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Early Return to Work Has Benefits for Relief of Back Pain and Functional Recovery After Controlling for Multiple Confounds

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Objective: The aim of the study was to evaluate the effect on health outcomes of an early or immediate return-to-work (RTW) after acute low back pain (LBP). **Methods:** A longitudinal cohort of workers ($N = 557$) consulting for uncomplicated LBP were assessed on demographic, pain, occupational, and psychosocial variables. Pain and function were assessed at 3-month postpain onset. We tested the longitudinal effects of an early RTW on 3-month outcomes. **Results:** Pain and function improved more rapidly for workers with an immediate (30.7%) or early (1 to 7 days) RTW (36.8%). Eleven demographic, health, or workplace variables were identified as potential confounds, but controlling for these factors only partially attenuated the benefits of an early RTW. **Conclusions:** An early RTW improves acute LBP and functional recovery, and alternate confounding explanations only partially eclipse this therapeutic effect.

Keywords: acute low back pain, disability, early return-to-work, functional recovery, health benefits, pain recovery, patient education, sickness absence, sickness certification

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LBP is one of the most frequently encountered conditions in occupational medicine practice and accounts for one-third of all lost work time resulting from occupational musculoskeletal injuries and illnesses.[1] Although some practice variation and controversy remains about the preferred treatment of acute LBP,[2] a nearly universal recommendation is that patients presenting with no medical "red flags" should resume normal activities as soon as tolerated, including an early RTW.[3–6] This recommendation evolved from evidence that excessive bed rest is detrimental[7] and from administrative disability insurance data showing a rapidly escalating risk of long-term disability and high claim costs with increasing weeks of work absence.[8,9] Early RTW is considered ideal, but not all patients experience the same rate of pain recovery[10] and patients face varying levels of occupational exposures when returning to work.[11] This creates dilemmas over sickness certification and whether more proactive efforts should be pursued to treat symptoms and/or facilitate RTW with employers.[12–14] Although there are obvious cost savings to insurers and financial advantages for workers to return to full wages, health benefits of an early RTW have not been studied.

One explanation for encouraging an early RTW is to negate the physical inactivity and deconditioning that might otherwise occur while a person is out of work. When patients with acute LBP are advised to stay active, this produces significantly better improvements in pain and function than when recommended bed rest.[15] Systematic reviews, however, have failed to show significant benefits of physical exercise and conditioning interventions for acute LBP when trial results are aggregated using meta-analytic methods.[16–18] Although regular exercise and physical fitness seem to stave off the onset of acute LBP,[19] no similar fitness advantage has been reported for acute LBP recovery.[20] Also, in occupations that involve heavy work, repetitive tasks, or highly sedentary work, these job demands may contribute further to discomfort and aggravation and oppose any benefits of physical activity at work.[11] Thus, although being at work may provide opportunities to stay active, the physical reconditioning aspects of RTW are unclear.

Negative psychosocial variables (yellow flags) are associated with a more likely transition to chronic pain,[21] and there is also an emerging body of literature showing coworker, supervisor, and general organizational support lead to improved back disability outcomes.[11] Therefore, another possible explanation for the benefits of RTW includes the added social support offered by the workplace.[22,23] Hence, this type of support may help to foster pain self-management strategies and counter automatic pain catastrophizing and other dysfunctional pain beliefs. Although not every workplace provides these types of positive personal rewards, staying at home may increase feelings of loneliness, victimization, perceived injustice, and other negative pain beliefs that can impede pain recovery.[24] Thus, RTW may help offset negative pain beliefs and foster self-efficacy beliefs by demonstrating for an individual his or her ability to function at work despite lingering symptoms.

One major challenge of testing the health benefits of RTW has been the inability to test these effects using randomized study designs, for both practical and ethical reasons. Although interventions designed to improve RTW rates for acute LBP show parallel health benefits,[25] it is unclear whether these improvements in pain and function can be attributed to having returned to work. Cross-sectional studies of acute LBP show correlations between RTW status and pain outcomes,[26] but again the causal direction is unclear. In observational cohorts of workers with acute LBP, prospective associations between early RTW and health outcomes can be computed, but many confounds exist in this comparison, most notably initial pain severity. Confounding variables are extraneous variables that offer a simpler, third variable explanation for the apparent association between the independent and dependent

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Clinical significance: In this low back pain (LBP) cohort, symptoms improved for those who returned to work more quickly, even after controlling for pain intensity and other potentially confounding factors. Thus, an early return-to-work (RTW) should be encouraged, not only to reduce long-term disability but also to improve health recovery.

The authors report no conflicts of interest.

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variables and are correlated with both. In addition to the potential confounds in prior studies, there are few prognostic studies of LBP during the acute phase, and almost none that originate in the day 1 or 2 after pain onset.

In the following study, we use existing data from a prospective cohort of workers with acute LBP[27] that included a very early survey assessment (of RTW and other potential risk factors and confounds) and a follow-up assessment at 3 months. The goal of our analyses below was to assess the effect of early versus later RTW on 3-month outcomes of pain and function while controlling for baseline demographics, pain severity, occupation, and other characteristics representing potential confounds.

