Accepted: 1 August 2017
DOI: 10.1002/ajim.22763

RESEARCH ARTICLE

WILEY AMERICAN JOURNAL OF INDUSTRIAL MEDICINE

Factors underlying observed injury rate differences between temporary workers and permanent peers

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Funding information
National Institute for Occupational Safety and Health, Grant number: U60OH008487-10

Background: Temporary workers face increased risk of injury as compared to permanent workers in similar occupations. This study explores the role played by several potential risk factors.

Methods: Injured temporary and permanent workers, matched by industry, tenure and demographic characteristics, were interviewed to isolate the association of temporary employment with several injury risk factors.

Results: Temporary workers had higher workers' compensation claims rates than their permanent worker-peers. In interviews temporary workers a reported a lower frequency of exposure to hazards. However, they also reported being less likely to be equipped to cope with hazards by such countermeasures as experience screening, safety training and task control.

Conclusion: Policies are needed to improve screening and training of temporary workers to assigned tasks, to discourage job-switching, to improve temporary workers' hazard awareness, to protect their right to report unsafe conditions. The responsibilities of agencies and host employers for ensuring the safety of their temporary workers need clarification in regulatory policy.

KEYWORDS
hazard exposures, safety training, temporary workers, workers' compensation

1 | BACKGROUND

The temporary help supply (THS) workforce in Washington State has grown rapidly since 1990 as compared to that of the directly employed workforce. Over the same time period the distribution of temporary help supply workers has spread beyond its traditional focus in office services toward higher hazard sectors such as construction, food processing, light assembly, and warehousing/logistics.[1,2]

At issue is whether the increasing share of the temporary help supply workforce in the higher hazard industries and occupations has led to a deterioration in health and safety outcomes. Evidence from survey-based research on this question ranges from no difference in health outcomes,[3–6] to findings of higher frequency and severity of occupational injuries.[7,8] Longer exposure to temporary employment has also been associated with poorer general health.[9,10]

Research using administrative databases of workers' compensation insurance records is less equivocal. Across several different countries with varying systems of insurance coverage for occupational injuries, temporary workers have been found to have elevated injury claims rates as compared to their permanent peers. A pair of studies in Washington State showed that time-loss claims rates were higher for temporary workers than for permanent workers even after controlling for occupation and industry.[1,2] Similar results have been shown in other settings.[11–13]

Many of these studies fault the relatively short work assignments of temporary workers as being a key driver of the increased rate of injury. Several factors may increase the risk for injury when a worker's tenure at a particular workplace is brief: unfamiliarity with new work practices and surroundings, limited safety training, a disproportionate share of younger workers, or an inability to recognize hazards and

refuse hazardous work or to demand appropriate protective equipment for fear of dismissal. Employers may hire temporary workers as a means of shielding permanent workers from risky tasks, and they may invest less time in providing them with appropriate training and protection equipment. In addition, temporary workers who are hired through an agency have two separate parties who are responsible for their safety, which raises the possibility that neither will take full responsibility to prepare the worker adequately.

A Canadian study in a general working population using workers' compensation records that controlled for age, gender and occupation, found that workers in their first month at a given employer were four times more likely to have a lost-workday claim as compared to workers with more than 1 year of experience in their current job.[14] Similarly, an Italian study found an inverse relationship between injury risk and tenure while controlling for both age and previous experience.[15] Even after controlling for occupation or industry, systematic differences in job tenure and age may remain between temporary workers and "standard employment" workers. Given the higher percentage of temporary workers with short job tenure, it is important to isolate the independent contribution of job tenure to injury rate from that of employment arrangement.

Much the same reasoning applies to the need to control for the age of the worker. The 2005 Current Population Survey found 19.3% of temporary workers were under the age of 25 years, as opposed to 9.7% of full-time permanent workers. As young age has also been associated with increased injury/illness it will be important to control for this factor as well.[16]

The precariousness of temporary workers' employment may place them at greater risk for adverse physical and psychosocial hazards in their employment that lead to injury. In surveys, temporary workers have been found to be more likely than their permanent peers to experience "mismatched placements," lack of familiarity with their host employer's worksite, limited communication about physical hazards, which creates barriers to risk mitigation, and lower levels of job control and security.[17–19]

In contrast to studies focusing on health outcomes, relatively few studies have explored the antecedent factors that could be driving the higher injury rates for temporary workers. These include whether temporary workers are given the more hazardous jobs in a given worksite; whether they are screened by their agency or host employer for experience with the assignment; whether they feel able to refuse unsafe work; the frequency and quality of safety training; and whether they were equipped with the appropriate protective gear. While simply comparing temporary workers' claims rates to those of their permanent peers, controlling for industry, job tenure, and demographics can quantify the dimensions of the excess injury burden faced by temporary workers, it cannot confirm the part played by any of these antecedent risk factors.

In order to explore the association of injury risk factors such as hazard exposures, experience screening, safety training and supervision with temporary employment, we conducted a set of case follow-up interviews among temporary workers and their permanent peers matched by workplace and demographic characteristics. The purpose was to distinguish the role played by the workers' temporary status from that of short tenure, youth, gender, or industry that could potentially explain their higher injury rates relative to their permanent-employed peers.

