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Injury rates, severity, and drug testing programs in small construction companies

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ABSTRACT

Problem: Construction work is hazardous and workers consistently rank in the top of all occupations and industries for illicit drug and heavy alcohol use. *Methods:* Drug-testing programs were classified into three categories: no program, pre-employment/post-accident, and pre-employment/post-accident/random/suspicion. We analyzed workers' compensation claims from 1,360 construction companies over a six-year period to assess the possible association of testing program with injury rate. *Results:* Compared to no program, results respectively were RR = 0.85 (CI = 0.72–1.0) and RR = 0.97 (CI = 0.86–1.10) for all injuries, and RR = 0.78 (CI = 0.60–1.03) and RR = 1.01 (CI = 0.86–1.19) for lost-time injuries. Variability of results was exhibited across trade and union status, among other categories. *Summary:* Drug-testing programs may be associated with lower, non-significant, injury rates in this population. *Impact on Industry:* Drug-testing programs may be associated with lower injury rates, but care should be exercised to ensure accurate injury reporting, characterize underlying safety practices of a company, and to determine quality and consistency of testing.

1. Introduction

The construction industry is uniquely difficult and challenging to study due to the pace and organization of work and projects. Many physical hazards are present under normal conditions, and the work is often physically demanding and strenuous. Natural conditions and weather also can greatly affect the worksite as well as employee working conditions. This industry has a high rate of fatalities, annually; while it employs about 8% of the workforce, it experiences 22% of the fatalities (National Institute of Occupational Safety and Health (NIOSH), 2009). The construction sector also contributes to a high number of severe and non-fatal injuries (Courtney, Matz, & Webster, 2002; Dement & Lipscomb, 1999). Compared to other industries, employment in the construction industry has also been associated with a higher probability of disability should an injury occur on the job (Stover, Wickizer, Zimmerman, Fulton-Kehoe, & Franklin, 2007). In addition to the direct cost of injuries, there is an emotional and financial toll on injured workers and their families, along with their co-workers, places of employment, and the public (Waehrer, Dong, Miller, Haile, & Men, 2007). This comprehensive cost has been shown to be disproportionately high in construction, almost double the cost, compared to other industries (Waehrer et al., 2007).

Small construction firms dominate the industry but published data pertaining to health and safety are limited. Small business establishments are generally defined as having less than 500 employees (United States Census Bureau, 2009b) or generating less than $7–33.5 million in average annual receipts, depending on construction industry sector (United States Small Business Administration, 2012). Nationally, small firms of fewer than 10 employees make up one fourth of the construction industry; yet, they experience one half of the fatal injuries (National Institute of Occupational Safety and Health (NIOSH), 2009). Small- and medium-sized companies have been shown to be at increased risk, compared to larger companies (Lowery et al., 1998). The US Census in 2007 reported that there were 15,863 employer construction establishments in the state of Minnesota and, in that same year, there were 134,584 employed in this sector (United States Census Bureau, 2009a). This is an average of approximately nine employees per establishment, with slightly less in recent years, indicating that the vast majority of establishments are small businesses, a trend that has not changed. The hazards encountered by small business, non-union and residential sectors are difficult to characterize due to limited information on work, hours, and injury occurrence (Lipscomb, Dement, & Behlman, 2003). Moreover, safety training and education is inconsistent and less likely to be categorized or documented. Non-union contractors lack some of the resources available to large and union contractors, and also do not receive the same amount of health and safety attention on their jobsites (Gillen, Baltz, Gassel, Kirsch, & Vaccaro, 2002). There are few published studies or reports that address both the residential sector and small construction firms.