METHODS

Participants

Clinicians from eight private occupational health clinics in the United States (Rhode Island, Massachusetts, Maine, and Ohio) recruited participants from their normal flow of outpatients with back pain between September 2000 and October 2002. In this setting, most patients were referred to the clinic by their employers after their first report of a work injury. Inclusion criteria were as follows: (1) acute episode (<14 days) of nonspecific or uncomplicated sacral or lumbar back pain; (2) employed adult age 18 or older; and (3) ability to read documents in English or Spanish. Clinicians were encouraged to recruit patients sequentially without regard to severity or demographics, except for those cases involving significant trauma or neurological deficits. Participants were recruited at the initial visit; therefore, their diagnosis (of complicated LBP) was based solely on patient interview and physical examination. More detailed diagnostic codes were not collected as part of the original study.

Procedure

Eligible participants were identified by front desk staff or clinicians before or during the initial evaluation visit for acute LBP. After providing informed consent, participants completed a questionnaire containing questions related to demographics, injury circumstances, and potential disability risk factors. Participants then proceeded with evaluation and treatment as usual. The results of the survey data were not shared with clinicians, and no add-on interventions were provided. One and 3 months after pain onset, participants completed a follow-up survey describing pain, function, and work status. These follow-up periods coincided with the usual definitions for acute (<1 month), subacute (1 to 3 months), and chronic pain (>3 months). All study methods were approved by the Institutional Review Board of the Liberty Mutual Research Institute for Safety (Project #CDR02-05).

Measures

Early Return to Work

At 1-month follow-up, participants indicated whether they had been able to resume work with or without any job modifications. Participants also reported the number of days absent from work and the number of days on modified duty work status. Based on the number of days reported at 1-month follow-up, participants were categorized as ''immediate RTW'' (0 days lost), ''early RTW'' (1 to 7 days lost), or ''longer absence'' (>7 days). The cutoff of 7 days was chosen because this aligned with the 7-day waiting period before insurance indemnity payments were initiated in these jurisdictions as a substitute for lost wages. Although it may seem unusual to include those with no lost work time in a RTW cohort study, all study participants left the workplace for at least a few hours to be evaluated by an off-site physician, and all were eligible to either return to work or return home after the medical evaluation. Our research team was especially interested in the factors that allowed some individuals to resume their work immediately despite pain and dysfunction of sufficient severity to trigger a report of work injury.

Potential Confounds

At the time of study enrollment, participants completed a basic demographic questionnaire, several questions about the nature of their work and the circumstances of their back injury, and the Back Disability Risk Questionnaire (BDRQ).[28] The BDRQ includes information that can be used to identify patients that are at a low, medium, or high risk for back disability. The BDRQ samples question from a number of known disability risk domains (eg, workplace concerns, no available modified duty, pain catastrophizing), and the total score represents the number of items showing potentially elevated risk. We selected potential covariates from the original dataset based on the existing literature reflecting the importance of sex, age, and education[27]; injury type and severity[10]; workplace factors[11]; pain beliefs[24]; and mood.[29] In addition to the physical rating of job demands provided by participants in the BDRQ, occupational titles were used to look up the frequency of physical work demands catalogued by the Occupational Information Network (O*NET), a database and on-line resource tool developed under the sponsorship of the US Department of Labor's Employment and Training Administration.[30,31]

Outcome Measures

A 16-item abbreviated form of the Roland-Morris Disability Questionnaire (RMDQ)[32,33] was used to assess level of functional recovery at the 3-month follow-up. The reproducibility, construct validity, reliability, and responsiveness of the RMDQ are well established.[34,35] In our sample, the internal consistency (Cronbach alpha) for the RMDQ was 0.73 at 1-month follow-up, and 0.86 at 3-month follow-up. Participants also reported their current back pain using an 11-point scale Numeric Rating Scale (NRS) from ''0'' (no pain at all) to ''10'' (worst pain possible).[36]

Data Analyses

Univariate relationships between pain, function, RTW, and potentially confounding baseline variables were assessed. Those variables showing significant associations or trends ($P < 0.10$) with RTW and/or with pain or function at follow-up were retained as confounders in multivariate analyses. For the 3-month outcomes of pain and function, we used linear regression analyses to test whether RTW status predicted these outcomes after controlling for confounding variables in a series of hierarchical steps by variable domains. Logarithmic transformations (base 10) were used for both pain and function outcome measures to correct for non-normal distribution properties. Demographic variables were added to the model first, then circumstances of health and injury, and then workplace factors. This produced four separate models, with each model controlling for a larger set of potential confounders. All analyses were conducted with the IBM SPSS Statistical Package (Release 20).[37] Alpha levels were set to 0.05 with the exception of a more liberal alpha level (.10) when choosing potential confounds for the final models.

RESULTS

Over a 2-year recruitment period, 618 patients (67.5% male) with a presenting complaint of acute LBP agreed to participate. For the full sample, back pain improved from a rating of 6.19 (SD = 2.06) at the initial visit to 3.07 (SD = 2.28) at 1-month follow-up and 2.56 (SD = 2.14) at 3-month follow-up. A subset of participants ($n = 557$) who had complete RMDQ data at 3 months were chosen for all remaining analyses (a 90% retention rate). Comparisons of those lost to follow-up with those with complete

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TABLE 1. Demographic, Health, and Occupational Characteristics by Duration of Work Absence