2 | METHODS

This study was focused on workers in the temporary help supply (THS) industry as defined within the North American Industrial Classification System (NAICS) code 561320. For this segment of contingent work in Washington State, a record of hours worked, industries where temporary workers are deployed and counts of workers' compensation claims filed are available.

2.1 | Washington state workers compensation system

In Washington State, employers are required to obtain workers' compensation insurance through the Washington State Department of Labor and Industries (L&I) State Fund, unless they are eligible to self-insure, are self-employed or are the federal government. The State Fund Insurance program insures 75% of the eligible workforce and all but 350 of the 174 000 employers [Washington State, 2015]. Each employer reports hours worked by their employees for payment of the workers' compensation insurance premium grouped by a risk-classification system referred to as the Washington Industrial Classification (WIC) system [Washington Administrative Code 296-17A]. The State Fund classifies covered work into one of 391 separate main risk classes based upon the nature of the hazards faced in each industry, of which 16 are reserved for temporary employees working for temporary help services companies. These include separate classes for temporary office support, technical services, warehousing, retail/wholesale, health care, food processing, agriculture, janitorial services, vehicle operation, machine operators, assembly work, and construction. This allows us to identify and classify temporary workers and compare them to permanent workers performing similar types of work. Using the occupation information listed on injured workers' claims, we selected risk classes for permanent workers with the highest degree of similarity to each of the twelve largest temporary risk classes. A more detailed description of the methods used to select matching risk classes is included in Supplementary Material Appendix1.

2.2 | Comparing claims rates between temporary and permanent workers

The risk classes for temporary workers were compared to their associated permanent risk class groupings on such measures as claims per 100 FTE, musculoskeletal claims per 100 FTE, average, and median lost workdays and costs per claim. Because temporary workers are distributed across industries differently from permanent workers, overall claims rates for temporary and permanent workers were adjusted using the combined permanent and temporary worker

population in each risk class as a "standard population" to generate an expected number of claims for temporary and permanent workers in each risk class.[20] The expected claims were then summed across risk classes and divided by the standard population to obtain the risk-class adjusted overall claims rate for temporary and permanent workers.

2.3 | Case follow-up interviews

In order to understand further the factors underlying the higher claims rates we have observed for temporary workers, we conducted case follow-up interviews with a total of 460 workers with time-loss workers compensation claims over the course of the study period from 2011 to 2015.

We selected for interview all workers who filed a workers' compensation claim in the previous month and whose employer reported hours into one or more of the Temporary Help Services risk classes in the State Fund database. Over the study period, about 2800 claims were filed among workers in temporary risk classes (see Figure 1). The "place of injury" field on the temporary worker's claim form was used to obtain the risk class of the host employer.

Each month we selected all temporary claims received from temporary workers and, after excluding claims without place of injury information, we matched each claim to the set of permanent-employment claims within the set of comparable risk classes initiated during that month. We then applied additional matching criteria to control for any systematic differences in age, tenure and gender. For age, we only selected permanent workers who were within ±5 years of age of the temporary claimant. For tenure, we matched on tenure categories of 0-3 months, 3 months to 1 year, and more than 1 year.

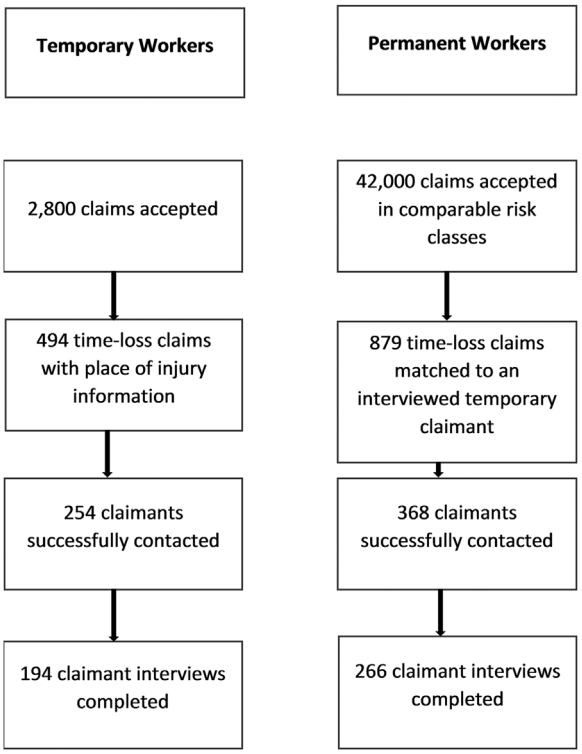

FIGURE 1 Selection of claimants for interview

Since occupational segregation by gender occurs in many work settings, the nature of the hazards to which workers are exposed may be expected to vary by gender. Through this means, temporary worker claims could be matched to permanent-worker claims in the selected risk class grouping that corresponded to that of the injured temporary worker. For permanent workers in the comparable risk classes there were about 42 000 accepted time-loss claims.

