c]Work-fear avoidance composite score was generated to indicate the worker's thoughts about how work might harm or cause pain to be worse.

[d]Time to PT care was included as a covariate in the adjusted models.

TABLE 2 Baseline characteristics of back-injured workers receiving any physical therapy services within the first year

Baseline characteristics	All claims (*N* = 662)	
Socio-demographics	Number or mean	% or SD[a]
Age, years		
18–24	44	6.6
25–34	157	23.7
35–44	215	32.5
45–54	182	27.5
55+	64	9.7
Sex		
Female	247	37.3
Male	415	62.7
Race/Ethnicity		
White non-Hispanic/Latino	496	74.9
Hispanic/Latino	82	12.4
Other non-Hispanic/Latino	84	12.7
Marital status		
Married	365	55.1
Living with a partner	82	12.4
Divorced/separated/widowed	140	21.1
Never married	75	11.3
Education		
Less than high school	73	11.0
High school graduate or GED[a]	214	32.3
Vocational or some college	308	46.5
College graduate	67	10.1
Annual household income		
<$30,000	165	25.9
$30,000–$44,999	222	34.7
$45,000–$70,000	173	27.1
Over $70,000	78	12.2
Residential area of worker		
Urban	379	59.1
Suburban	132	20.6
Large town	67	10.5
Rural	63	9.8
Pain and function		
Pain intensity in the past week, mean, SD[a]	5.9	2.3
RMDQ score, mean, SD[a]	15.0	6.1
Injury severity		

(Continues)

TABLE 2 (Continued)

Baseline characteristics	All claims (*N* = 662)	
Mild sprain or strain	282	42.6
Major sprain without evidence of nerve injury or radiculopathy	158	23.9
Evidence of radiculopathy	187	28.3
Reflexes absent, bladder complaints, or motor abnormalities	34	5.1
Psychosocial factors		
Catastrophizing, Mean, SD[a]	2.1	1.1
Work-fear avoidance composite score		
Disagree	17	2.6
Neutral	272	41.1
Agree	372	56.3
Recovery expectations		
Very high	338	52.6
High	144	22.4
Low	160	24.9
SF-36 Mental Health in the past week, Mean, SD[a]	41.5	13.2
Clinical		
Body mass index		
Normal/underweight	170	25.7
Overweight	252	38.1
Obese	225	34.0
First provider seen for injury		
Primary care	257	38.8
Occupational Medicine	59	8.9
Physical medicine/rehabilitation services	83	12.5
Chiropractor	104	15.7
Other provider	159	24.0
Current health status		
Excellent	118	17.9
Very good	255	38.6
Good	217	32.9
Fair/poor	70	10.6
Previous injury >1 month off work		
No	449	68.1
Yes	210	31.8
Employment-Related		
Job very hectic		
Strongly disagree/disagree	149	22.6

(Continues)

TABLE 2 (Continued)

Baseline characteristics	All claims (*N* = 662)	
Agree	304	46.1
Strongly agree	206	31.3
Part-time work		
Full-time	610	92.3
Part-time	51	7.7
Employer offered accommodations		
Yes	366	56.1
No	287	43.9

[a]Abbreviations: GED, General Education Development; RMDQ, Roland Morris Disability Questionnaire; SF-36v2, The Short Form Health Survey version-2.0.

Among the 662 workers in our sample, we identified 174 (26.3%) workers who were receiving wage-replacement benefits for work disability 1 year after injury. From the follow-up interview, there were 371 (56.0%) workers who responded that they were not working in the past week. The reported mean (SD) pain intensity score (0–10 scale) and RMDQ score (0–24 scale) for this worker population receiving PT services at 1-year follow-up was 4.8 (2.8) and 11.1 (7.4), respectively.