	Days Absent at 1 mo					
	0 d ($n=171$)	1–7 d ($n=205$)	8+ d ($n=181$)	Total ($N=557$)*		
	n (%)	*n* (%)	*n* (%)	*N* (%)	X^2	*P*
Sex						
Male	118 (69.0)	122 (59.5)	128 (70.7)	368 (66.1)	6.33	0.04
Female	53 (31.0)	83 (40.5)	53 (29.3)	189 (33.9)		
Age						
<35	79 (46.2)	107 (52.2)	82 (45.3)	268 (48.1)	3.21	0.52
35–49	65 (38.0)	75 (36.6)	75 (41.4)	215 (38.6)		
50+	27 (15.8)	23 (11.2)	24 (13.3)	74 (13.3)		
Education						
Less than 12 y	25 (14.6)	40 (19.6)	41 (23.0)	106 (17.5)	6.68	0.15
High school graduate	57 (33.3)	59 (28.9)	62 (34.8)	178 (29.5)		
Some college	89 (52.0)	105 (51.5)	75 (42.1)	269 (44.5)		
Income						
<$25,000	51 (30.9)	93 (46.7)	81 (47.6)	225 (42.1)	19.12	<0.005
$25,000–$39,999	61 (37.0)	54 (27.1)	58 (34.1)	173 (32.4)		
$40,000+	53 (32.1)	52 (31.5)	31 (18.2)	136 (25.5)		
Marital status						
Never married	53 (31.4)	73 (36.1)	71 (39.7)	197 (36.3)	3.53	0.47
Married	85 (50.3)	92 (45.5)	83 (46.4)	260 (48.0)		
Divorced or widowed	31 (18.3)	37 (18.3)	25 (14.0)	85 (15.7)		
Injury type						
Overexertion/repetitive motion	116 (67.8)	136 (66.3)	121 (66.9)	373 (67.0)	14.44	0.03
Bodily reaction	37 (21.6)	37 (18.0)	23 (12.7)	97 (17.4)		
Falls	13 (7.6)	16 (7.8)	27 (14.9)	56 (10.1)		
Other	5 (2.9)	16 (7.8)	10 (5.5)	31 (5.6)		
Self-rated pain at baseline						
Pain rating from 0 to 4	49 (28.8)	50 (24.4)	27 (14.9)	126 (22.7)	34.16	<0.001
Pain rating from 5 to 7	97 (57.1)	106 (51.7)	81 (44.8)	284 (51.1)		
Pain rating from 8 to 10	24 (14.1)	49 (23.9)	73 (40.3)	146 (26.2)		
Worried about reinjury						
Little or not at all	57 (33.3)	58 (28.3)	29 (16.0)	144 (25.9)	15.00	0.005
Somewhat	53 (31.0)	73 (35.6)	73 (40.3)	199 (35.7)		
Very or extremely	61 (35.7)	74 (36.1)	79 (43.6)	214 (38.4)		
How often exercise before injury						
Never or rarely	47 (27.5)	63 (30.7)	45 (24.9)	155 (27.8)	2.10	0.72
1–3 times/wk	94 (55.0)	103 (50.2)	99 (54.7)	296 (53.1)		
>4 times/wk	30 (17.5)	39 (19.0)	37 (20.4)	106 (19.0)		
Quality of health						
Excellent or very good	96 (56.5)	111 (54.2)	97 (53.9)	306 (55.1)	0.52	0.97
Good	69 (40.6)	86 (42.0)	76 (42.2)	231 (41.6)		
Fair or poor	5 (2.9)	8 (3.9)	7 (3.8)	20 (3.6)		
Depressed during past week						
Little or none of the time	132 (77.2)	136 (66.3)	114 (63.0)	382 (68.6)	19.91	<0.005
Some or a good bit of the time	34 (19.9)	62 (30.2)	47 (26.0)	143 (25.7)		
Most or all of the time	5 (2.9)	7 (3.4)	20 (11.0)	32 (5.7)		
Stressed during the past week						
Little or none of the time	65 (38.0)	75 (36.6)	70 (38.7)	210 (37.7)	1.43	0.84
Some or a good bit of time	84 (49.1)	103 (50.2)	82 (45.3)	269 (48.3)		
Most or all of the time	22 (12.9)	27 (13.2)	29 (16.0)	78 (14.0)		
Currently smoking						
Yes	58 (34.9)	89 (43.4)	89 (50.0)	236 (43.0)	7.97	0.019
No	108 (65.1)	116 (56.6)	89 (50.0)	313 (57.0)		
Body mass index						
Normal	53 (31.9)	62 (30.4)	48 (26.7)	163 (29.5)	2.34	0.673
Overweight	67 (39.6)	87 (42.6)	72 (40.0)	226 (40.9)		
Obese	49 (29.5)	55 (27.0)	60 (33.3)	164 (29.6)		
Job Tenure						
<1 y	32 (18.6)	62 (30.2)	69 (38.1)	163 (29.3)	28.12	<0.001
1–1.99 y	21 (12.2)	30 (14.6)	31 (17.1)	82 (14.7)		
2–4.99 y	46 (26.7)	59 (28.8)	43 (23.8)	148 (26.6)		
5+ y	72 (41.9)	54 (26.3)	38 (21.0)	164 (29.4)		
Company size						
Small (<50 employees)	27 (16.0)	32 (15.9)	46 (25.8)	105 (19.2)	9.06	0.060
Medium (51–500 employees)	65 (38.5)	88 (43.8)	68 (38.2)	221 (40.3)		
Large (>500 employees)	77 (45.6)	81 (40.3)	64 (36.0)	222 (40.5)		

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TABLE 1. (*Continued*)