Interviews were conducted by telephone. Over the course of the 5-year study period we selected 494 temporary workers with time-loss claims who satisfied the risk class selection criteria. We then identified 879 permanent workers with time loss claims working in the matched risk classes who also could be matched to a selected temporary worker. A recruitment letter with informed consent materials was mailed to the address of the claimant. A substantial number of claimants were not possible to reach due to a wrong address or telephone number on the claim file or because there was no answer after multiple attempts. We contacted 368 permanent workers (41.9%) and 254 temporary workers (51.4%). Of those workers contacted, 102 (11.6%) permanent, and 60 (12.1%) temporary workers declined to be interviewed. We successfully completed interviews with 266 permanent workers and 194 temporary workers. This represents a response rate of 30.3% and 39.3% for permanent and temporary workers, respectively. We completed 122 matched sets of interviews with one temporary worker and at least one permanent worker matched by risk class, gender, age, and tenure.

The case follow-up questionnaire was based upon the themes uncovered in previously conducted focus groups with temporary workers and agency managers. These themes included risk factors noted in the literature as driving differential injury outcomes for temporary workers (See Supplementary Material Appendix2). Topics covered by the questionnaire include: work scheduling; hazards encountered and the worker's perception of the level of risk faced; ability to control the type of job assigned; physical and mental exhaustion due to work; self-reported health status; pre-assignment experience screening and task familiarity; extent and quality of safety training and equipment provided; closeness of supervision on the job; and the worker's perception of the importance placed upon safety by supervisors. Spanish-language versions of the questionnaire and all recruitment and consenting materials were also created and made available to workers if preferred. The questionnaires were pilot tested for clarity and length. Interviews were conducted by staff supervised by the author. One Spanish-English bilingual staffperson was available to conduct interviews with workers preferring this option.

Responses to the survey were linked to the injured worker's claim file so that such information as tenure at the host employer, risk class, injury type, claim cost, and lost workdays could be captured. This was also used to compare survey respondents' characteristics to those of non-respondent claimants.

2.4 | Analyses

In addition to the claims rate and cost comparisons described earlier, we calculated the following descriptive statistics, broken out by

temporary and permanent status for all claimants and separately for survey respondents: proportions by gender; age; Latino ethnicity (for survey respondents only); length of service at the job of injury; risk class grouping and distribution across seven injury types (events). Proportions were calculated for all categorical variables generated from the survey and were compared between temporary and permanent status using the chi-square test. For continuous variables, group means were calculated and comparisons between temporary and permanent workers were made using the *t*-test.

Most outcome variables on the survey were categorical, multi-level, and ordinal (eg, low, medium, high hazard). Excess risk for these outcomes was estimated by calculating the crude odds ratios for temporary versus permanent-employed workers using cumulative logistic regression methods with PROC LOGISTIC in SAS v 9.4. Odds ratios were also calculated adjusting for several other predictors including: tenure before injury, hazard level of the risk class as represented by workers' compensation premium, claimant age and gender, ethnicity (Latino/non-Latino), education level and pre-injury income. Wald 95% confidence intervals were calculated.

We also performed a separate estimation (not shown) of all models using the treatment-control matching criteria we originally used to select subjects for interview. In this method the explanatory variable was the worker's status as a temporary or permanently employed worker, and the data were analyzed as matched sets rather than as individual records.[21] For this model we used generalized estimating equation methods, with the "repeated" variable in the PROC GENMOD procedure in SAS v9.4 being the matched set identifier, to estimate odds ratios for excess risk while accounting for any correlation of observations in the matched pairs. Since the results for the unmatched cumulative logistic regression model were very similar to those using the matching approach, only the former are presented here.

Correlation among variables in the multivariate models such as risk class, education, and income was a concern. Tests for multicollinearity were performed and were found to be at acceptable levels: all variance inflation factors were less than 1.4 and coefficients were stable. Interaction terms for temporary/permanent status, age and gender were estimated, but as these did not have consistent signs across outcomes and because they did not have an impact on the main effect of temporary/permanent status, they were omitted.

Approval of study design, protocols, and survey instruments was obtained from the Washington State Institutional Review Board.

3 | RESULTS

3.1 | Workers' compensation data descriptive measures

For the period from 2011 to 2015, we compared accepted claims rates between each of the temporary risk classes and the previously validated comparable permanent risk classes. Figure 2 shows the comparison, across the sixteen matched risk classes, of the rate of lost work-day claims per 100 full-time equivalent (FTE) workers. The results showed that temporary workers experienced higher claims rates than their permanent counterparts across all risk classes with the exceptions of Warehousing and Office Services. The overall unadjusted rate ratio for temporary status workers relative to permanent counterparts was 1.44 (95% CI: 1.28-1.60). When adjusted for the differing distribution of workers across risk classes, the overall claims rate ratio for permanent workers was 2.01 (95% CI: 1.85-2.16). For the individual matched risk classes the ratio of claims rates for temporary workers as compared to permanent workers ranged from 0.82 in warehousing to 5.25 in agriculture. Breaking out claims into work-related musculoskeletal disorders (WMSDs) and non-WMSDs shows that temporary workers had higher claims rates than their permanent peers for both categories (data not shown). We also found that WMSD claims accounted for a slightly smaller share of total claims for temporary workers than for their permanent peers.