3.1 | Work disability at 1-year follow-up

We conducted three logistic regression models to test the associations between intensity of PT treatment within 28 days of the first PT visit and work disability at 1-year follow-up after adjusting for covariates (Table 4). Although we found modest associations in two

TABLE 3 Distribution of intensity of PT treatments within 28 days of the first PT visit among back-injured workers receiving PT services (*N* = 662)

Descriptive statistics	Time to first PT visit (days)	Active PT codes	Passive PT codes	Manual Therapy codes	Total number of PT codes	Total number of PT days
Mean (SD)	47 (62.2)	10 (9)	5 (6)	4 (5)	20 (12)	7 (3)
Median, (range)	21 (0–355)	8 (0–66)	3 (0-58)	3 (0–51)	19 (1–79)	7 (1–20)
25th percentile (Q1)	9	3	0	0	11	4
75th percentile (Q3)	54	14	8	7	28	9
Interquartile range (Q3–Q1)	45	11	8	7	17	5

Abbreviations: Q1, quartile 1; Q3, quartile 3.

TABLE 4 Logistic regression models examining the association between total intensity of PT treatments and work disability at 1-year follow-up (*N* = 574)[a]

		Work disability at 1-year follow-up			
	PT intensity	Unadjusted OR (95% CI)b	*p* Value	Adjusted OR (95% CI)b	*p* Value
Model 4.1	Type of PT treatment[b]				
	Active PT	1.01 (0.99–1.03)	0.58	0.99 (0.97–1.02)	0.77
	Passive PT	1.01 (0.99–1.04)	0.33	0.99 (0.96–1.03)	0.68
	Manual Therapy	1.03 (1.00–1.07)	0.04	1.04 (0.99–1.09)	0.09
Model 4.2	Total PT codes	1.01 (0.99–1.03)	0.08	1.00 (0.98–1.02)	0.71
Model 4.3	Total PT days	1.07 (1.02–1.13)	0.01	1.04 (0.96–1.11)	0.34

Abbreviations: OR, odds ratio; 95% CI, 95% confidence interval.

[a]Models were adjusted for time to first PT visit, age, sex, marital status, education, race/ethnicity, annual household income, residential area of the worker, pain intensity, RMDQ score, injury severity, catastrophizing, work-fear avoidance, recovery expectations, SF-36 mental health score, body mass index, current health status, first provider seen after injury, previous injury leading to >1 month off work, hectic job, full-time work, and employer-offered accommodations.

[b]Type of PT treatment is categorized as three separate measures for the total number of Active PT, Passive PT, and Manual therapy procedures within 28 days of first PT visit

of the three unadjusted models ($p < 0.05$), there was no significant association between intensity of PT treatment and work disability at 1-year follow-up in the adjusted models.

3.2 | Working for pay at 1-year follow-up

We examined the associations between intensity of PT treatment and self-reported working for pay in the past week at 1-year follow-up using three logistic regression models (Table 5). In our adjusted models, we found that a greater amount of active PT was associated with lower odds of working at 1-year follow-up ($p < 0.05$).

3.3 | Pain intensity score at 1-year follow-up

Results from the multiple linear regression models examining the associations between total intensity of PT services and self-reported pain intensity score at 1-year follow-up are presented in Table 6. In the adjusted models, we found that for each additional hour (4 units) of active PT and total PT codes, there was a 0.12 and 0.08 reduction in pain intensity scores at 1-year follow-up, respectively. We also found a 0.06 reduction in pain intensity scores at 1-year follow-up for each additional day of PT treatment. We did not find any significant associations between passive PT and manual therapy treatments and pain intensity scores at 1-year follow-up.

TABLE 5 Logistic regression models examining the association between total intensity of PT treatments and working for pay at 1-year follow-up ($N = 574$)[a]

		Working for Pay at 1-year follow-up			
	PT intensity	Unadjusted OR (95% CI)	*p* Value	Adjusted OR (95% CI)	*p* Value
Model 5.1	Type of PT treatment[b]				
	Active PT	0.96 (0.94–0.98)	<0.01	0.97 (0.9–0.99)	0.04
	Passive PT	0.98 (0.95–1.00)	0.05	1.00 (0.97–1.04)	0.84
	Manual therapy	0.97 (0.94–1.00)	0.09	0.97 (0.93–1.02)	0.23
Model 5.2	Total PT codes	0.97 (0.96–0.98)	<0.01	0.98 (0.96–1.00)	0.07
Model 5.3	Total PT days	0.88 (0.84–0.93)	<0.01	0.93 (0.87–1.00)	0.07

Abbreviations: OR, odds ratio; 95% CI, 95% confidence interval.