	Days Absent at 1 mo					
	0 d ($n = 171$)	**1–7 d ($n = 205$)**	**8+ d ($n = 181$)**	**Total ($N = 557$)***		
	***n* (%)**	***n* (%)**	***n* (%)**	***N* (%)**	**X^2**	***P***
Employer supports modified duty						
No	37 (21.6)	75 (36.6)	102 (56.4)	214 (38.4)	45.25	<0.001
Yes	134 (78.4)	130 (63.4)	79 (43.6)	343 (61.6)		
Negative supervisor responses						
0 negative behaviors	117 (75.5)	139 (72.4)	106 (63.5)	362 (70.0)	11.15	0.025
1 negative behavior	35 (22.8)	33 (17.2)	40 (24.0)	108 (20.9)		
2+ negative behaviors	6 (3.8)	20 (10.4)	21 (12.5)	47 (9.1)		
Physical demands of job						
Rating of 0–6	53 (31.0)	54 (26.3)	31 (17.1)	138 (24.8)	15.93	0.003
Rating of 7–8	68 (39.8)	73 (35.6)	63 (34.8)	204 (36.6)		
Rating of 9–10	50 (29.2)	78 (38.0)	87 (48.1)	215 (38.6)		
BDRQ risk factor stratification						
Low risk	104 (60.8)	49 (23.9)	21 (11.6)	174 (31.2)	122.80	<0.001
Moderate risk	53 (31.0)	105 (51.2)	84 (46.4)	242 (43.4)		
High risk	14 (8.2)	51 (24.9)	76 (42.0)	141 (25.3)		

BDRQ, Back Disability Risk Questionnaire.
*Totals less than the full sample size ($N = 557$) indicate unreported data.

3-month data revealed those lost to follow-up were younger (32.1 years vs 36.6 years), more likely to be male (80.7% vs 66.1%), with higher levels of pain at baseline (6.71 vs 6.14).

Demographic variables for the remaining analytic subsample ($n = 557$) are shown in Table 1. Overall, the most common demographic characteristics were being young, white, male, with moderate-to-low income, significant physical job demands, and working with a large employer (>500 employees). These demographic characteristics are consistent with that of workers who would be referred by their employers to visit private occupational medicine clinics in the study region after the onset of back pain at work. After the initial visit with a health care provider, 171 patients (30.7%) returned to work immediately with no lost work time, 205 (36.8%) returned to work within 7 days, and 181 (32.5%) lost eight or more work days of work.

Demographic, health, and occupational characteristics were compared across the three groups achieving an immediate RTW, early RTW, or longer work absence (Table 1). These comparisons showed that late returners were more likely to be female, of lower income, working for a smaller employer, and/or injured by a fall. As expected, late returners also showed elevations on many of the disability risk factors included in the BDRQ: depressed mood, initial pain intensity, smoking, being new on the job, more physically demanding work, more worries about reinjury, and/or less workplace support. The majority of workers with an early RTW (60.8%) were categorized as low risk using the BDRQ summary risk stratification, and the majority of workers with late RTW (68.7%) were identified as moderate or high risk. Of the nine physical work demand variables extracted from the O∗NET system, five were significant predictors of early RTW ($P < 0.05$) (Table 2). Workers

TABLE 2. Occupational Characteristics Extracted From O*NET by Duration of Work Absence

	Days Absent at 1 mo						
	(a) 0 d ($n = 154$)	**(b) 1–7 d ($n = 185$)**	**(c) 8+ d ($n = 173$)**	**Total ($N = 512$)***			**Tukey post hoc**
	***M* (SD)**	***M* (SD)**	***M* (SD)**	***M (SD)***	***F***	***P***	**comparison**
Cramped work space, awkward positions*	2.39 (0.69)	2.37 (0.72)	2.48 (0.71)	2.42 (0.71)	1.26	0.28	
Exposed to whole body vibration*	1.42 (0.52)	1.41 (0.53)	1.51 (0.61)	1.45 (0.55)	1.67	0.19	
Spend time sitting†	2.46 (0.76)	2.49 (0.84)	2.28 (0.74)	2.41 (0.79)	3.68	0.03	b > c
Spend time standing†	3.68 (0.74)	3.66 (0.81)	3.86 (0.71)	3.73 (0.76)	3.59	0.03	b < c
Spend time climbing ladders, scaffolds, or poles†	1.46 (0.56)	1.46 (0.61)	1.61 (0.72)	1.51 (0.64)	3.15	0.04	
Spend time walking and running†	3.18 (0.70)	3.27 (0.78)	3.34 (0.66)	3.27 (0.72)	1.83	0.16	
Spend time kneeling, crouching, stooping, or crawling†	2.21 (0.46)	2.27 (0.57)	2.39 (0.61)	2.29 (0.56)	4.41	0.01	a < c
Spend time bending or twisting the body†	2.93 (0.63)	2.96 (0.72)	3.13 (0.64)	3.01 (0.67)	4.64	0.01	a, b < c
Spend time making repetitive motions†	3.28 (0.63)	3.29 (0.61)	3.38 (0.54)	3.31 (0.60)	1.45	0.24	

*Response categories: 1 (never), 2 (once a year or more but not every month), 3 (once a month or more but not every week), 4 (once a week or more but not every day), or 5 (every day).
†Response categories: 1 (never), 2 (less than half the time), 3 (about half the time), 4 (more than half the time), or 5 (continually or almost continually).

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with a later RTW spent less time sitting at work and spent more time standing, climbing, kneeling/crouching, and/or twisting.

