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Initial return to work and long-term employment patterns: Associations with work-related permanent impairment and with participation in workers' compensation-based return-to-work programs

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Abstract

Background: Roughly 10% of injured workers experience work injuries that result in permanent impairment and a permanent partial disability (PPD) award. This study aimed to characterize and quantify long-term employment outcomes for injured workers, by degree of whole body impairment (WBI) and by participation in several workers' compensation (WC)-based return-to-work (RTW) programs.

Methods: A retrospective cohort of 43,968 Washington State workers was followed for up to 10 years after WC claim closure (2009-2017). Degree of impairment was classified as: (1) no PPD award, (2) PPD award with WBI <10%, or (3) PPD award with WBI ≥10%. State wage files were used to construct employment outcomes for regression modeling: (1) time to first RTW, (2) time to first RTW interruption, (3) RTW volatility, and (4) employment gaps.

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Disclaimer: The findings and conclusions in this report are solely the responsibility of the authors and do not necessarily represent the official views of the National Institute for Occupational Safety and Health.

Results: Wage patterns and employment outcomes differed significantly by degree of impairment. Compared to other workers, workers with WBI ≥10% had delayed RTW, shorter average times to first RTW interruption, and higher rates of both RTW interruptions and quarters without wages. Time to first RTW averaged over a year, increasing with degree of impairment. About 9% overall—and 27% of workers with ≥10% WBI—had no observed wages after claim closure. In adjusted models, workers with WBI ≥10% had significantly poorer employment outcomes, compared to workers with no PPD award (P<.001).

Conclusions: State wage files provide an efficient approach to identifying RTW patterns. Workers with permanent impairment were at substantially higher risk of poor employment outcomes. WC-based RTW programs may promote better employment outcomes.

Keywords

occupational injuries; workers' compensation; permanent impairment; vocational rehabilitation; permanent partial disability; disability evaluation; return to work; unemployment; Functional Comorbidity Index

1 INTRODUCTION

In Washington State and across the U.S., roughly 10% of all workers injured at work experience serious work injuries that result in permanent impairment and a permanent partial disability (PPD) award.[1] Workers' compensation (WC)-based PPD awards provide compensation for work-related permanent impairments that do not preclude return to work (RTW) but do prevent working at full physical capacity (e.g., vision or hearing loss, amputation, spinal impairment). Work-related permanent impairment is associated with long-term functional disability, pain, and unstable health, all of which may interfere with timely and sustained RTW.[2-8] Compared to other workers, disabled workers have 50% higher unemployment rates, and they are more likely to work part-time and in entry-level jobs.[9,10] Disabled workers may also face negative treatment by managers and coworkers, lack of accommodation, and discrimination.[11-13] Moreover, workers with permanent impairments are at higher risk for reinjury[14] and mortality.[15]

Initial RTW does not necessarily indicate successful RTW. After RTW, many injured workers with permanent impairments face RTW interruption (i.e., breaks in employment due to reinjury, unstable health, disability, lay-off, etc.).[2] For example, in an early Ontario-based study of workers with permanent impairments, 85% of workers were observed to RTW at least briefly, while only 50% exhibited sustained RTW.[2] A more recent Australian study, which did not specifically assess permanent impairment, found that time to sustained RTW was 1.8 times longer than time to initial RTW (proxied by cessation of time loss payments); further, although 94% of injured workers had RTW at least briefly, only 79% achieved sustained RTW during the two-year follow-up period.[16] Among Canadian workers who were 50-64 years of age and had a permanent impairment, a higher (more severe) impairment rating was associated with earlier labor force exit.[17]

Employment is a critical social determinant of health,[18,19] and sustained RTW after occupational injury or illness is important for the health and economic stability of workers,

as well as for workplace productivity. Substantial economic disparities for permanently impaired workers have been documented using a variety of economic measures, including wage losses (based on unemployment insurance data),[20-22] earnings losses more broadly (based on tax data),[23] and poverty.[24] Estimates of the magnitude of these disparities vary substantially by jurisdiction, which may be due in part to the impairment rating system used, and to jurisdictional variation in benefit adequacy.[20] Nevertheless, there is consistent evidence that workers with permanent impairments are economically disadvantaged relative to the general working population,[24] to matched uninjured workers,[22] and to injured workers without permanent impairment.[21,23] The negative economic impact of permanent impairment may lessen over time, but it persists long-term. For example, a RAND study of California workers with permanent impairments documented that earnings for permanently impaired workers in the first quarter after injury were 60% of earnings for a matched control group of uninjured workers; at five years after injury, earnings remained only 72% of those for the control group.[22]

Injured workers with permanent impairments account for a large share of WC-based vocational rehabilitation program participants.[14] Accumulating evidence suggests that vocational rehabilitation and other RTW programs affect injured workers in both positive and negative ways.[5,25-29] Even after vocational retraining to facilitate RTW, workers disabled by an occupational injury face substantial employment challenges.[5] A Washington State study found that about 50% of workers who completed a vocational retraining plan RTW within two years, while fewer than 45% of workers with incomplete plans had RTW nearly five years later.[27] However, there is little existing research on the impact of WC-based programs on employment outcomes beyond initial RTW, such as sustained RTW and RTW interruption. To understand how vocational rehabilitation and other RTW programs can best assist workers, we need to better understand the impact of these programs on specific employment patterns.

In sum, injured workers often face delayed, temporary, or intermittent RTW, or may never RTW at all. The primary aim of this study was to characterize and quantify long-term employment outcomes, including RTW and subsequent RTW interruption, by degree of permanent impairment. In order to broadly characterize various attributes of long-term employment patterns, we used several regression approaches designed to model a set of employment metrics that were based on the timing, order, volatility, and prevalence of presence/absence of quarterly wages after WC claim closure. Secondarily, we explored the potential impact of several WC-based RTW programs on employment outcomes.

2 METHODS

2.1 Study setting

No-fault WC coverage for work-related injuries and illnesses is compulsory in Washington State.[30] The Washington State Department of Labor and Industries (L&I) is the exclusive State Fund insurer for about 70% of workers specified by Washington's Industrial Insurance Act.[31] Self-insured employers account for the remaining 30%; no private WC insurers operate in WA. L&I administers the state WC system for both State Fund and self-insured employers, and maintains population-based administrative databases of WC claims.[32,33]

2.2 Study design and cohort

We used administrative WC claims data to construct a retrospective cohort. We used state wage files (i.e., data from mandatory unemployment insurance-related employer tax and wage reports) to measure long-term employment outcomes for up to ten years after first WC claim closure. The eligible cohort included injured workers with an accepted compensable State Fund WC claim that: (1) was their first known WC claim filed in Washington State (i.e., the worker had no prior State Fund or self-insured claim); and (2) closed for the first time during 2009 through 2017, whether or not it later reopened (i.e., if there were multiple claim closure dates for a claim, the first claim closure date was used to determine cohort eligibility). Injured workers with self-insured employers were not included in the eligible cohort, due to incomplete vocational rehabilitation and medical billing data for those WC claims.

Prior to delivering administrative data to the research team, L&I staff applied six exclusion criteria: (1) under age 18 when injured, (2) residence outside Washington State, (3) medical-only claims (<4 work days lost due to the injury, hence no time loss compensation), (4) fatal or total permanent disability claims, (5) confidentiality exclusions imposed by L&I (e.g., L&I employees), and (6) no valid Social Security number. After these exclusions, 4.01% (n=1842) had no state wage data before and after the injury, and were excluded during data analysis; these workers may have been self-employed or working in occupations exempt from unemployment insurance coverage and wage reporting requirements,[34] and therefore it could not be assumed that absence of wages after the injury indicated no RTW. A further 100 workers were excluded due to death on or before the first claim closure date (WC claims for these workers were not classified as fatal claims). The resulting cohort consisted of 43,968 injured workers.