[a]Models were adjusted for time to first PT visit, age, sex, marital status, education, race/ethnicity, annual household income, residential area of the worker, pain intensity, RMDQ score, injury severity, catastrophizing, work-fear avoidance, recovery expectations, SF-36 mental health score, body mass index, current health status, first provider seen after injury, previous injury leading to >1 month off work, hectic job, full-time work, and employer offered accommodations

[b]Type of PT treatment is categorized as three separate measures for the total number of Active PT, Passive PT, and Manual therapy procedures within 28 days of first PT visit

TABLE 6 Multiple linear regression models examining the association between total intensity of PT treatments and pain intensity score at 1-year follow-up ($N = 574$)[a]

		Pain intensity score at 1-year follow-up			
	PT intensity	Unadjusted estimate (β) (95% CI)	*p* Value	Adjusted estimate (β) (95% CI)	*p* Value
Model 6.1	Type of PT treatment[b]				
	Active PT	−0.01 (−0.03, 0.02)	0.47	−0.03 (−0.05, −0.01)	0.02
	Passive PT	0.01 (−0.03, 0.04)	0.70	−0.01 (−0.04, 0.02)	0.59
	Manual Therapy	0.01 (−0.04, 0.05)	0.80	−0.01 (−0.04, 0.04)	0.98
Model 6.2	Total PT codes	−0.01 (−0.02, 0.01)	0.78	−0.02 (−0.03, −0.01)	0.04
Model 6.3	Total PT days	−0.01 (−0.07, 0.06)	0.91	−0.06 (−0.12, −0.01)	0.04

Abbreviations: OR, odds ratio; 95% CI, 95% confidence interval.

[a]Models were adjusted for time to first PT visit, age, sex, marital status, education, race/ethnicity, annual household income, residential area of the worker, pain intensity, RMDQ score, injury severity, catastrophizing, work-fear avoidance, recovery expectations, SF-36 mental health score, body mass index, current health status, first provider seen after injury, previous injury leading to >1 month off work, hectic job, full-time work, and employer-offered accommodations.

[b]Type of PT treatment is categorized as three separate measures for the total number of active PT, passive PT, and manual therapy procedures within 28 days of first PT visit.

TABLE 7 Multiple linear regression models examining the association between total intensity of PT treatments and RMDQ score at 1-year follow-up (*N* = 574)[a]

	PT intensity	RMDQ score at 1-year follow-up Unadjusted estimate (β) (95% CI)	*p* Value	Adjusted estimate (β) (95% CI)	*p* Value
Model 7.1	Type of PT treatment[b]				
	Active PT	−0.02 (−0.10, 0.04)	0.41	−0.07 (−0.13, −0.02)	0.01
	Passive PT	0.07 (−0.02, 0.15)	0.14	0.02 (−0.04, 0.09)	0.41
	Manual Therapy	−0.02 (−0.12, 0.09)	0.78	−0.11 (−0.20, −0.01)	0.03
Model 7.2	Total PT codes	−0.01 (−0.05, 0.05)	0.99	−0.04 (−0.08, −0.01)	0.02
Model 7.3	Total PT days	0.05 (−0.12, 0.22)	0.57	−0.16 (−0.29, −0.01)	0.04

Abbreviations: OR, odds ratio; 95% CI, 95% confidence interval.

[a]Models were adjusted for time to first PT visit, age, sex, marital status, education, race/ethnicity, annual household income, residential area of the worker, pain intensity, RMDQ score, injury severity, catastrophizing, work-fear avoidance, recovery expectations, SF-36 mental health score, body mass index, current health status, first provider seen after injury, previous injury leading to >1 month off work, hectic job, full-time work, and employer offered. accommodations.

[b]Type of PT treatment is categorized as three separate measures for the total number of active PT, passive PT, and manual therapy procedures within 28 days of first PT visit.