Variables from Table 1 that were at least marginally associated ($P < 0.10$) with an early RTW status were retained as potential confounders and tested for associations with 3-month pain and function (Table 3). Potential confounders that could be tested included sex, income, injury type, initial pain intensity, worries about reinjury, smoking status, depressed mood, job tenure, company size, support for modified duty, negative supervisor interactions, physical job demands, and a single summary variable dividing the average of O∗NET physical demand ratings into tertiles (low, moderate, and high). For the 3-month pain outcome (Table 2), all demographic and health variables were significant univariate predictors (with the exception of smoking). Support for modified duty was the only significant workplace predictor. For the 3-month function outcome, all potential covariates were statistically significant predictors with the exception of physical job demands (both self-report and O∗NET classifications). Therefore, all potential confounds from Table 3 were advanced for multivariate analyses with the exception of physical job demands.

Potential confounders were added to models predicting 3-month pain and function in stepwise fashion to assess whether the introduction of potentially confounding variables attenuated the association between early RTW and functional recovery. Results for the outcome of pain are shown in Table 4, and the attenuating effect of confounders is depicted in Figure 1. Inclusion of sex and income

TABLE 3. Three-Month Outcomes by Factors Associated With Return-To-Work Status (Potential Confounders)

	Numerical Pain Rating Scale 0–10 ($N = 534$)			Functional Disability (RMDQ) ($N = 532$)		
Baseline Characteristics	***M* (SD)**	***F***	***P***	***M* (SD)**	***F***	***P***
Sex						
Male	2.28 (1.89)	11.48	0.001	19.84 (26.62)	15.46	<0.001
Female	2.91 (2.34)			30.00 (31.31)		
Income						
<$25,000	2.79 (2.27)	4.25	0.006	225 (42.1)	19.12	<0.005
$25,000–$39,999	2.40 (2.02)			173 (32.4)		
$40,000+	2.04 (1.61)			136 (25.5)		
Injury type						
Overexertion/repetitive motion	2.37 (1.91)	4.77	0.003	22.75 (27.71)	4.94	0.002
Bodily reaction	2.29 (2.00)			17.12 (24.82)		
Falls	3.25 (2.65)			31.83 (34.56)		
Other	3.36 (2.63)			35.90 (35.04)		
Depressed during past week						
Little or none of the time	2.28 (1.92)	5.42	0.005	20.01 (26.80)	8.74	<0.005
Some or a good bit of the time	2.80 (2.10)			28.07 (29.28)		
Most or all of the time	3.25 (2.94)			38.97 (38.84)		
Self-rated pain at baseline						
Pain rating from 0 to 4	1.95 (159)	12.85	<0.005	18.26 (27.17)	6.20	0.002
Pain rating from 5 to 7	2.38 (1.86)			22.16 (27.50)		
Pain rating from 8 to 10	3.19 (2.61)			30.23 (31.26)		
Smoking cigarettes						
Yes	2.62 (2.16)	1.38	0.241	26.6 (29.5)	4.92	0.027
No	2.41 (2.01)			21.0 (28.0)		
Job Tenure						
<1 y	2.70 (2.25)	0.87	0.456	26.82 (29.78)	2.54	0.056
1–1.99 y	2.56 (2.22)			26.53 (31.64)		
2–4.99 y	2.43 (2.04)			23.24 (28.90)		
5+ y	2.33 (1.85)			18.60 (25.37)		
Company Size						
Small (<50 employees)	2.63 (2.19)	0.77	0.770	28.89 (30.41)	2.21	0.099
Medium (51–500 employees)	2.49 (2.12)			22.51 (28.77)		
Large (>500 employees)	2.44 (1.98)			21.8 (27.75)		
Negative supervisor responses						
0 negative behaviors	2.36 (1.87)	2.26	0.105	21.29 (28.30)	2.58	0.077
1 negative behavior	2.83 (2.44)			26.89 (30.00)		
2+ negative behaviors	2.64 (2.36)			27.55 (28.29)		
Physical demands of job						
Rating of 0–6	2.40 (2.11)	1.22	0.297	23.76 (30.67)	0.61	0.545
Rating of 7–8	2.37 (1.89)			21.63 (27.63)		
Rating of 9–10	2.67 (2.21)			24.76 (28.46)		
Employer supports modified duty						
No	2.82 (2.45)	5.19	0.023	29.67 (32.33)	12.70	<0.001
Yes	2.40 (1.92)			20.69 (26.75)		
O∗NET occupational demands						
Low physical demands	2.73 (2.29)	1.65	0.194	25.39 (31.76)	0.28	0.759
Moderate physical demands	2.55 (2.09)			23.24 (27.92)		
High physical demands	2.30 (1.88)			22.92 (27.97)		

BDRQ, Back Disability Risk Questionnaire.