2.3 Permanent impairment

The primary predictor of interest was degree of permanent impairment, classified into three mutually exclusive groups based on the permanent impairment rating for the initial injury: (1) no PPD award (i.e., no compensated permanent impairment), (2) a PPD award with whole body impairment (WBI) <10%, or (3) a PPD award with WBI ≥10%. Washington State defines impairment as permanent anatomic or functional abnormality or loss of function after maximum medical improvement has been achieved.[35] For workers who have suffered a permanent loss of function but are still able to work, degree of impairment is rated prior to claim closure, after treatment has been completed.[36] PPD awards are made at claim closure, and may be paid as a lump sum or in monthly installments, depending on the size of the award.[36]

Administrative WC PPD rating data were challenging to summarize. Several impairment rating/award systems were involved. In addition, multiple entries for the same PPD award were often indistinguishable as to whether they represented duplicate entries, multiple/bilateral injuries, pre-existing unpaid impairment based on evaluation, protests, repayments, or other subsequent increases or decreases in the PPD award. We constructed a measure of WBI that would allow us to compare workers based on a conservative estimate of WBI percentage, regardless of the rating system used to produce an individual worker's rating or

award. The resulting estimate can best be thought of as a lower bound estimate of WBI, based on the single largest contribution from the single impaired body part contributing most to WBI. A more detailed description of how WBI was constructed and classified can be found in an earlier publication.[8]

2.4 Workers' compensation-based return-to-work programs

Stay at Work is a WC-based financial incentive program that took effect in Washington State on June 15, 2011. Under this program, L&I reimburses eligible employers for certain costs of providing temporary light-duty or transitional jobs for specific injured workers, while they recover. Costs eligible for reimbursement can include: up to half of the worker's base wages for up to 66 days (maximum of $10,000 per claim); up to $1,000 per claim for training fees or materials such as tuition, books and supplies; up to $2,500 per claim for equipment or tools; and up to $400 per claim for clothing. Technically, it is the employer who participates in Stay at Work; however, because the employer participates with respect to a specific injured worker, and because all analyses were worker-level, we henceforth refer to worker participation.

Some injured workers who can no longer work in their previous occupation may be determined eligible for WC-based vocational retraining for a new occupation, subject to L&I approval of a vocational retraining plan. A new retraining option (known as Option 2) became available as of January 1, 2008. Option 2 provides self-directed retraining funds as a voluntary alternative to participating in the approved conventional retraining plan. Workers have 15 days after plan approval to decide whether to participate in the approved plan or choose Option 2. When workers choose Option 2, their claim is closed, time-loss benefits end, a vocational award of roughly six to nine months of time-loss benefits is paid, and vocational retraining funds are set aside. The worker can access their vocational retraining funds for tuition, training fees, and certain related expenses, for up to five years. The worker can seek training at any L&I-approved program or course, and the retraining goal can differ from that in the approved retraining plan.

To explore WC program-related outcomes, we conducted three separate analyses. For the first analysis, comparing employment outcomes for workers who participated in the Stay at Work program to those who did not, we excluded workers who did not have access to this program because their claims were never open (either initially or via reopening) once the Stay at Work program was implemented on June 15, 2011. Subgroup assignments were based on Stay at Work participation at any time during the initial WC claim. For the second analysis, comparing outcomes for workers who completed a vocational retraining plan to those who did not complete their plan, we included workers who: (1) had an approved vocational retraining plan for the initial injury, and (2) did not choose Option 2 in place of the approved conventional retraining plan. For the third analysis, comparing outcomes for workers who chose Option 2 to those who chose a conventional retraining plan (whether completed or not), we included workers who: (1) had an approved vocational retraining plan for the initial injury, and (2) had access to Option 2, which was first offered January 1, 2008. For the latter two analyses, subgroup assignments were based on events occurring prior to the initial WC claim's first claim closure date.

2.5 Covariates

Worker and injury characteristics (i.e., gender, age at first claim closure, preferred language, residence county, injured body part, comorbidities) were extracted from WC claims data. Urban-rural residence was based on the worker's residence county, and was classified using the six-level 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties.[37] Injured body part was categorized as spine/neck, upper extremity, lower extremity, or other/multiple. For workers with a PPD award, body part was based on the impaired body part used for the WBI percentage estimate. For workers with no PPD award, body part was based on Occupational Injury and Illness Classification System (version 1.01) codes present in the WC claims file. We obtained professional and facility WC billing data for the first visit or admission for the initial injury, which was used to construct the Functional Comorbidity Index.[38]

Pre-injury quarterly wages were based on state wage data, averaged over the four quarters prior to the injury quarter, and adjusted to December 2018 dollars using the Consumer Price Index. Information about the job where the initial injury occurred included employer size, industry sector, and hazard group. Large employers were defined as those with ≥50 FTE workers during the injury quarter. Industry sector was based on North American Industry Classification System (NAICS) two-digit sector codes, but—due to small numbers in some sectors—was further collapsed into nine groups: (1) Agriculture, Forestry, Fishing, Hunting (NAICS sector: 11); (2) Construction, Utilities, Mining (NAICS sectors: 21, 22, 23); (3) Manufacturing (NAICS sectors: 31, 32, 33); (4) Retail/Wholesale Trade (NAICS sectors: 42, 44, 45); (5) Transportation, Warehousing (NAICS sectors: 48, 49); (6) Information, Finance, Real Estate, Professional (NAICS sectors: 51, 52, 53, 54, 55); (7) Administrative, Support, Other Services (NAICS sectors: 56, 81, 92); (8) Education, Health Care, Social Services (NAICS sectors: 61, 62); and (9) Arts, Entertainment, Hospitality (NAICS sectors: 71, 72). We also constructed a continuous hazard group variable based on L&I-assigned employer risk class; this was developed for WC insurance administration purposes, to estimate potential for loss (claim costs) by nature of business. Hazard group classifies employer risk from one (lowest risk) to nine (highest risk).[39]

2.6 Employment outcomes

State wage files from the Washington State Employment Security Department were used to construct employment outcomes. These files include quarterly wages for workers covered by unemployment insurance, which excludes self-employment and exempt occupations.[34] These files do not include WC indemnity (wage replacement) payments or disability compensation. For this study, L&I staff used Social Security numbers to link administrative WC claims with quarterly wage data through the end of 2018, and transmitted linked data, without identifiers, to our research team. Employment outcomes were measured beginning with the first claim closure quarter, and followed for up to 10 years. Wage data were censored on the earliest of three dates: (1) administrative follow-up end date (December 31, 2018), (2) total permanent disability effective date, or (3) date of death. Wages were adjusted to December 2018 dollars using the Consumer Price Index.

For construction of employment outcomes, observation for each included worker began with the quarter that the initial claim first closed (Q0). Although injured workers may RTW prior to claim closure, this origin was selected because it represented the most identifiable point at which all included workers would have: attained maximum medical improvement, been deemed able to work, and been rated with respect to degree of permanent impairment (if any). Each quarter was initially classified as having either (1) any wages or (2) no wages. First RTW was defined as the first quarter with any wages. A RTW interruption was defined as a quarter with no wages following a quarter with any wages (i.e., transition from a period of employment to a period of unemployment). For each worker, RTW interruptions were counted and the quarter with the first RTW interruption was identified.

For descriptive purposes, a variable was constructed to summarize five specific wage patterns of interest: (1) timely and ongoing RTW, (2) delayed but ongoing RTW, (3) intermittent RTW, (4) RTW termination, and (5) never RTW. For each worker, wage pattern category was assigned based on all observed quarters from the quarter that the initial claim first closed (Q0) through censoring. These pattern categories were somewhat arbitrary; classifications for individual workers could change with shorter or longer observation periods. Table I provides detailed definitions and illustrative examples of each of these wage patterns. Wage pattern examples were selected to demonstrate variation rather than frequency, and include a selection of patterns exhibited by multiple workers having at least five years of uncensored follow-up after the first claim closure.

2.7 Data analysis

In order to broadly characterize long-term employment patterns, we used four different regression modeling approaches: (1) time to first RTW, (2) time to first RTW interruption, (3) RTW volatility, and (4) employment gaps. Each approach was intended to capture a somewhat different aspect of RTW and employment trajectories.