As compared to workers in the matched permanent risk classes, claimants who are temporary workers are younger than their permanent counterparts and disproportionately male (Table 1). The median length of tenure at the worksite before injury was substantially shorter for temporary workers. Comparing across broad categories of injury type showed only minor differences between temporary and permanent workers. Falls injuries make up a somewhat lower share of temporary workers' claims whereas struck/caught injuries account for a higher share than is the case for permanent workers. The most common type of injury for both groups is overexertion/bending injury, that is, musculoskeletal disorders.

The demographic profile of injured workers who participated in the case follow-up interviews differed from that of claimants in general (Table 1). Respondents were more likely to be middle-aged and, for permanent workers, more were male. Although claimants' ethnicity is not recorded in the claims database, we found among the survey respondents that those who self-identified as Latino comprised about 18% of the temporary workforce and almost 26% of the permanent workforce at the matched set of industries. A smaller fraction of respondents to the case follow-up interview had been working at their job of injury for less than a month than was true for claimants overall. Because of our efforts to match permanent workers to temporary workers by tenure, respondents in permanent employment tended to have shorter tenure than permanent workers overall. Comparing respondents to claimants overall by injury type, a somewhat larger share of survey respondents had experienced a fall from elevation.

Among claimants overall, mean time-loss days per claim was higher for temporary workers (Table 1). However among survey respondents the length of time-loss for temporary and permanent workers was similar. For both groups time loss was substantially higher for survey respondents than that for claimants overall. Pre-injury earnings of claimants show that temporary workers earned about 20-30% less than their permanent counterparts in the matched risk classes. Surveyed respondents had higher pre-injury earnings than non-respondents.

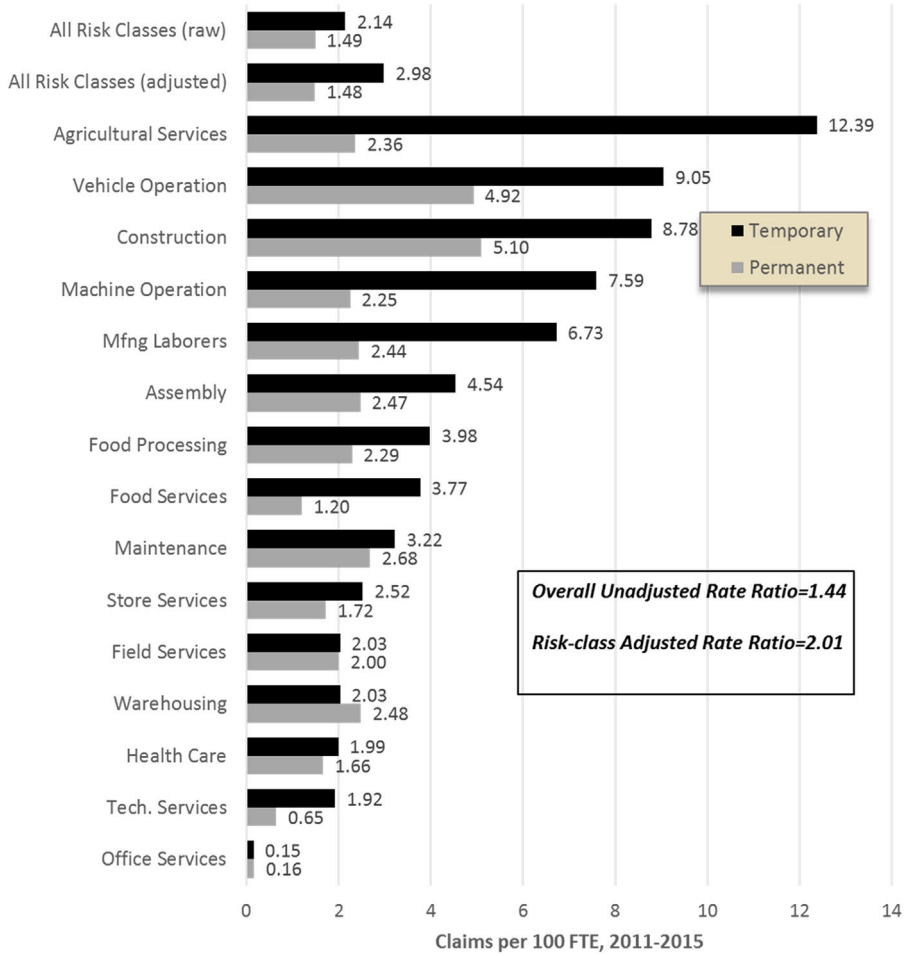

FIGURE 2 Temporary vs permanent workers' lost workday claims rate per 100 FTE, by risk class and adjusted rate ratio, 2011-2015, Washington State

3.2 | Injured worker case follow-up interview: Descriptive measures

Tables 2 and 3 provide summary measures for surveyed temporary and permanent workers for questions on hazard exposures at the worksite of injury, job demands, tenure, health status, pre-assignment experience screening, safety training, supervision, and PPE. For both temporary and permanent workers the top three risks faced were ergonomics, machinery and falls. For each of the ten hazards, temporary workers' perception of their level of risk was lower than that of permanent workers. The greatest disparity in reported risk was for fall hazards. As compared to their permanent peers, temporary workers reported having less control over work schedules, less pre-assignment experience screening, and less frequent and less adequate safety training. No significant differences were found for: exposure to chemical, housekeeping, ergonomic, machinery or temperature hazards; isolated work, physical or mental exhaustion, provision of personal protective equipment, health status, or their assessment of the importance of safety to their agency or host employers.