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TABLE 4. Summary of Hierarchical Regression Analysis ($N = 534$) to Predict 3-Month Pain Rating (Log Transformation)

	Model 1			Model 2			Model 3			Model 4		
Variable	***B***	**SE *B***	β	***B***	**SE *B***	β	***B***	**SE *B***	***B***	***B***	**SE *B***	β
Return-to-work in first month												
Immediate (0 lost d)	−0.135	0.033	−0.202**	−0.117	0.033	−0.174**	−0.080	0.033	−0.116*	−0.085	0.035	−0.124*
Early (1–7 lost d)	−0.100	0.032	−0.158**	−0.102	0.032	−0.160**	−0.085	0.031	−0.130**	−0.087	0.031	−0.133**
Delayed (8+ lost d)†												
Sex (female)				0.082	0.029	0.127**	0.075	0.028	0.113*	0.075	0.028	0.113**
Income												
<$25,000†												
$25,000–$39,999				−0.039	0.032	−0.058	−0.030	0.031	−0.044	−0.029	0.032	−0.042
$40,000+				−0.062	0.035	−0.087	−0.047	0.034	−0.065	−0.044	0.036	−0.061
(Not reported)				0.033	0.069	0.021	0.056	0.066	0.036	0.059	0.067	0.037
Injury type												
Overexertion/repetitive motion†												
Bodily reaction							0.031	0.033	0.038	0.032	0.033	0.040
Fall							0.105	0.043	0.099	0.106	0.044	0.101*
Other							0.136	0.058	0.094*	0.136	0.059	0.094*
Pain reported at time of injury												
Pain rating from 0 to 4†												
Pain rating from 5 to 7							0.043	0.032	0.068	0.043	0.032	0.069
Pain rating from 8 to 10							0.106	0.037	0.151**	0.106	0.037	0.150**
Worried about reinjury												
Little or not at all†												
Somewhat							0.143	0.032	0.218**	0.145	0.033	0.221**
Very or extremely							0.151	0.032	0.235**	0.154	0.033	0.240**
Smoke cigarettes (no)							−0.013	0.026	−0.020	−0.013	0.026	−0.021
Depressed during past week												
Little or none of the time†												
Some or a good bit of the time							0.065	0.029	0.091*	0.065	0.030	0.090*
Most or all of the time							0.043	0.056	0.032	0.045	0.057	0.033
Job tenure												
<1 y												
1–1.99 y										0.002	0.040	0.002
2–4.99 y										−0.008	0.034	−0.011
5+ y										−0.008	0.035	−0.011
Company size												
Small (<50 employees) †												
Medium (51–500 employees)										0.007	0.035	0.011
Large (>500 employees)										0.007	0.035	0.012
Negative supervisor response												
0 negative behaviors†												
1 negative behavior										0.010	0.032	0.013
2+ negative behaviors										−0.015	0.046	−0.014
Employer supports modified duty										0.017	0.027	0.027

B, unstandardized regression coefficient; *β*, standardized regression coefficient; SE, standard error.
*$P < 0.01$.
**$P < 0.05$.
†Base category for dummy coding of categorical variable.

(model 2) reduced the variance explained by 14% for an immediate RTW, but there was no attenuation in the benefits shown by an early RTW. In the next step, inclusion of injury type, pain at baseline, smoking, and depressed mood (model 3) further reduced the apparent benefits of RTW on pain recovery (29% for an immediate RTW and 19% for early RTW). Adding workplace variables in the final step (model 4) showed no further reduction in the association between early RTW and 3-month pain outcome. In the final model, which included all potential confounders (model 4), the benefits of both immediate and early RTW remained statistically significant ($P < .05$). Based on the degree of attenuation when adding individual variables, evidence of a confounding (or attenuating) effect was most pronounced for sex, initial pain intensity, injury type, worries about reinjury, and depressed mood. R-square for the final model was 159 [omnibus $F(24,538) = 4.25$, $P < 0.05$].

Results were similar for the functional outcome measure (Table 5), and the attenuation effect is depicted in Figure 2. Adding sex and income (model 2) attenuated the effect of an immediate RTW but no attenuation was found for an early RTW. Adding health and injury variables (model 3) attenuated the effect by an additional 32% for an immediate RTW and 24% for an early RTW. Adding workplace variables (model 4) further attenuated the effect by an additional 6% for an immediate RTW and 6% for an early RTW. In the final model which included all potential confounders, the benefits of both an immediate and an early RTW remained statistically significant ($P < 0.05$). Based on the degree of attenuation when entering individual variables, evidence of a confounding (or attenuating) effect was most pronounced for sex, initial pain intensity, worries about reinjury, and depressed mood. R-square for the final model was .185 [omnibus $F(24,536) = 5.05$, $P < 0.05$].

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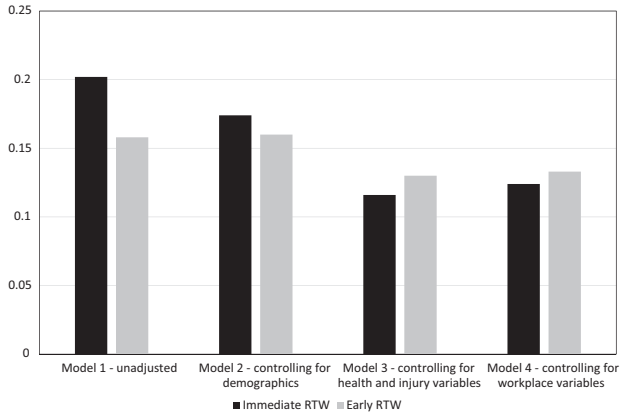

FIGURE 1. Effect (beta weight) of immediate or early RTW on 3-month pain when adjusting for potential confounders.