3.4 | Roland Morris Disability Questionnaire Score at 1-year follow-up

We conducted three multiple linear regression models that examined the associations between intensity of PT treatments and the RMDQ score at 1-year follow-up (Table 7). In the adjusted models, we found that for each additional hour (4 units) of active PT and manual therapy, there was a 0.28 and 0.44 lower RMDQ (better function) score at 1-year follow-up ($p < 0.05$), respectively. Our results also indicated that an increase in the number of PT codes and PT days was significantly associated with a 0.16 and 0.16 point decrease in RMDQ scores at 1-year follow-up. We did not find significant associations between passive PT and the RMDQ score at 1-year follow-up.

4 | DISCUSSION

Our results highlight the associations between intensity of PT treatment on work and health outcomes at 1-year follow-up among injured workers with back pain. We found that the intensity of PT treatment among patients receiving PT care—whether measured as the type of PT treatment, total number of PT codes, or total number of PT days—was not associated with work disability at 1-year follow-up. However, there was a small association between higher intensity of active PT treatment and lower odds of self-reported working for pay at 1-year follow-up. We also found that increased intensity of PT treatment was associated with decreased pain intensity and RMDQ scores at 1-year follow-up.

In the adjusted models, our findings showed that a greater amount of active PT was associated with decreased pain intensity and RMDQ scores at 1-year follow-up while receiving passive PT services was not. Additionally, higher use of manual therapy services had a borderline significant association with decreased RMDQ scores at 1-year follow-up ($p = 0.05$). These results are consistent with findings from other studies that found associations between the type of PT treatment and greater improvement in pain and function outcomes[14,18,27] and are supported by clinical guidelines, which recommend that nonpharmacological treatments such as active PT and manual therapy procedures be considered as first-line treatment for acute or chronic back pain.[9,10] Systematic reviews also showed how exercise therapy, a common active PT treatment, appears to have a modest effect at decreasing pain and improving function in adults with chronic low-back pain.[28,29]

In a retrospective study of working-age individuals (18–60-year-old) with LBP, researchers found that individuals receiving guideline-adherent active PT care were more likely to have fewer clinical visits, lower costs, and improvement in disability scores.[18] In another study from the Netherlands, researchers examined whether adherence to Dutch PT and manual therapy guidelines would improve outcomes among patients with chronic LBP.[27] Results from the Dutch study showed that guideline adherence with an active PT approach was associated with improvement in the patient's physical functioning.[27] Reduction in pain intensity scores was found to be associated with greater amounts of active PT treatments in a prospective cohort study of older adults with back pain compared to older adults that did not receive any active PT.[14] They also found that increased use of passive and manual therapy did not result in significant associations with pain and function outcomes among back-injured adults.[14]

While our multiple linear regression models showed statistical significance between two of our outcomes (pain intensity and RMDQ score) and active PT, the magnitude of associations was small. For example, workers at the 75th percentile of active PT codes had 0.42 lower pain intensity and 0.98 lower RMDQ scores compared to those with no active PT codes. Despite the improvement in pain intensity and RMDQ scores, we do not consider these differences to be clinically meaningful.[30,31]

Our results showed that greater use of active PT was associated with lower odds of working for pay in the past week at 1-year follow-up in the adjusted model. A possible explanation for this may be residual confounding from workers that continue to be symptomatic and in need of medical services, having a longer duration of medical care and inability to return to work at full capacity. Having increased numbers of PT codes (active, passive, or manual therapy) may indicate that a worker still requires medical treatment and consequently remains unable to work at full capacity. There are other factors that are associated with negative return-to-work outcomes. In a systematic review of factors affecting negative return-to-work outcomes, the researchers found that older age, being female, greater pain or disability, depression, higher physical job demands, previous sick leave and unemployment, or activity-related limitations were factors that may explain not working.[32] Additionally, it is possible that work outcomes are affected by other individual factors beyond clinical measures such as pain and function, including psychological, health behaviors, and the work environment that need to be accounted for before returning to work.