Time to first RTW was analyzed using Cox proportional hazards regression,[40] estimating time from the first claim closure quarter to the first quarter with any wages. In order to include workers who RTW (or were already working) during the same quarter that their initial WC claim first closed, a small arbitrary value (0.001) was added to the time variable for those workers.[41] Time to first RTW interruption was also analyzed using Cox proportional hazards regression, estimating time from the first quarter with any wages to the first quarter with no wages, conditional on having some observed wages (i.e., workers who never RTW were excluded). RTW volatility and employment gaps were analyzed using negative binomial regression with the exposure term (at-risk denominator) measured at the worker level. The outcome for RTW volatility was the count of RTW interruptions, and the exposure was the count of quarters with any wages, conditional on having some observed wages (i.e., workers who never RTW were excluded). The outcome for employment gaps was the count of quarters with no wages, and the exposure was the count of observed calendar quarters. Table I summarizes outcome definitions for each of the four regression modeling approaches, and provides measurement examples.

Parallel models were used to explore participation-related outcomes for the three separate analyses of WC-based RTW programs (described in section 2.4). Adjusted models for each

regression approach included degree of permanent impairment, all covariates described in section 2.5, as well as fixed effects for year of first claim closure (2009 through 2017). Robust variance estimates were used to produce 95% confidence intervals (CI). The amount of missing data was negligible (<1%) for all variables; case-wise deletion was used in regression models. Unadjusted Kaplan-Meier survival curves were used to illustrate differences in time to first RTW and time to first RTW interruption, by degree of impairment. All analyses were conducted using Stata/MP 15.1 for Windows (StataCorp, College Station, TX, USA).[42]

3 RESULTS

In this retrospective cohort, 73.8% had no PPD award, 19.6% were in the WBI <10% group and 6.6% were in the WBI ≥10% group (Table II). All characteristics in Table II were differentially distributed across these groups, to a statistically significant degree. For example, nearly half (47.8%) of those in the WBI ≥10% group had spine/neck injury compared to about a quarter (26.0%) overall. Compared to the WBI ≥10% group, the WBI <10% group had markedly higher percentages of upper and lower extremity injuries, and markedly lower percentages of spine/neck and other/multiple injuries. Spanish language preference applied to 19.8% of workers in the WBI ≥10% group, but to only 12.0% of workers with no PPD award. Construction/utilities/mining was the most common industry category for the WBI ≥10% group (17.6%), but only accounted for 9.3% of workers with no PPD award.

Nearly 90% of the workers included in each of the vocational rehabilitation program analyses had a permanent impairment (Table II). Over half (51.5%) of workers with an approved vocational retraining plan selected self-directed retraining funds (Option 2) in place of the conventional retraining plan; 56.7% of the WBI ≥10% group chose Option 2, compared to only 36.6% of those with no PPD award. Of workers with an approved vocational retraining plan (excluding those who chose Option 2), 41.0% completed their plan; 38.2% of the WBI ≥10% group completed their plan, compared to more than half (51.7%) of those with no PPD award.

The Functional Comorbidity Index ranged from 0 to 8, with 93.0% having no identified comorbidities; mean values were 0.07 (95% CI: 0.07, 0.08) for the no PPD award group, 0.08 (95% CI: 0.08, 0.09) for the WBI <10% group, and 0.17 (95% CI: 0.15, 0.19) for the WBI ≥10% group. Mean adjusted pre-injury quarterly wages were $6196 (95% CI: $6133, $6260) for the no PPD award group, $7218 (95% CI: $7076, $7360) for the WBI <10% group, and $7149 (95% CI: 6894, $7404) for the WBI ≥10% group. Hazard group ranged from 1 to 9, with a mean of 3.70 (95% CI: 3.67, 3.72) for the no PPD award group, 4.09 (95% CI: 4.04, 4.14) for the WBI <10% group), and 4.35 (95% CI: 4.26, 4.44) for the WBI ≥10% group. Year of first claim closure (2009 through 2017) was fairly evenly distributed across impairment groups.

As shown in Table III, wage patterns were significantly different by degree of impairment. Based on wage files, 8.98% of the overall cohort—and over a quarter (27.32%) of workers with WBI ≥10%--did not RTW during the observation period. Only 17.78% of workers with

WBI ≥10% exhibited timely and ongoing RTW, compared to 34.43% of workers with no PPD award. Less than 1% of this cohort had a subsequent total permanent disability award (pension) or a recorded death during the observation period, and the observation period was roughly similar across all impairment categories. Workers with WBI ≥10% took longer on average to RTW, and then had shorter average times to the first RTW interruption, compared to workers in the other two impairment categories (workers with WBI <10% and workers with no PPD award). The same pattern—poorest outcomes among workers with WBI ≥10%—held for both the frequency of RTW interruptions, and the frequency of quarters with no wages. Up to 15 RTW interruptions were observed over the follow-up period. With the exception of time to first RTW interruption, there were monotonic associations between a higher degree of impairment and poorer employment outcomes.

Figure 1 uses unadjusted Kaplan-Meier survival curves to depict time to first RTW (1A) and time to first RTW interruption among those who RTW (1B), by degree of impairment. Figure 2 depicts the proportion of injured workers with any quarterly wages over time since first claim closure, by degree of impairment. Each of these figures shows poorer employment outcomes for workers with WBI ≥10%, relative to workers with no PPD award.

We estimated associations between degree of permanent impairment and employment outcomes using four modeling approaches (Table IV). Poorer employment outcomes would be indicated by a hazard ratio <1 for the time to first RTW models, and a hazard ratio or incidence rate ratio >1 for the other three modeling approaches. In adjusted models, workers with WBI ≥10% had substantially and significantly poorer employment outcomes, compared to workers with no PPD award. Compared to workers with no PPD award, workers with WBI ≥10% were 43% less likely to RTW and 15% more likely to have a RTW interruption (instantaneous hazard); they also had an 18% higher rate of RTW interruptions (RTW volatility), and a 65% higher rate of quarters with no wages (employment gaps). However, findings were mixed for workers with WBI <10%. Compared to workers with no PPD award, workers with WBI <10% had significantly poorer outcomes with respect to time to first RTW and employment gaps, but not with respect to first RTW interruption and RTW volatility.

There were also strong associations between most covariates and employment outcomes, though many exhibited smaller effect sizes than those observed for permanent impairment (Table IV). For example, compared to men, women were 3% less likely to RTW and 4% more likely to have a RTW interruption (instantaneous hazard). Women also had a 6% higher rate of quarters with no wages than did men; however, there was little difference in RTW volatility. Older workers generally exhibited poorer employment outcomes compared to younger workers (all four modeling approaches), particularly in the upper age categories. Higher pre-injury wages and a large (versus small) pre-injury employer were associated with better employment outcomes (all four approaches). Compared to a spine/neck injury, the other three body part categories were associated with better (though not always statistically significant) employment outcomes (all four approaches). A higher score on the Functional Comorbidity Index was significantly associated with poorer employment outcomes for three of the four modeling approaches, but not with time to first RTW. Workers residing in the most rural (noncore) counties had markedly poorer employment outcomes (all four

approaches), including a 34% higher rate of RTW interruptions (RTW volatility), compared to workers residing in the most urban county (large central metropolitan).

We estimated associations between participation in each of three WC-based RTW programs and the four employment outcomes (Table V). Adjusted models included all covariates presented in Table IV (as well as fixed effects for year of first claim closure), and also included the specified program participation variable. We found that participation in the Stay at Work program was associated with significantly and substantially better employment outcomes (all four modeling approaches), compared to those who did not participate. We also found that completion of a conventional vocational retraining plan was associated with significantly and substantially better employment outcomes (all four approaches), compared to those who did not complete their plan. In contrast, we found that choosing self-directed retraining funds (Option 2) was significantly and substantially associated with poorer employment outcomes, compared to choosing a conventional retraining plan (Table V).