DISCUSSION

Encouraging an early RTW after onset of acute LBP is a standard recommendation in current clinical guidelines. However, there are no prior studies evaluating the health benefits of RTW in a prospective cohort of workers experiencing an acute episode of work-related LBP. This study supports the potential therapeutic value of RTW as soon as possible after pain-onset (ie, within 7 days). In our cohort, early RTW contributed to short-term (3-month) improvements in pain and function. Stepwise analysis of potential confounds related to demographic, health, and workplace variables revealed some attenuation of early RTW benefits, but the positive effects of RTW on pain and function remained statistically significant even after controlling for these variables. Although it is impossible to control for all possible confounds in an observational cohort study, our findings support the health benefits of an early RTW after acute LBP.

Although there is no precise statistical test to determine whether a variable should be classified as a true confounder, the benefits of an early RTW in this study were partially attenuated when variables were added to the model (approximately 40% reduction in R-squared). Thus, some of the apparent benefits of an early RTW are due to shared correlations with other extraneous variables. However, 60% of the association between an early RTW and improvements in pain and function at 3 months remained even after controlling for 11 possible demographic, health, and psychosocial confounds. Confounding variables included in the final models included sex, income, injury type, pain intensity, worries of reinjury, smoking, depressed mood, job tenure, company size, negative supervisor interactions, and availability of modified duty. Therefore, we can conclude that the observed benefits of an early RTW on pain and function were not attributable solely to shared associations with these prognostic variables.

Female sex and lower income were associated with poorer RTW and pain recovery at 3 months. These were the only demographic factors that showed evidence of confounding in the relationship between early RTW and pain or function. Thus, the benefits of an early RTW may be different for male and female workers and different for low- or high-income workers. These two variables should continue to be included as covariates when studying work outcomes for acute LBP. It is possible that an early RTW for those with lower income may not be a choice, but an imperative, as lost work time can lead to an untenable wage reduction or potential job loss. Sex has not been a consistent moderator of acute LBP outcomes across studies,[38] but sex differences in occupations and family roles may have some bearing on the ability to RTW. Age is usually an important factor in RTW outcomes,[29] but we found no effect of age on RTW in this sample of mostly young, blue-collar workers. Thirteen percent of the sample was over the age of 50, and this older group showed similar rates of immediate or early RTW as younger workers. This lack of an age effect on RTW might be an artifact of a healthy worker effect, whereby only the healthiest workers persist in more physically demanding occupations.

Work-related variables, when entered in the model, weakened the effect of RTW on functional recovery at 3 months. Thus, the positive influence of a supportive work environment is reflected in both the ability to return to work sooner and the ability to regain physical function within a few months after pain onset. Workplace support, particularly efforts to offer and coordinate temporary job modifications, has been shown to facilitate an early RTW.[39] Furthermore, workplace support may help workers to reestablish usual patterns of physical and social activities and have positive effects on well-being. In this study, functional improvement was greatest for those with longer job tenure and for those in larger organizations. There was also a trend ($P = .077$) for those reporting negative supervisor interactions to report poorer function at follow-up. These findings support the continued emphasis on employer policies and practices as a means of supporting early RTW efforts and preventing long-term musculoskeletal disability.[40]

Although an early RTW facilitated recovery from acute LBP in our study, caution should be exercised when RTW would be extremely painful or when heavy physical job tasks cannot be altered. Workers experience varying levels of discomfort and activity limitation after acute LBP onset, and some symptoms can persist for several weeks or months.[41] Therefore, job modification and flexibility are critical to make an early RTW possible, and these employer measures have been shown to double rates of RTW for musculoskeletal and other health conditions.[39,42,43] Recent Cochrane systematic reviews have found more evidentiary support for workplace interventions[44] than for RTW coordination and clinical case management,[45] but this continues to be a developing area of research.

Only 60% of workers expected their employers to support modified duty provisions in our study, but this variable had a pronounced effect on RTW. Among those who anticipated employer support for job modification, 39% stayed on the job and only 23% had more than 7 days off work. Among those with no expected modified work, only 17% stayed on the job, and nearly half (48%) were out for more than 7 days. These data support the value of offering routine job modifications, especially given our results that an early RTW speeds the pain recovery process.

Although fear of reinjury was not found to be a major confound for our specific research question, this factor stood out as having the strongest negative associations with both early RTW and improvements in pain and function. This supports the basic tenet of the Fear Avoidance Beliefs Model of pain,[46] wherein efforts to restrict activity and avoid pain can ultimately lead to a repeating cycle of disengagement, deconditioning, recurring pain, and despair. An early RTW may help to break this cycle of automatic thoughts and activity restriction, thus producing measurable improvements in pain and function weeks later. Although our present data did not provide an opportunity to test this model in more detail, other longitudinal studies have shown evidence for this model in the transition from acute to chronic pain.[47] Our findings do support the need to include fear of reinjury in basic screening questions for work-related acute LBP and as a possible target for intervention in either the clinic (by providing back education and reassurance) or in the workplace (by modifying job tasks that are of greatest concern).