Our results also showed that workers who received a greater number of PT codes and PT days experienced a small association with improvement in RMDQ scores at 1-year follow-up in the adjusted model, which suggests that workers with back pain receiving greater intensity of PT treatments may have small but positive functional outcomes. When we examined the 75th percentile of total PT codes (~7 h of PT treatment) and total PT days for these workers, we saw a reduction in the RMDQ score of 1.40 and 1.44, respectively. Again, while our study found small differences in the RMDQ score, it may not be clinically meaningful.[33]

One potential explanation for these small differences in 1-year outcomes is that most workers who initiated PT care within the first 2 months (75th percentile = 54 days), may see the impact on outcomes wane over time as the time since treatment increases. Another consideration is the need of a comprehensive and interdisciplinary approach including the use of other clinical treatments, psychosocial interventions, and health-related strategies for the back injury. For example, a recent meta-analysis of systematic reviews concluded that combining behavioral therapies, such as cognitive behavioral therapy, with active exercise therapies was better than either type of therapy alone.[34] It is possible that injured workers receiving PT care through a WC system tend to suffer from temporary or permanent disability and continue to have a worse prognosis for return-to-work outcomes, leading to potentially greater use of PT services. Thus, more research is needed to better understand whether a combination of PT services with other nonpharmacological and pharmacological treatments improves a worker's overall health outcome and ability to return to work.

4.1 | Limitations

This study is subject to some limitations. First confounding by indication is recognized as a limitation. Although we incorporated baseline measures for pain intensity and RMDQ scores in our adjusted models, some workers received PT services before the baseline interview, which was administered roughly 3 weeks after a WC claim was submitted to L&I and the results of these PT treatments may have influenced the worker's initial response to the baseline interview (e.g., indicating improvement in baseline pain intensity and RMDQ scores at baseline). Second, we did not account for additional factors such as whether the worker received prescription drugs and other pain medications in our adjusted models as well as information about the timing and coordination of the PT referral, which can lead to delayed treatment with a PT provider. Other factors such as treatments provided by other non-PT providers and the lack of information about active fitness levels outside the scope of medical treatments were not captured in this study. Third, our study was subject to recall and social desirability biases for three of the outcome measures from the follow-up interview survey (working for pay, pain intensity, and RMDQ scores). Fourth, the impact of PT benefits may also be degraded over time as the follow-up interview was approximately 1-year after the baseline interview. Fifth, while PT codes were used to identify the intensity of PT treatment in this study, we are still uncertain about whether PT interventions were accurately and consistently received by the worker and implemented as planned. For example, we do not know whether PT care such as active exercise or activity training was performed at home or routinely followed based on the PT provider's recommendation. Sixth, this study was conducted among an injured working population in WA and the intensity of PT treatments that each injured worker received may differ based on each WC system's coverage plan for PT services. In WA, injured workers are allowed up to 12 PT visits with no authorization and between 12 and 24 PT visits with the recommendation of their healthcare provider; however, any additional visit exceeding 24 visits will require a formal utilization review. Differences in PT utilization as well as the specific PT procedural codes that are covered in the WA WC system may impact the injured worker's care coordination and recovery time; therefore, our methods and results may not be generalizable to other injured workers in other states. Lastly, we recognize that our data source is dated and may not reflect the changes and policy reforms that have been enacted over the last few decades in the healthcare field; however, the interview survey data that are captured in the D-RISC study are novel and have a unique value for a WC system.

Despite these limitations, this study has some notable strengths. First, this is a population-based study of workers with back injuries. Second, we were able to link WC claims data with data that are not routinely captured in WC systems, including self-reported demographic, pain and function, psychosocial and health behavioral, health status, and employment-related data. Third, this study addresses a fundamental gap in the literature regarding post-injury treatment and specifically PT care for injured workers with back pain, which has not been widely studied in this population.