4 DISCUSSION

In this study, we found that wage patterns and employment outcomes significantly differed by degree of impairment. For the most part, there were monotonic associations between a higher degree of impairment and poorer employment outcomes; however, there was little difference between workers with no PPD and workers with WBI <10% regarding timing or frequency of RTW interruption. Workers with WBI ≥10% took longer on average to RTW, and then had shorter average times to the first RTW interruption, compared to workers in the other two impairment categories. Workers with WBI ≥10% also had the highest frequency of RTW interruptions and the highest frequency of quarters with no wages. A higher risk of reinjury among workers with ≥10% WBI may contribute to their higher risk of RTW interruption. In a previous related study, workers with ≥10% WBI had an estimated 34% higher risk of reinjury, compared to workers with no PPD award, based on adjusted models that accounted for working time at risk.[14]

It is important to note that all workers in this cohort would have been classified as having RTW, had we used cessation of time-loss compensation or WC claim closure as a proxy. Yet 8.98% of the overall cohort, and 27.32% of workers with ≥10% WBI, had no observed wages after claim closure. Although most workers RTW within the same calendar quarter that their claim first closed, many workers experienced lengthy delays before first RTW. The average time from first claim closure to first RTW was more than a year (restricted mean: 4.18 quarters), monotonically increasing with increasing degree of impairment.

Several recent studies have demonstrated the importance of characterizing employment trajectories beyond simply measuring initial RTW, whether that be via measuring time to sustained RTW,[16] or via using sequence and/or cluster analysis to identify specific employment patterns.[43,44] In this cohort, some workers exhibited intermittent RTW patterns over an extended period; for other workers, intermittent RTW patterns eventually stabilized into a longer stretch of either employment or unemployment (Table III). By modeling four different employment outcomes in this study (i.e., time to first RTW, time to first RTW interruption, RTW volatility, employment gaps), we were able to broadly characterize

various attributes of long-term employment patterns. In adjusted models (Table IV), workers with WBI ≥10% had substantially and significantly poorer employment outcomes, compared to workers with no PPD award, for all four modeling approaches. However, findings were mixed for workers with WBI <10%. Compared to workers with no PPD award, workers with WBI <10% had significantly poorer outcomes with respect to time to first RTW and employment gaps, but not with respect to first RTW interruption and RTW volatility. There may be quite different mechanisms of effect for initial RTW versus RTW interruption; RTW may depend on availability of the pre-injury (perhaps modified) job or the ability to be hired into a new job, while RTW interruption may depend more upon workplace conditions that support or interfere with sustained RTW, reinjury incidence, etc. RTW volatility (rate of transitions from periods of employment to periods of unemployment) is related to the intermittent nature of RTW, whether due to employment type (seasonal, temporary), workplace characteristics, or worker/injury characteristics. Strikingly, as many as 15 RTW interruptions for an individual worker were observed over 10 years of follow-up. This observation is even more striking when we consider that these data represented quarterly intervals, and thus RTW interruptions lasting less than a calendar quarter would not have been observed.

We found that participation in the Stay at Work program was associated with significantly and substantially better employment outcomes, compared to outcomes for those who did not participate. Employment outcomes for injured workers participating in WC vocational rehabilitation programs were of particular interest because nearly 90% of these workers had a work-related permanent impairment. Further, choice of Option 2 was more prevalent among workers with permanent impairment; 56.7% of the WBI ≥10% group chose Option 2, compared to only 36.6% of those with no PPD award. Among workers who chose the conventional retraining plan, workers with permanent impairment were less likely to complete their plan; 38.2% of the WBI ≥10% group completed their plan, compared to more than half (51.7%) of those with no PPD award. Consistent with findings from an earlier evaluation,[27] completion of a conventional vocational retraining plan was associated with significantly and substantially better employment outcomes, compared to outcomes for those who did not complete their plan. In contrast, we found that choosing self-directed retraining funds (Option 2) was significantly and substantially associated with poorer employment outcomes, compared to choosing a conventional retraining plan (whether completed or not). In an earlier related study,[14] we found a higher risk of reinjury among injured workers who: (1) did not complete their approved vocational retraining plan, compared to those who did; and (2) chose Option 2, compared to those who chose a conventional retraining plan (the Stay at Work program was not assessed).

These program-related findings are descriptive and exploratory, and, at least in part, they likely reflect selection effects into each of these programs (whether by WC staff, employers, or workers themselves). However, these findings merit further inquiry into the underlying mechanisms, especially as these programs operate at the WC system level and thus could have important impacts on the health and safety of large numbers of workers. Every year, roughly 300,000 U. S. workers experience serious work injuries that result in permanent impairment and a PPD award.[1] However, there has been little systematic research regarding the impact of WC-based programs on long-term employment outcomes for workers with

permanent impairments. In a California study, researchers found that RTW programs led to significant reductions in the duration of work-injury absences, and that most of that impact was driven by a large improvement in RTW for injured workers with permanent impairments.[28] Previous research documenting WC benefit inadequacy demonstrates the importance of promoting good employment outcomes to minimize workers' economic losses. In a Wisconsin study of injured workers (1989-1990), WC benefits for workers with PPD awards were estimated to cover 83% of 10-year after-tax projected losses for men, and 63% for women.[21] In a more recent New Mexico study linking WC claims (1994-2000) to federal tax data, WC benefits for workers with PPD awards were estimated to cover 35% of 10-year after-tax losses for men, and 28% for women.[23]

While our regression models were not specifically designed to assess other covariates, most had strong associations with employment outcomes, and the observed associations may provide exploratory fodder for further research. A higher score on the Functional Comorbidity Index was significantly associated with poorer employment outcomes for three of the four modeling approaches, but was not associated with time to first RTW. This suggests that, for workers with comorbidities, sustained RTW is more challenging than initial RTW. Other research has found that injured workers with multiple chronic comorbidities had significantly higher odds of not working post injury and poorer hours and earnings recovery (using state wage data) compared to those with no chronic comorbidities.[45] Using data from the Health and Retirement Study, researchers found that workers with multimorbidity had a higher risk of transitioning to partial retirement and to full retirement, when compared to workers without chronic conditions or to those who had just one comorbidity.[46] Our findings that women, compared to men, had delayed RTW followed by quicker RTW interruption, along with more quarters with no wages, generally comport with other studies showing women at higher risk for RTW interruption[16] and economic losses[21,23] after work injury. Our findings that older workers generally exhibited poorer employment outcomes compared to younger workers, particularly in the upper age categories, comport with other studies showing older age as a risk factor for both RTW interruption[16] and early retirement after work injury.[17,47] Higher pre-injury wages were associated with better employment outcomes. Other studies have documented that workers with low income prior to a work injury are particularly likely to exit the labor force early,[17] are more vulnerable to poverty,[24] and face a substantially greater risk of being unable to escape poverty after work-related permanent impairment.[24]

Strengths and Limitations

Strengths of this study included the large cohort, and identification of the first-known WC claim filed in Washington State. Assembling the cohort based on the first-known WC claim allowed for definitive identification of the PPD rating with the initial injury; for subsequent claims, the PPD rating can reflect adjustment of a rating from a prior injury that caused permanent impairment—a circumstance that would not be clearly distinguishable using the available WC claims data. Washington State is one of only four states with no private WC insurers, which facilitates population-based research.[32,33] In addition, access to state wage files enabled us to avoid conflating the end of time loss compensation with actual RTW, thereby avoiding an inherent limitation of studies that rely solely on WC claims data and do

not measure employment directly.[16,48-50] Though common practice, using the end of time loss compensation as a proxy for RTW leads to underestimation of time lost from work.[51] State wage files are an efficient but underutilized approach for identifying RTW patterns.[52]

This study also had several limitations. First, with respect to the initial claim closure quarter (Q0), we were unable to determine from wage files whether the worker was already working when the WC claim closed, or whether RTW occurred after claim closure but within the same quarter (up to 3 months later). Second, our addition of a small constant term to the time variable would have no impact on estimates based on the regression models, but would have a minor impact on estimates of mean and median times to first RTW. Third, state wage files do not capture earnings for workers who are self-employed or work in exempt occupations.[34] A study based on the Current Population Survey found that self-employment rates were higher among workers with limitations, compared to workers without limitations, and the self-employment differential also increased with education and age.[53] Such differential inclusion in wage files may have affected our estimates for permanent impairment and age subgroups, to an unknown degree. Finally, all covariates were also based on administrative data, and thus have measurement limitations. The Functional Comorbidity Index was almost certainly underestimated, because diagnoses unrelated to the WC injury may not be reported to WC for billing purposes.[38] The WBI variable was essentially a lower bound estimate,[8] and the strength of association between impairment ratings and economic losses varies by jurisdiction and ratings system.[20,54-57] Although there is evidence that impairment ratings are associated with earnings losses,[56] there is also strong evidence that impairment ratings are inaccurate representations of work disability and at best explain a small amount of related earnings losses.[54,55,57] This may in part explain the relatively small and inconsistent directions of effect (along with inconsistent statistical significance) that we found across the four employment outcomes, when comparing workers with <10% WBI to workers with no PPD award.