Temporary workers reported somewhat more frequent switches of job duties occurring after starting work at the host employer. Most said this happened frequently and that they did not feel able to refuse the re-assignment. Finally, about half of this group said that their temporary agency was unaware of the change in job assignment.

Temporary workers received training less frequently, both at their agency and at their host employers. Almost 40% of temporary claimants reported "never" receiving safety training from their temporary agency, and a further 48% said they only received such training at the start of their employment. Over 40% never received training from their host employer, and another 35% only received such training at the start of their assignment. By contrast, about 25% of permanently employed claimants reported never receiving safety training from their employer, and another 20% only received training at the start of their employment.

3.3 | Multivariable regression analyses

Tables 2 and 3 also present the results from the cumulative logistic regression estimate of the relative odds for temporary workers as compared to their permanent worker peers for a range of outcome variables associated with hazards for injury (Table 2) and for the countermeasures which employers may take to abate these risks (Table 3). As was seen in the descriptive measures, the odds ratio

TABLE 1 Claimant demographics, employment and injury type, all claimants (N = 43 502) and survey respondents (N = 460), 2011-2015

	All claimants		Survey respondents	
	Permanent, n = 41 184	Temporary, n = 2318	Permanent, n = 266	Temporary, n = 194
Sex	%	%	%	%
Male	62.6	76.8	79.0	76.8
Female	37.4	23.2	21.0	23.2
Age				
<25 years old	11.7	19.1	11.7	11.9
25-44 years	45.4	49.7	50.8	52.6
45 or more years	42.1	30.0	36.8	33.0
Latino	-	-	25.8	18.2
Tenure				
<30 days	36.6	47.4	25.6	37.6
30-90 days	6.6	15.6	24.1	14.4
91-365 days	19.8	25.2	31.2	32.0
1-5 years	20.2	9.6	15.8	12.4
5 or more years	16.9	2.3	3.4	3.6
Injury type				
Falls from elevation	7.9	5.5	13.5	7.2
Falls-same level	10.9	8.5	9.8	6.2
Overexertion/bending	44.7	44.4	46.2	48.5
Struck/caught	20.4	29.0	24.1	28.4
Transportation	3.5	2.3	1.1	2.6
Violence	1.7	0.5	1.9	0.0
Other (toxics/fire)	11.0	9.7	3.4	7.2
Time loss days				
Mean	55.6	80.8	177.7	166.5
Median	1.0	7.0	38.0	38.5
Claimant earnings per month				
Mean	$2171	$1503	$2582	$2057
Median	$2072	$1640	$2400	$1764

shows that temporary workers are more likely to be working as part of a team relative to permanent workers when adjusted for tenure, industry, age, gender, Latino ethnicity, education and income, but the difference is not statistically significant.

The odds of reporting exposure to higher levels of risk from each of ten hazard types was, in almost every case, lower for temporary workers than it was for their permanent-employed peers, adjusted for the same set of controls previously described. While for most hazards the adjusted odds ratio was not significantly different from 1.0, for four hazard types—biological, dust-related, crowding, and falls—temporary workers reported lower exposures at a statistically significant level.

The multivariable logistic regression results show that temporary workers reported a lower degree of control over their work schedule as compared to permanent worker peers. However, they were also less likely to experience physical or mental exhaustion at the end of their shift. In addition, they were somewhat more likely than their permanent peers to report good health, both at the current period and in comparison to their peers.

While controlling for tenure, industry and claimant demographics, temporary workers were less likely to say their agency or their host employer had screened their prior work history for experience with the tasks of the job they were going to perform.Temporary workers were even less likely to be screened for experience with assigned job tasks by their host employers before beginning work. If we examine whether temporary workers' espertise was assessed by *either* their agency or their host employer, the results indicate that temporary workers are still less likely to be screened than their permanent peers

The results of the adjusted cumulative logistic regression model show that temporary claimants were more likely to say they had received training less frequently at both their agency and at their host employer as compared to their permanent counterparts. However, we did not find a significant difference between the two groups of workers

TABLE 2 Crude and adjusted logistic models of relative odds for temporary workers vs permanent workers in regards to hazard exposures, work demand/control, and health status