5 | CONCLUSION

To our knowledge, this is one of the first studies to examine the implications of intensity of PT care on work and health outcomes among an injured working population with back pain. While we did not find any strong associations between the intensity of PT treatment on work and health outcomes at 1-year follow-up, our results suggest that workers who received active and frequent PT treatments within the first 28 days of initiating PT care had a small, but positive association with less pain and improved functional status at 1-year follow-up. The results of this study could help stakeholders, such as physicians, PT providers, injured workers, WC systems, and policymakers, better understand whether active PT services are beneficial to work and health outcomes and how to improve clinical practice patterns to better benefit patients. Additional research is needed to better understand whether a more comprehensive and interdisciplinary approach for treatment of back pain would be beneficial for workers, including strategies that address psychosocial, work-related, and health behavioral factors. Furthermore, it may also be important to better understand the relationships between the use of active PT on work and health outcomes for workers with back pain.

AUTHOR CONTRIBUTIONS

Brian Chin, Sean D. Rundell, Jeanne M. Sears, Deborah Fulton-Kehoe, and Gary M. Franklin participated in the conception and research design of this study. Brian Chin, Deborah Fulton-Kehoe, and Gary M. Franklin participated in the acquisition of data. Brian Chin conducted the data analysis and drafted the work. Brian Chin, Sean D. Rundell, Jeanne M. Sears, and Deborah Fulton-Kehoe participated in the interpretation of the data. Brian Chin, Sean D. Rundell, Jeanne M. Sears, Deborah Fulton-Kehoe, June T. Spector, and Gary M. Franklin revised the work for important intellectual content and provided the final approval of this version to be published. Brian Chin, Sean D. Rundell, Jeanne M. Sears, Deborah Fulton-Kehoe, June T. Spector, and Gary M. Franklin agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are not available for data-sharing due to privacy and third-party restrictions.

DISCLOSURE BY AJIM EDITOR OF RECORD

John Meyer declares that he has no conflict of interest in the review and publication decision regarding this article.

DISCLAIMER

The findings and conclusions presented in this article are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, the University of Washington School of Public Health, or the Washington State Department of Labor and Industries.

ETHICS APPROVAL AND INFORMED CONSENT

This study was approved by the University of Washington Human Subjects Division Institutional Review Board. All survey participants gave written informed consent. Administrative and medical billing data provided to the researchers contained no direct identifiers.

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APPENDIX A

See Table A1.

TABLE A1 Current Procedural Terminology (CPT) codes for physical therapy treatment categories

Evaluation	Procedure codes	Description
97001–97002	CPT	Physical Therapy/Occupational Therapy evaluation codes
95831–95852	CPT	Muscle and Range of Motion testing codes
97750–97755	CPT	Physical performance codes
1045M[a]	L&I	Functional capacity evaluation
1001M[a]	L&I	Work hardening evaluation
0389R[a]	L&I	Job mod/pre-job accommodation consultation code
8918H[a]	L&I	Vehicle modification consultation
8916H[a]	L&I	Home modification consultation
Passive interventions		
97010–97039	CPT	Modality codes
E0745–E0764[a]	HCPCS	Electrical stimulator codes
G0283[a]	HCPCS	Other electrical stimulus code

(Continues)

TABLE A1 (Continued)

Evaluation	Procedure codes	Description
97124	CPT	Massage
97597–97610	CPT	Wound care
97760–97762	CPT	Orthotic/prosthetic management
90901, 90911	CPT	Biofeedback
97799, 97139	CPT	Unlisted procedures
97039	CPT	Unlisted modality
S8948[a]	CPT	Application of a modality, low-level laser
G0281[a]	CPT	Electrical Stimulation
Manual therapy		
97140	CPT	Manual Therapy
Active interventions		
97110–97116	CPT	Exercise codes
97530	CPT	Activity training
97532	CPT	Cognitive training
97533	CPT	Sensory integrative techniques
95992	CPT	Canalith repositioning (NMS re-ed)
97545–97546	CPT	Work Hardening/Conditioning codes
97150	CPT	Therapy (group)
97532–97542	CPT	Educational Interventions
97535	CPT	Self-care/home management training
97537	CPT	Community/work reintegration
97542	CPT	Wheelchair management (assessment, fitting, training)

[a]Refers to non-CPT codes: Washington State Department of Labor and Industries (L&I) local procedural codes and Healthcare Common Procedure Coding System (HCPCS)