5 CONCLUSIONS

Injured workers may face delayed RTW, may RTW temporarily or intermittently, or may never RTW at all. Though underutilized, state wage files provide an efficient approach to identifying RTW patterns, and can be used as an alternative to proxies that overestimate successful RTW, such as the end of time loss compensation or WC claim closure. We found that workers with permanent impairment were at substantially higher risk of poorer employment outcomes compared to other workers, and that WC-based vocational rehabilitation and RTW programs may be useful to promote better employment outcomes.

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Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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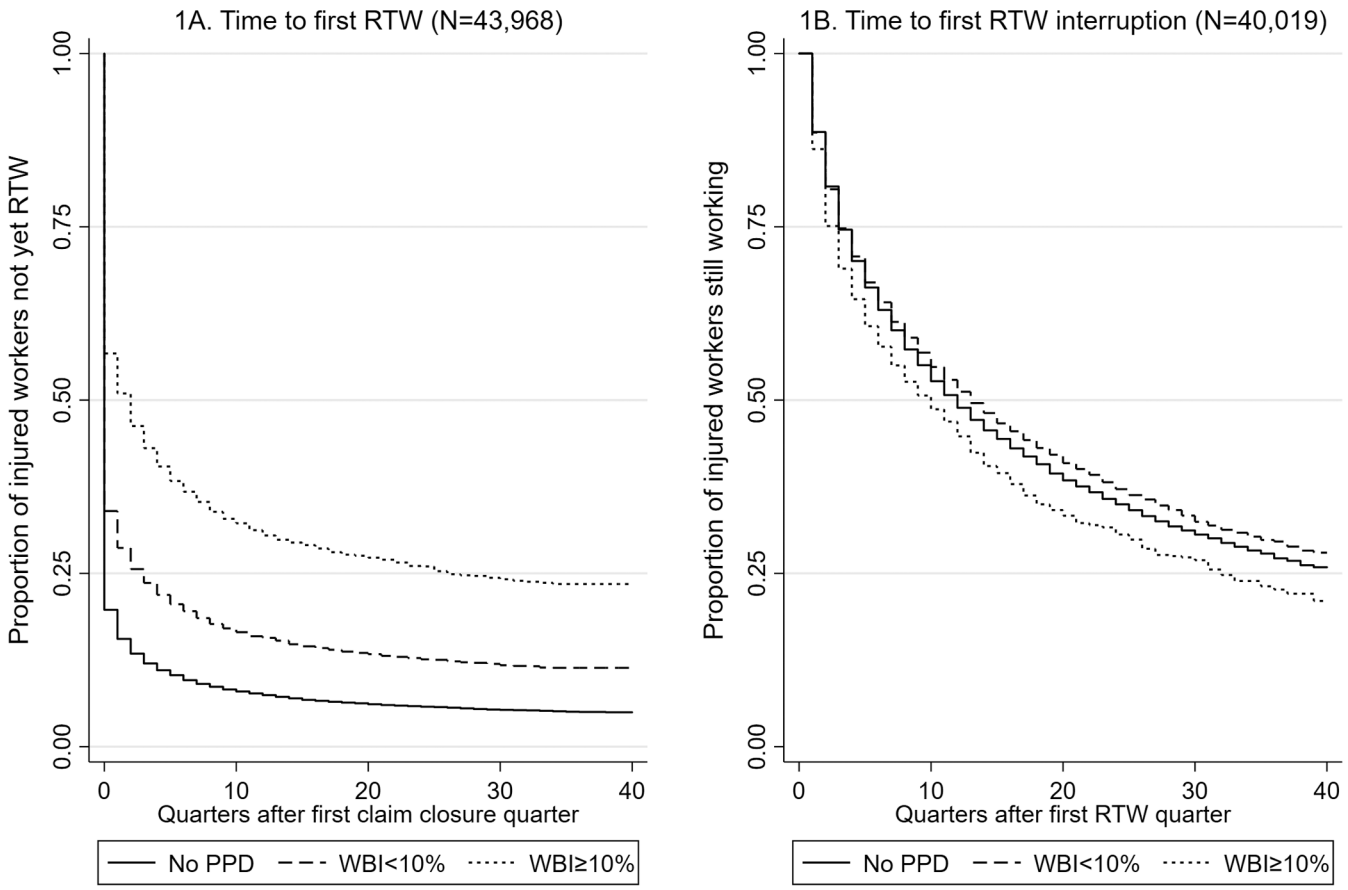

FIGURE 1.

Time to first RTW (1A) and time to first RTW interruption among those who RTW (1B); unadjusted Kaplan-Meier survival curves, by degree of impairment. Abbreviations: PPD, permanent partial disability; RTW, return/returned to work; WBI, whole body impairment