The most substantial clinical implication of our results is that employers, clinicians, and insurers should continue to adopt policies

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TABLE 5. Summary of Hierarchical Regression Analysis ($N = 534$) to Predict 3-Month Functional Limitation (Log Transformation)

	Model 1			Model 2			Model 3			Model 4		
Variable	***B***	**SE *B***	β	***B***	**SE *B***	β	***B***	**SE *B***	β	***B***	**SE *B***	β
Return-to-work in first month												
Immediate (0 lost d)	−0.389	0.080	−0.240**	−0.366	0.079	−0.226**	−0.247	0.078	−0.149**	−0.221	0.082	−0.133**
Early (1–7 lost d)	−0.292	0.076	−0.190**	−0.314	0.076	−0.204**	−0.247	0.072	−0.158**	−0.239	0.066	−0.147**
Delayed (8+ lost d)†												
Sex (female)				0.236	0.069	0.151**	0.235	0.065	0.149**	0.239	0.066	0.151**
Income												
<$25,000†												
$25,000–$39,999				−0.139	0.076	−0.086	−0.095	0.073	−0.058	−0.072	0.075	−0.044
$40,000+				−0.151	0.083	−0.087	−0.075	0.081	−0.043	−0.057	0.085	−0.033
(Not reported)				0.004	0.165	0.001	0.084	0.156	0.022	0.097	0.159	0.026
Injury type												
Overexertion/repetitive motion†												
Bodily reaction							−0.064	0.078	−0.033	−0.066	0.079	−0.034
Fall							0.140	0.102	0.056	0.127	0.103	0.050
Other							0.231	0.137	0.067	0.220	0.138	0.064
Pain reported at time of injury												
Pain rating from 0 to 4†												
Pain rating from 5 to 7							0.072	0.075	0.048	0.067	0.076	0.045
Pain rating from 8 to 10							0.162	0.088	0.095	0.161	0.088	0.095
Worried about reinjury												
Little or not at all†												
Somewhat							0.305	0.077	0.194**	0.304	0.078	0.194**
Very or extremely							0.419	0.077	0.272**	0.408	0.078	0.265**
Smoke cigarettes (no)							−0.141	0.062	−0.093	−0.140	0.062	−0.092
Depressed during past week												
Little or none of the time†												
Some or a good bit of the time							0.133	0.069	0.078	0.129	0.070	0.075
Most or all of the time							0.111	0.133	0.034	0.097	0.134	0.030
Job tenure												
< 1 y†												
1–10.99 y										0.051	0.094	0.024
2–40.99 y										−0.042	0.081	−0.025
5+ y										−0.032	0.084	−0.019
Company size												
Small (<50 employees) †												
Medium (51–500 employees)										−0.095	0.083	−0.062
Large (>500 employees)										−0.064	0.083	−0.042
Negative supervisor response												
0 negative behaviors†												
1 negative behavior										0.069	0.076	0.036
2+ negative behaviors										0.156	0.108	0.059
Employer supports modified duty										−0.007	0.064	−0.00411

B, unstandardized regression coefficient; *β*, tandardized regression coefficient; SE, standard error.
*$P < 0.01$.
**$P < 0.05$.
†Base category for dummy coding of categorical variable.

and procedures that facilitate early RTW for back-injured workers. How best to facilitate early RTW and when to provide additional support and resources remains an important question for clinical practice, insurance claims management, and employer absence management practices. Research of early RTW facilitation in these settings should continue to address issues of timing and cost to optimize health benefits, RTW rates, and cost-effectiveness for feasible implementation. Given the high prevalence of work-related LBP across the working population, even small improvements in RTW rates can produce large health and disability cost benefits when multiplied across the workforce.

As with any observational cohort, there are study limitations. The study's focus on work-related cases of acute LBP in a mostly blue-collar occupational setting may limit generalizability to other clinical and occupational settings. Also, other confounds may exist that were not measured. The age of the dataset (collected from 2000 to 2002) is also a study limitation, though there have been few changes in acute LBP management or RTW practices in the United States since 2000. One exception is the rising rate of opioid prescribing since 2000,[48,49] but it's difficult to judge how this might have impacted the health benefits of early RTW. Strengths of the study include controlling for multiple confounds, assessing patients almost immediately after pain onset (nearly all were within 2 days), a high (95%) retention rate, and inclusion of both immediate and early RTW as separate groupings in our analyses.

The clinical significance of study findings is that patients should generally be encouraged to return to work as soon as they are able and with adequate employer support. Returning to work within the first 7 days after pain onset was observed to reduce back pain and improve function, and alternate explanations involving potential

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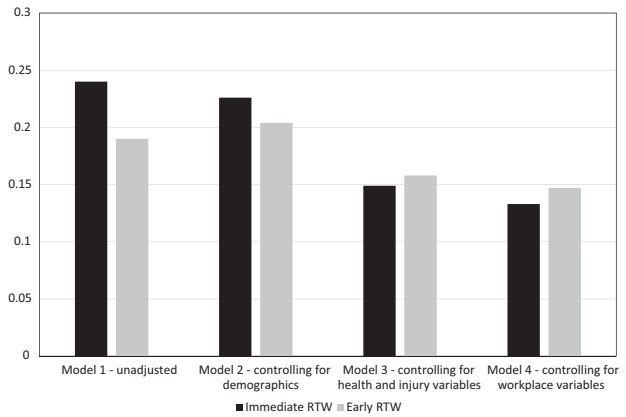

FIGURE 2. Effect (beta weight) of immediate or early RTW on 3-month function when adjusting for potential confounders.

confounds did not fully eclipse this therapeutic benefit. It should be noted that our models explained only 15% to 19% of the total variance in pain or function, so the benefit of early RTW on pain recovery is still small and many other factors, for example, health care treatment, comorbid health conditions, patient education and counseling, and family support, are other obvious factors. An early RTW may be therapeutic by increasing physical activity, by providing social and financial reinforcement, and by gaining confidence in the ability to solve pain-related challenges on the job. For the majority of patients with work-related cases of LBP, an early RTW seems to have not just financial, but also short-term health benefits.

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