	Permanent	Temporary				
Outcome	***n* = 266**	***n* = 194**	**Crude OR**	**95%CI**	**Adjusted OR[b]**	**95%CI**
Work Schedule[a]	%	%				
Worked as part of team	49.3	55.8	1.30	0.90, 1.89	1.52	0.98, 2.48
Hazards reported						
Chemicals	28.6	24.3	0.79	0.52, 1.21	0.94	0.58, 1.53
Biological	**29.3**	**14.8**	**0.41**	**0.26, 0.67**	**0.37**	**0.21, 0.65**
Dust	**49.1**	**33.7**	**0.56**	**0.38, 0.81**	**0.56**	**0.36, 0.86**
Housekeeping	37.7	33.5	0.89	0.59, 1.26	0.87	0.56, 1.33
Ergonomics	80.5	75.4	0.85	0.59, 1.22	0.94	0.62, 1.43
Machinery	62.4	57.1	0.86	0.61, 1.21	1.10	0.74, 1.65
Noise	**51.5**	**39.0**	0.72	0.50, 1.03	0.84	0.55, 1.28
Temperature	48.7	39.5	**0.68**	**0.48, 0.98**	0.72	0.47, 1.10
Crowding	**31.9**	**18.4**	**0.50**	**0.32, 0.78**	**0.45**	**0.27, 0.75**
Falls	**65.6**	**43.0**	**0.47**	**0.30, 0.73**	**0.53**	**0.32, 0.86**
Job control and fatigue						
No schedule control	**50.6**	**62.1**	**1.50**	**1.04, 2.17**	**1.48**	**1.01, 2.24**
Always or often physically exhausted	58.1	55.9	0.91	0.65, 1.28	0.90	0.61, 1.33
Always or often mentally exhausted	44.7	38.8	0.72	0.51, 1.00	0.71	0.48, 1.05
Health status (good to excellent)						
Current health	68.9	76.9	1.24	0.88, 1.73	1.37	0.93, 2.00
Health before injury	90.5	90.7	0.99	0.70, 1.39	0.99	0.67, 1.47
Health compared to peers	78.9	79.8	1.15	0.81, 1.62	1.23	0.83, 1.81
Tenure until injury <1 month	**21.1**	**37.1**	**2.58**	**1.81, 3.66**	**2.24**	**1.50, 3.35**

[a]Significance of group proportion differences for categorical variables estimated by chi-square test. Rows in boldface: $P < 0.05$. Odds ratios calculated by cumulative logistic regression using PROC LOGISTIC in SAS v9.4. Reference group = permanent workers. Wald 95% confidence limits are shown.
[b]Adjusted models control for tenure before injury, industry grouping, age, sex, Latino ethnicity, education, and income.

on training adequacy once adjustment for tenure and demographic differences was made.

Two questions addressed the issue of the host employers' provision of adequate safety to temporary workers. On the first, temporary workers had higher odds of reporting that they were supervised closely by their host employer. Claimants were also asked to assess how important was safety to their managers at both the agency and at the job site. Temporary workers were somewhat more likely than their permanent peers to respond that safety was important to their managers at both the agency and at the host. We also did not find evidence to support the hypothesis that temporary workers were not provided with appropriate safety equipment. Temporary workers were slightly more likely to say they were supplied with appropriate PPE.

4 | DISCUSSION

The comparison of time-loss claims rates show that temporary workers experience on average twice the rate of injury as their permanently employed peers. This gap also appears when looking at claims costs per worker, lost workdays per worker or the workers' compensation insurance premium paid to cover these workers.[1,2] The claims rate comparisons between temporary and permanent workers were made while controlling only for risk class. However, other factors affecting the probability of injury, such as youth, pre-assignment inexperience or gender, are left uncontrolled in this comparison. Therefore, the proposition that it is the temporary status of these workers which exposes them to greater risk of injury than their permanent counterparts cannot be evaluated from these claims data alone. The demographic characteristics of the claimant pool from which the survey respondents was drawn show systematic differences that could contribute to differential claims rates: temporary claimants are more likely to be male, younger, and to have shorter tenure at their current employer than their permanent peers.

Multivariable logistic regression models based on the follow up survey showed that temporary claimants reported lower exposure to each of ten hazard types, when their risk was adjusted for tenure, industry, age, gender, Latino ethnicity, education, and income. These results were unexpected, given findings from other studies reviewed.[17] Since both groups of claimants were drawn from a matched

TABLE 3 Crude and adjusted logistic models of relative odds for surveyed temporary workers vs permanent workers in regards to safety training, screening, and supervision