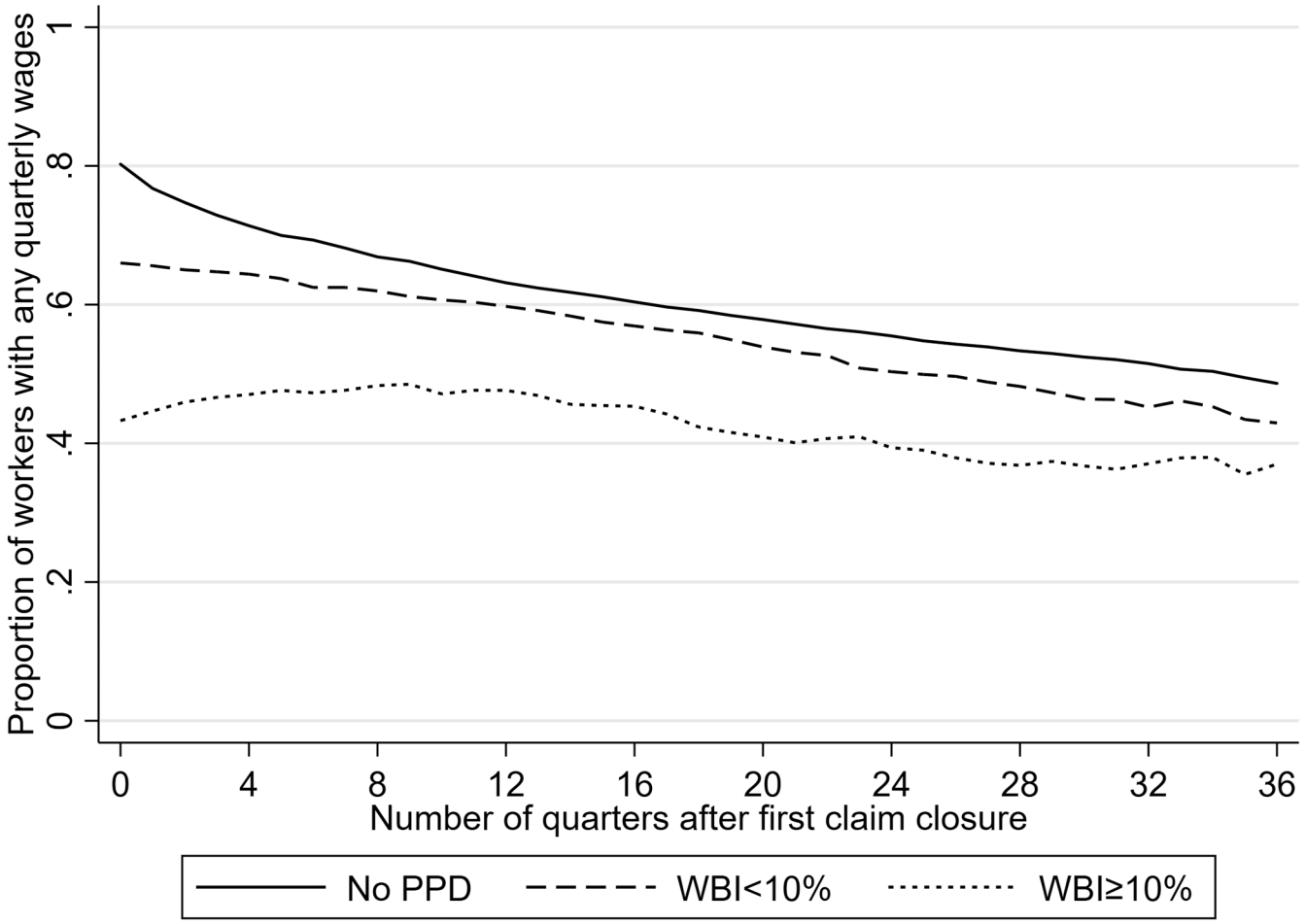

FIGURE 2.

Proportion of injured workers with any quarterly wages, by quarter after first claim closure quarter (among those workers remaining under observation), and by degree of impairment. Abbreviations: PPD, permanent partial disability; WBI, whole body impairment

TABLE I

Definitions and examples of wage patterns and employment outcomes for regression models

Wage pattern category (definition)	Wage pattern examples (0=Q with no wages; 1=Q with any wages[a])	Employment outcomes for regression models: Time to first RTW (N Qs)	Time to first RTW interruption (N Qs)	RTW volatility (N RTW interruptions/N Qs with any wages)	Employment gaps (N Qs with no wages/N Qs observed)
Timely and ongoing RTW (wages in all observed Qs)	11111111111111111111	0.001[b]	>20 (censored)	0/21	0/21 (no pattern variation)
Delayed but ongoing RTW (RTW after Q0; wages in every observed Q after RTW)	00111111111111111111	2	>18 (censored)	0/19	2/21
	00000011111111111111	6	>14 (censored)	0/15	6/21
	00000000000000111111	15	>5 (censored)	0/6	15/21
Intermittent RTW (RTW in any Q, followed by RTW interruption in future Q, followed by RTW in future Q; pattern may repeat)	00000000001100000000	11	2	1/2	19/21
	01011111111111111111	1	1	1/19	2/21
	10000000000001111111	0.001[b]	1	1/8	13/21
	10100000000000000000	0.001[b]	1	2/2	19/21
	10010111111111111111	0.001[b]	1	2/18	3/21
	10111011000000000000	0.001[b]	1	3/7	14/21
	11110001011101000000	0.001[b]	4	4/10	11/21
	11101110110111011101	0.001[b]	3	5/16	5/21
RTW termination (timely RTW; no wages observed after first RTW interruption)	11000000000000000000	0.001[b]	2	1/2	19/21
	11111100000000000000	0.001[b]	6	1/6	15/21
	11111111111111111100	0.001[b]	19	1/19	2/21
Never RTW (no wages in all observed Qs)	00000000000000000000	>20 (censored)	N/A (excluded)	N/A (excluded)	21/21 (no pattern variation)

Abbreviations: N/A, not applicable; Q, quarter; Q0, quarter of first claim closure; RTW, return/returned to work.

[a] Order of presence/absence of any quarterly wages from quarter of first claim closure (Q0) through 5 years of follow-up.

[b] In order to include workers who RTW (or were already working) during the same quarter that their initial workers' compensation claim first closed (Q0), a small arbitrary value (0.001) was added to the time variable for those workers.

TABLE II

Worker, injury, job, and workers' compensation program participation characteristics, by degree of impairment

Variable	Total (N=43,968) n (%)	No PPD award (n=32,450) n (%)	WBI <10% (n=8,604) n (%)	WBI ≥10% (n=2,914) n (%)
Body part				
Spine/neck	11,433 (26.0%)	8,782 (27.1%)	1,259 (14.6%)	1,392 (47.8%)
Upper extremity	14,649 (33.3%)	9,427 (29.1%)	4,541 (52.8%)	681 (23.4%)
Lower extremity	9,785 (22.3%)	6,781 (20.9%)	2,689 (31.3%)	315 (10.8%)
Other/multiple	8,098 (18.4%)	7,457 (23.0%)	115 (1.3%)	526 (18.1%)
Gender				
Male	24,919 (56.7%)	18,102 (55.8%)	5,083 (59.1%)	1,734 (59.5%)
Female	19,048 (43.3%)	14,347 (44.2%)	3,521 (40.9%)	1,180 (40.5%)
Age at first claim closure				
18-24	8,966 (20.4%)	7,789 (24.0%)	991 (11.5%)	186 (6.4%)
25-34	13,274 (30.2%)	10,418 (32.1%)	2,207 (25.7%)	649 (22.3%)
35-44	9,168 (20.9%)	6,346 (19.6%)	2,061 (24.0%)	761 (26.1%)
45-54	7,165 (16.3%)	4,639 (14.3%)	1,804 (21.0%)	722 (24.8%)
55-64	4,406 (10.0%)	2,686 (8.3%)	1,246 (14.5%)	474 (16.3%)
≥65	989 (2.2%)	572 (1.8%)	295 (3.4%)	122 (4.2%)
Preferred language				
English	36,538 (83.1%)	27,572 (85.0%)	6,713 (78.0%)	2,253 (77.3%)
Spanish	6,081 (13.8%)	3,890 (12.0%)	1,614 (18.8%)	577 (19.8%)
Other	1,349 (3.1%)	988 (3.0%)	277 (3.2%)	84 (2.9%)
Urban-rural residence county				
Large central metropolitan	11,589 (26.6%)	8,933 (27.8%)	2,091 (24.5%)	565 (19.5%)
Large fringe metropolitan	12,869 (29.5%)	9,475 (29.5%)	2,516 (29.5%)	878 (30.2%)
Medium metropolitan	8,283 (19.0%)	6,064 (18.9%)	1,614 (18.9%)	605 (20.8%)
Small metropolitan	5,889 (13.5%)	4,059 (12.6%)	1,308 (15.4%)	522 (18.0%)
Micropolitan	3,904 (9.0%)	2,835 (8.8%)	796 (9.3%)	273 (9.4%)
Noncore	1,022 (2.3%)	766 (2.4%)	196 (2.3%)	60 (2.1%)
Employer size				
Small (<50 FTE employees)	19,756 (45.3%)	14,208 (44.0%)	4,107 (48.3%)	1,441 (51.3%)
Large (≥50 FTE employees)	23,850 (54.7%)	18,088 (56.0%)	4,394 (51.7%)	1,368 (48.7%)
Industry sector				
Agriculture, Forestry, Fishing, Hunting	3,047 (6.9%)	2,074 (6.4%)	712 (8.3%)	261 (9.0%)
Construction, Utilities, Mining	4,826 (11.0%)	3,014 (9.3%)	1,300 (15.1%)	512 (17.6%)
Manufacturing	3,156 (7.2%)	2,168 (6.7%)	763 (8.9%)	225 (7.7%)
Retail/Wholesale Trade	7,017 (16.0%)	5,260 (16.2%)	1,338 (15.6%)	419 (14.4%)
Transportation, Warehousing	2,434 (5.5%)	1,911 (5.9%)	377 (4.4%)	146 (5.0%)
Information, Finance, Real Estate, Professional	2,846 (6.5%)	2,058 (6.3%)	604 (7.0%)	184 (6.3%)
Administrative, Support, Other Services	7,814 (17.8%)	5,853 (18.0%)	1,466 (17.0%)	495 (17.0%)
Education, Health Care, Social Services	7,199 (16.4%)	5,628 (17.3%)	1,164 (13.5%)	407 (14.0%)

Variable	Total (N=43,968) n (%)	No PPD award (n=32,450) n (%)	WBI <10% (n=8,604) n (%)	WBI ≥10% (n=2,914) n (%)
Arts, Entertainment, Hospitality	5,617 (12.8%)	4,475 (13.8%)	878 (10.2%)	264 (9.1%)
Stay at Work program[a]	**(N=31,536)**	**(n=23,167)**	**(n=6,173)**	**(n=2,196)**
No participation in Stay at Work	29,734 (94.3%)	22,043 (95.1%)	5,640 (91.4%)	2,051 (93.4%)
Participated in Stay at Work	1,802 (5.7%)	1,124 (4.9%)	533 (8.6%)	145 (6.6%)
Vocational retraining plan[b]	**(N=1,319)**	**(n=143)**	**(n=608)**	**(n=568)**
Plan not completed	778 (59.0%)	69 (48.3%)	358 (58.9%)	351 (61.8%)
Plan completed	541 (41.0%)	74 (51.7%)	250 (41.1%)	217 (38.2%)
Vocational retraining approach[c]	**(N=1,267)**	**(n=131)**	**(n=589)**	**(n=547)**
Conventional vocational retraining plan	615 (48.5%)	83 (63.4%)	295 (50.1%)	237 (43.3%)
Option 2: Self-directed retraining funds	652 (51.5%)	48 (36.6%)	294 (49.9%)	310 (56.7%)

Note: All variables in Table II were significantly associated with degree of impairment ($P<.001$ for all variables, with exception of $P=.013$ for vocational retraining plan completion).

Abbreviations: FTE, full-time equivalent; PPD, permanent partial disability; WBI, whole body impairment.

[a] Inclusion conditional on initial claim being open at some point after the Stay at Work program was implemented (June 15, 2011).

[b] Inclusion conditional on having an approved vocational retraining plan and not having selected Option 2.

[c] Inclusion conditional on having an approved vocational retraining plan (completed or not completed).

TABLE III

Unadjusted employment outcome summaries, by degree of permanent impairment

	Total (N=43,968)		No PPD award (n=32,450)		WBI <10% (n=8,604)		WBI ≥10% (n=2,914)	
Variable	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Wage pattern[a]								
Timely and ongoing RTW	14,349	32.64	11,172	34.43	2,659	30.90	518	17.78
Delayed but ongoing RTW	1,941	4.41	1,200	3.70	485	5.64	256	8.79
Intermittent RTW	12,289	27.95	9,012	27.77	2,391	27.79	886	30.40
RTW termination	11,440	26.02	9,065	27.94	1,917	22.28	458	15.72
Never RTW	3,949	8.98	2,001	6.17	1,152	13.39	796	27.32
Reason for censoring								
Administrative[b]	43,878	99.80	32,398	99.84	8,575	99.66	2,905	99.69
Total permanent disability[c]	50	0.11	35	0.11	14	0.16	1	0.03
Death	40	0.09	17	0.05	15	0.17	8	0.27
Any wages (RTW) in Q0 or Q1[d]	34,969	79.53	27,403	84.45	6,137	71.33	1,429	49.04
Time measured in Qs	**Estimate**	**(95% CI)**	**Estimate**	**(95% CI)**	**Estimate**	**(95% CI)**	**Estimate**	**(95% CI)**
Observation time (mean)	22.79	(22.70-22.89)	22.60	(22.49-22.72)	23.38	(23.16-23.60)	23.23	(22.86-23.60)
Time to first RTW								
Median	0.001[e]	(0.001-0.001)	0.001[e]	(0.001-0.001)	0.001[e]	(0.001-0.001)	2	(1-2)
Restricted mean[f]	4.18	(4.08-4.29)	2.96	(2.85-3.06)	6.16	(5.88-6.44)	12.02	(11.40-12.64)
Time to first RTW interruption after first RTW (N=40,019)								
Median	12	(12-12)	12	(12-12)	13	(13-14)	10	(9-11)
Restricted mean[f]	18.02	(17.85-18.19)	17.98	(17.78-18.17)	18.72	(18.33-19.11)	16.14	(15.42-16.86)
N RTW interruptions[g] as a proportion of N Qs with any wages (N=40,019)	0.15	(0.14-0.15)	0.14	(0.14-0.15)	0.15	(0.14-0.15)	0.18	(0.16-0.19)
N Qs with no wages as a proportion of N observed Qs	0.36	(0.35-0.36)	0.33	(0.33-0.33)	0.39	(0.39-0.40)	0.55	(0.53-0.56)

Abbreviations: CI, confidence interval; PPD, permanent partial disability; Q, quarter; RTW, return/returned to work; WBI, whole body impairment.

[a] Wage pattern category definitions are presented in Table I.

[b] The study observation period ended on December 31, 2018.

[c] Related to a subsequent claim for the same worker.

[d] All included workers were observed for wages during the first claim closure quarter (Q0) and the subsequent quarter (Q1); some workers were censored beginning in quarter 2.

[e] In order to include workers who RTW (or were already working) during the same quarter that their initial workers' compensation claim first closed (Q0), a small arbitrary value (0.001) was added to the time variable for those workers.

[f] The restricted mean was calculated by restriction to the longest follow-up time; it underestimates mean survival time due to censoring.

[g] RTW interruption was defined as a quarter with no wages following a quarter with wages.

TABLE IV

Unadjusted and adjusted employment outcome regression models, by degree of permanent impairment

Characteristic/Model	Time to first RTW Unadjusted N=43,968 Adjusted N=43,023			Time to first RTW interruption Unadjusted N=40,019 Adjusted N=39,227			RTW volatility Unadjusted N=40,019 Adjusted N=39,227			Employment gaps Unadjusted N=43,968 Adjusted N=43,023		
Unadjusted	**HR**	**(95% CI)**	***P*[a]**	**HR**	**(95% CI)**	***P*[a]**	**IRR**	**(95% CI)**	***P*[a]**	**IRR**	**(95% CI)**	***P*[a]**
Impairment (Ref: No PPD award)			<.001			<.001			<.001			<.001
WBI <10%	0.82	(0.80-0.83)		0.95	(0.92-0.98)		0.97	(0.93-1.01)		1.19	(1.16-1.22)	
WBI ≥10%	0.57	(0.55-0.59)		1.15	(1.09-1.22)		1.18	(1.10-1.26)		1.65	(1.60-1.69)	
Adjusted	**HR**	**(95% CI)**	***P*[a]**	**HR**	**(95% CI)**	***P*[a]**	**IRR**	**(95% CI)**	***P*[a]**	**IRR**	**(95% CI)**	***P*[a]**
Impairment (Ref: No PPD award)			<.001			<.001			<.001			<.001
WBI <10%	0.83	(0.82-0.85)		0.98	(0.95-1.02)		1.00	(0.96-1.04)		1.15	(1.12-1.19)	
WBI ≥10%	0.62	(0.60-0.65)		1.15	(1.09-1.22)		1.18	(1.10-1.26)		1.53	(1.47-1.59)	
Female (Ref: Male)	0.97	(0.95-0.98)	<.001	1.04	(1.01-1.07)	.006	1.02	(0.98-1.05)	.350	1.06	(1.03-1.08)	<.001
Age (Ref: 18-24)			<.001			<.001			<.001			<.001
25-34	0.92	(0.90-0.93)		1.04	(1.00-1.07)		1.09	(1.05-1.14)		1.16	(1.12-1.20)	
35-44	0.86	(0.85-0.88)		0.97	(0.93-1.01)		1.03	(0.98-1.08)		1.19	(1.15-1.24)	
45-54	0.81	(0.79-0.83)		0.99	(0.94-1.03)		1.06	(1.01-1.12)		1.31	(1.25-1.37)	
55-64	0.77	(0.75-0.79)		1.21	(1.15-1.27)		1.40	(1.32-1.49)		1.65	(1.55-1.74)	
≥65	0.65	(0.61-0.69)		1.62	(1.49-1.76)		2.12	(1.90-2.37)		2.38	(2.19-2.58)	
Preferred language (Ref: English)			<.001			<.001			<.001			<.001
Spanish	0.94	(0.92-0.96)		0.98	(0.94-1.02)		1.03	(0.98-1.08)		1.10	(1.06-1.13)	
Other	0.97	(0.93-1.00)		0.85	(0.79-0.92)		0.82	(0.75-0.91)		0.99	(0.93-1.05)	
Urban-rural residence county (Ref: Large central metropolitan)			.016			.001			<.001			<.001
Large fringe metropolitan	0.98	(0.97-1.00)		1.03	(0.99-1.06)		1.04	(1.00-1.08)		1.04	(1.01-1.07)	
Medium metropolitan	1.00	(0.99-1.02)		1.05	(1.01-1.09)		1.08	(1.04-1.13)		1.05	(1.02-1.09)	
Small metropolitan	1.00	(0.98-1.02)		1.03	(0.98-1.07)		1.08	(1.02-1.13)		1.00	(0.96-1.04)	
Micropolitan	1.01	(0.99-1.03)		1.03	(0.98-1.08)		1.05	(0.99-1.12)		1.02	(0.97-1.07)	
Noncore	0.95	(0.91-0.99)		1.19	(1.09-1.29)		1.34	(1.22-1.47)		1.21	(1.13-1.29)	
Body part (Ref: Spine/neck)			<.001			.006			.006			<.001
Upper extremity	1.08	(1.06-1.09)		0.97	(0.94-1.00)		0.96	(0.92-1.00)		0.91	(0.88-0.94)	