	Permanent	Temporary				
Outcome	***n* = 266**	***n* = 194**	**Crude OR**	**95%CI**	**Adjusted OR[b]**	**95%CI**
Screened by employer for experience	%	%				
Agency[a]	**65.4**	**52.2**	**0.58**	**0.39, 0.85**	**0.64**	**0.41, 1.00**
Host employer[a]	**65.4**	**42.7**	**0.40**	**0.27, 0.58**	**0.46**	**0.30, 0.72**
Either[a]	65.4	58.3	0.74	0.50, 1.09	0.84	0.54, 1.32
Task/job switching						
Task/job switched	20.8	24.2	1.21	0.78, 1.90	0.79	0.46, 1.34
Safety training frequency—(never or only at start)						
Frequency-agency[a]	**44.7**	**88.0**	**3.93**	**2.74, 5.65**	**2.74**	**1.82, 4.12**
Frequency-host[a]	**44.7**	**75.3**	**2.91**	**2.05, 4.15**	**1.87**	**1.25, 2.80**
Safety training adequacy—(never or rarely)						
Adequacy-agency[a]	**28.0**	**37.1**	**1.57**	**1.08, 2.28**	1.16	0.75, 1.79
Adequacy-host[a]	28.0	36.7	1.23	0.84, 1.80	0.83	0.53, 1.30
Personal protective equipment						
Provided appropriate equipment	68.8	67.1	1.03	0.68, 1.55	1.28	0.78, 2.10
Supervision/safety importance						
Closely supervised at worksite	**55.6**	**65.0**	**1.49**	**1.05, 2.10**	**1.49**	**1.00, 2.23**
Safety importance-agency[a]	76.7	69.1	1.22	0.83, 1.79	1.41	0.90, 2.21
Safety importance-host[a]	76.7	73.2	1.14	0.79, 1.66	1.21	0.79, 1.86

Significance of group proportion differences for categorical variables estimated by chi-square test. Rows in boldface: $P < 0.05$. Odds ratios estimated by cumulative logistic regression using PROC LOGISTIC in SAS v9.4. Reference group = permanent Workers. Wald 95% confidence limits are shown.
[a]Since permanent workers only have one employer, values are repeated for screening, training frequency and adequacy, and safety importance.
[b]Adjusted models control for tenure before injury, industry grouping, age, sex, Latino ethnicity, education, and income.

set of risk classes it is perhaps not surprising that the pattern of risks faced should be similar (see Table 2).

It is possible that temporary workers are shielded from hazardous exposures by both their agencies and host employers. In interviews with temporary agency managers in preparation for the study, all stated that they had policies prohibiting work at high elevations, for example. Certainly agencies do have a financial incentive to limit hazardous exposures among their workers. But competition for clients was noted by all agency managers as being a factor limiting the conditions they could impose on host employers.

In this study, we collected no direct observational data on hazard exposures and could only report the workers' perception of the level of hazard they faced. As awareness of a job hazard is a function of experience, the brief length of time a temporary worker spends in a given workplace may leave them unaware of all of the hazards present. A more experienced permanent worker may have accumulated enough time to be familiar with a broader range of hazards across the workplace. Although tenure was among our matching criteria, it proved difficult to find enough permanent workers who had been injured in the first 2-3 weeks of their assignment.

A worker's ability to perceive hazards may also be shaped by the training they receive from their employers and by communicating with their co-workers. We have seen that temporary workers report receiving training less frequently than their permanent peers, and that a significant minority report that the training they do receive is often not adequate. Finally, because of their limited time in any given workplace, temporary workers may face more barriers to making changes in that workplace. It has been noted in studies of risk perception that people tend not to focus on hazards that they believe they cannot change.[22] For temporary workers this barrier is compounded by the possibility that voicing their misgivings about a hazard may cost them their assignment or even get them labelled as "difficult" by their agency.[23]

Temporary workers were less likely than permanent workers to say their agency or their host employer had screened them for previous work experience in the tasks they were expected to perform. They were also less likely to have received safety training at either their agency or at their host employer as compared to their permanent counterparts. This may be understandable from the point of view of employers, given the short-run nature of the job assignments and the time required to conduct trainings, but it is a potential driver of the higher claims rates we observe for temporary workers. While the results show a significant difference between temporary and permanent workers in the frequency of their training, it should be noted that even the frequency and adequacy of training reported by permanent workers is also quite low. Initiatives that merely aim to

close the gap between temporary workers' level of safety training and that of their permanent peers would still be inadequate.

One potential problem with relying on workers' compensation data for injury surveillance of temporary workers is that it is well-known that work-related injuries and illnesses are underreported to the workers compensation systems.[24] If there is a differential between temporary workers and permanent workers in claims reporting, estimates of the claims rate discrepancy may be inaccurate, in either direction. It is sometimes suggested that temporary workers, faced with a string of precarious, fixed-term assignments, may have more of an incentive than permanent workers to file for workers' compensation.[11] It is also argued that a lack of monitoring by the temporary agency could contribute both to higher actual injury rates and to increased fraudulent filing for benefits. Insurers may respond to this expectation by improperly denying claims of temporary workers. If temporary workers are more likely than their permanent peers to engage in fraudulent claim filing for non-existent injuries, we would expect to see this activity concentrated among claims for WMSD conditions, such as lower back strains, rather than such readily observable injuries as fractures, cuts or burns. However, we found that the proportion of WMSD claims to total claims is higher for permanent workers than for temporary workers and that the rate ratio of WMSD claims for temporary workers relative to that of permanent workers is lower than that for non-WMSD claims.