Characteristic/Model	Time to first RTW Unadjusted N=43,968 Adjusted N=43,023			Time to first RTW interruption Unadjusted N=40,019 Adjusted N=39,227			RTW volatility Unadjusted N=40,019 Adjusted N=39,227			Employment gaps Unadjusted N=43,968 Adjusted N=43,023		
Unadjusted	**HR**	**(95% CI)**	***P*[a]**	**HR**	**(95% CI)**	***P*[a]**	**IRR**	**(95% CI)**	***P*[a]**	**IRR**	**(95% CI)**	***P*[a]**
Lower extremity	1.09	(1.07-1.11)		0.94	(0.90-0.97)		0.93	(0.89-0.97)		0.88	(0.85-0.90)	
Other/multiple	1.03	(1.02-1.05)		0.97	(0.93-1.01)		0.99	(0.95-1.04)		0.95	(0.92-0.98)	
Functional Comorbidity Index	0.98	(0.96-1.00)	.101	1.06	(1.02-1.10)	.003	1.08	(1.03-1.13)	.001	1.05	(1.02-1.08)	.001
Pre-injury wages ($10,000 increments)	1.17	(1.15-1.19)	<.001	0.51	(0.49-0.52)	<.001	0.44	(0.42-0.46)	<.001	0.68	(0.63-0.73)	<.001
Large employer (Ref: Small employer)	1.07	(1.06-1.08)	<.001	0.93	(0.90-0.95)	<.001	0.93	(0.90-0.96)	<.001	0.89	(0.87-0.91)	<.001
Industry sector (Ref: Information, Finance, Real Estate, Professional)			<.001			<.001			<.001			<.001
Agriculture, Forestry, Fishing, Hunting	0.98	(0.95-1.02)		1.18	(1.09-1.27)		1.26	(1.15-1.38)		1.03	(0.96-1.10)	
Construction, Utilities, Mining	0.93	(0.90-0.96)		1.17	(1.10-1.26)		1.22	(1.12-1.32)		1.10	(1.04-1.17)	
Manufacturing	0.98	(0.95-1.01)		1.01	(0.95-1.09)		0.98	(0.90-1.07)		0.98	(0.92-1.04)	
Retail/Wholesale Trade	1.00	(0.97-1.02)		0.92	(0.87-0.98)		0.89	(0.83-0.96)		0.95	(0.90-1.01)	
Transportation, Warehousing	0.96	(0.93-1.00)		1.08	(1.01-1.17)		1.08	(0.99-1.18)		1.07	(1.00-1.14)	
Administrative, Support, Other Services	0.96	(0.94-0.99)		1.01	(0.95-1.07)		1.02	(0.95-1.09)		1.01	(0.95-1.06)	
Education, Health Care, Social Services	1.01	(0.98-1.04)		0.92	(0.87-0.97)		0.89	(0.83-0.96)		0.93	(0.87-0.99)	
Arts, Entertainment, Hospitality	0.98	(0.95-1.01)		0.96	(0.90-1.03)		0.93	(0.86-1.01)		0.99	(0.92-1.05)	
Hazard group	0.99	(0.99-0.99)	<.001	1.01	(1.01-1.02)	<.001	1.01	(1.01-1.02)	.002	1.01	(1.01-1.02)	<.001
Year of first claim closure (Ref: 2009)[b]			<.001			<.001			<.001			<.001

Abbreviations: CI, confidence interval; HR, hazard ratio; IRR, Incidence rate ratio; PPD, permanent partial disability; Ref, reference category; RTW, return/returned to work; WBI, whole body impairment.

[a] *P* value on referent line reflects joint test for set of categories within variable.

[b] A fixed effect for each year of first claim closure was also included in all models presented in this table; though statistically significant, these parameters were not of direct interest. For brevity, these parameters were not included in this table.

TABLE V

Unadjusted and adjusted employment outcome regression models, by participation in workers' compensation programs

	Time to first RTW			Time to first RTW interruption			RTW volatility			Employment gaps		
Model	**N**	**HR**	**(95% CI)**	**N**	**HR**	**(95% CI)**	**N**	**IRR**	**(95% CI)**	**N**	**IRR**	**(95% CI)**
Stay at Work program[a]												
Unadjusted	31,536	1.13	(1.10-1.15)	28,653	0.75	(0.70-0.81)	28,653	0.74	(0.67-0.81)	31,536	0.75	(0.71-0.80)
Adjusted[b]	30,867	1.12	(1.09-1.14)	28,086	0.86	(0.79-0.92)	28,086	0.84	(0.77-0.92)	30,867	0.80	(0.75-0.86)
Completed vocational retraining plan[c] (Ref: Approved plan not completed)												
Unadjusted	1,319	1.24	(1.09-1.41)	849	0.80	(0.68-0.95)	849	0.78	(0.63-0.97)	1,319	0.87	(0.81-0.93)
Adjusted[b]	1,240	1.30	(1.13-1.49)	798	0.75	(0.63-0.90)	798	0.73	(0.58-0.91)	1,240	0.86	(0.80-0.92)
Option 2: Self-directed retraining funds[d] (Ref: Conventional plan)												
Unadjusted	1,267	0.72	(0.63-0.82)	818	1.47	(1.24-1.74)	818	1.60	(1.29-1.98)	1,267	1.24	(1.16-1.33)
Adjusted[b]	1,207	0.69	(0.60-0.79)	776	1.56	(1.30-1.86)	776	1.70	(1.36-2.13)	1,207	1.27	(1.18-1.36)

Note: All estimates in this table were statistically significant at P<.001, with several exceptions for the vocational retraining plan completion models: (1) Time to first RTW (unadjusted, *P*=.001), (2) Time to first RTW interruption (unadjusted, *P*=.009; adjusted, *P*=.002), and (3) RTW volatility (unadjusted, *P*=.024, adjusted, *P*=.006).

Abbreviations: CI, confidence interval; HR, hazard ratio; IRR, incidence rate ratio; Ref, reference category; RTW, return/returned to work.

[a] Inclusion conditional on initial claim being open at some point after the Stay at Work program was implemented (June 15, 2011).

[b] Adjusted models included the same variables as shown for the adjusted models in Table IV, including degree of impairment.

[c] Inclusion conditional on having an approved vocational retraining plan and not having selected Option 2.

[d] Inclusion conditional on having an approved vocational retraining plan (completed or not completed).