Evidence on the issue of whether temporary workers are more or less likely than permanent workers to file claims for injuries is mixed. Shannon et al[25] found temporary workers were not more likely to file a claim than permanent workers, though small numbers of such respondents were a limitation. Riley and Morier[23] found among a cohort of low-wage workers in Los Angeles that economic insecurity and fears of adverse consequences for their ability to obtain work in the future led to significant under-reporting of injuries. That study did not, however, compare temporary employees with direct-hire workers. A study focused on the use of sickness absence benefits by temporary workers found that they are less likely to take such leave than their permanent counterparts.[26] This difference is attributed to their short tenure and, perhaps, to a desire to become permanent employees. Similarly, in field interviews with agency managers and host employers, we found frequent mention of the desire of their temporary workers to become the permanent employees of their clients, a process which frequently occurred after a period of three to 6 months. Such a "temp-to-hire" phenomenon may create incentives to under-report minor injuries to workers' compensation.

It should be noted that this study does not address directly the association between these risk factors and injury rates. Instead, it aims to explore the association between temporary employment and the presence of elevated risk factors for injury such as hazard exposures, poor training or inadequate experience, while controlling for other known predictors of injury such as tenure, age, and gender.

The results of this study are subject to one additional limitation: the experiences of temporary workers who obtain their assignments through temporary agencies may not reflect the experiences faced by workers in other segments of the non-permanent workforce. In particular, day-laborers and seasonal workers, who were not included in this study, may face even higher risks of injury both through exposure to hazards as well as through lack of training or experience.

5 | CONCLUSION

This study combines evidence from Washington State workers' compensation claims with case follow-up interviews of injured temporary and permanent workers to explore the role of several factors found in other studies to be important drivers of injury risk for contingent workers. By taking advantage of the state's unique set of industrial risk classes for temporary work, it allows a direct comparison to be made between agency temporary workers and their permanently employed counterparts in matched permanent risk classes. The matching criteria used to select claimants for interview allows us to compare temporary and permanent workers in a way that disentangles the role of their temporary status from that of their tenure, age, or gender. We do not find evidence that temporary workers are exposed to higher levels of physical hazards. After adjusting for systematic differences in age, gender, education and tenure, we found that temporary workers reported lower hazard exposures than their permanent counterparts. However, we also found that temporary workers were less protected by such countermeasures as experience screening, safety training and schedule control to cope with the hazards they do face.

Our findings suggest policy should pay greater attention to the challenges presented by the growth of temporary work and its diffusion into higher-hazard sectors. Temporary agencies and host employers should devote more resources to improving screening and developing training specifically for assigned tasks. Agencies should develop policies to better monitor safety practices at host employers' worksites; to discourage employers and workers against job-switching or work assignments out of scope; to improve hazard awareness among temporary workers; and to inform temporary workers of their right to report unsafe conditions and to refuse unsafe work without penalty. Host employers should provide a comprehensive description of the tasks and hazards faced by temporary workers to the agency and the worker prior to acceptance of the assignment, and should provide the temporary worker with the same safety training as that provided to new, permanent employees.

Regulators should devote more attention to the temporary work sector as it spreads into higher hazard industries. Recent guidance documents from the Occupational Safety and Health Administration and from the State of California provide examples of policies and practices to address the special challenges of temporary work OSHA.[27,28] Massachusetts has recently promulgated a rule requiring staffing agencies to provide their temporary employees with basic information about job assignments, including a complete job description, required personal protective equipment, training and licensure.[29] This rule also requires the agency to inform the worker if the job tasks are being changed, so that workers may be able to ask for another assignment or acquire additional training. Other policies that should be considered by regulatory bodies include: clarifying the responsibility of host employers to report temporary worker injuries on their OSHA

300 logs, and promoting better hazard communication between host employers, temporary agencies, and temporary workers.

AUTHORS' CONTRIBUTIONS

The author participated in the conception and design of the study and the acquisition, analysis and interpretation of the data for the article. The author drafted the article and approved the final version to be published. The author agrees to be accountable for all aspects of the work's accuracy or integrity.

ACKNOWLEDGMENTS

Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the Department of Health and Human Services. The author thanks Elyette Martin and Christina Rappin for their work in conducting the injured worker interviews. Jennifer Marcum, David Bonauto, and the anonymous reviewers provided many helpful comments on the manuscript.

FUNDING

The research for this publication was supported by Grant Number U60OH008487-10 funded by the National Institute of Occupational Safety and Health-Centers for Disease Control and Prevention. This research was supported by the Washington State Department of Labor and Industries which employs the authors.

ETHICS APPROVAL AND INFORMED CONSENT

Approval of study design, protocols, and survey instruments was obtained from the Washington State Institutional Review Board.

DISCLOSURE (AUTHOR)

We state that this manuscript is original, has been reviewed and approved by all authors, and is not under consideration by another journal.

DISCLOSURE BY AJIM EDITOR OF RECORD

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

DISCLAIMER

The findings and conclusions in this work are solely those of the author and do not necessarily represent the views of the Washington State Department of Labor and Industries.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

How to cite this article: Foley M. Factors underlying observed injury rate differences between temporary workers and permanent peers. *Am J Ind Med*. 2017;60:841–851. https://doi.org/10.1002/ajim.22763