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In addition to the already high risks posed by the work, pace, and environment, those employed in construction consistently rank in the top of all occupations and industries for illicit drug use and heavy alcohol use, a trend that has not changed in the last ten years (Larson, Eyerman, Foster, & Gfroerer, 2007). The Worker Substance Use and Workplace Policy Report found that prevalence of drug and heavy alcohol use increased as the size of the company decreased (Larson et al., 2007). Companies with fewer than ten employees had the highest past month prevalence of illicit drug use (9.9%), followed by establishments of 25 to 99 employees with a prevalence of 8.2% (Substance Abuse and Mental Health Services Administration (SAMHSA), 2008). The consequences of drug and alcohol use, especially while working in this high-risk occupation, can be costly and severe. Formalized occupational drug testing programs offer a potential mechanism to reduce the impacts of drug and alcohol in this industry. These have gained increasing exposure and acceptance in recent years, and many businesses have developed services to administer and manage drug testing programs for clients. Yet, many companies still have not adopted drug-free workplace polices, and construction companies rank near the bottom for testing employees (Gerber & Yacoubian, 2002). Moreover, small companies are also least likely to have drug testing programs (Gerber & Yacoubian, 2002). There has, however, been little research that evaluates the efficacy of these programs on preventing work-related injuries, specifically, in smaller construction companies and in regard to company and injury characteristics.

The objective of this study was to evaluate the impact of active company drug testing programs on the rates and severity of injuries sustained by workers in small construction firms.

2. Materials and methods

2.1. Population data and collection

Workers' compensation claims were used to examine injuries in employees of construction companies who obtained workers' compensation insurance from The Builders Group (TBG). TBG is a self-insured workers' compensation fund that insures small construction and construction-related businesses within the state of Minnesota. Criteria for acceptance into TBG are based mainly on the company's established financial stability. The study included all companies insured by TBG during the time period 2004–2009.

Person-time at risk for the population was based upon hours at-risk for each company by month. Hours at-risk were estimated from the monthly payroll reports submitted to TBG by each company. Payroll data were audited internally at TBG, and externally, for accuracy. Hours at-risk data were also further broken down on a monthly basis by trade within a company because different work activities are associated with different levels of risk. Company level data were classified by union status and premium size. The premium size, in general, correlates with the number of employees at a company and subsequent payroll, the type of trade/work of employees, and a company's past claims' experience. A company with a poor claim history would have higher premium than a company of similar size and trade with an average or good claim history. Companies of larger premium also tended to receive greater attention, service, and loss prevention from the insurance carrier. To control for potential confounding, companies were divided into three premium bands, $1,000–15 K, $15,001–75 K, and $>75,000 as a surrogate for number of employees, to account for underlying claims' experience among companies of the same size, and to differentiate between attention from the insurer.

2.2. Claims data, collection, and outcomes

Claims data captured all injury and illness events submitted to TBG for compensation. First reports of injury are completed by office personnel or management within an insured company and then submitted to TBG where they are further processed and categorized by a claim manager. All claims were classified as medical-only or lost-time. Minnesota state statutes classify lost-time claims as those involving injuries or illnesses that result in more than three consecutive calendar days of lost work time and include payment of medical, wage loss costs, and impairment. Medical-only claims involve injured or ill workers who receive medical care but have not missed more than three consecutive days of work and result only in the payment of medical costs. Additional information of interest on the nature of the claims included mechanisms of injury, types of injury, and cost of injury claim. The mechanism of injury, type of injury, and cost of injury claim were collapsed from the original data into fewer categories containing similar groups and descriptions for more robust analyses.

2.3. Drug testing program classification

Presence of a drug testing program was obtained from the compensation carrier, as reported by the insured, and verified by the carrier and internal carrier loss control department. Drug testing programs included: pre-employment; post-accident; random; and reasonable suspicion. Pre-employment testing occurs prior to a prospective employee starting the job. Post-accident testing occurs after an employee is injured, injures another employee, or sometimes even after a pre-set value of equipment or materials are damaged in a workplace incident. Random testing occurs in pre-set internals (monthly, quarterly, etc.) with a pre-set percentage of the safety-sensitive population of a company. Reasonable suspicion testing may occur if a trained supervisor is a first hand witness or detects evidence of drug or alcohol use or suspects the employee is under the influence. Those companies participating in testing programs were categorized as pre-employment/post-accident programs (n = 67 companies, 11,649,512 hours) or participation in all four testing programs combined (n = 207 companies, 25,673, 201 hours) versus no testing program (n = 1,084, 148,486,239 hours). The insurance carrier made a distinction between testing programs and categorized companies accordingly because participation in all four types of testing is usually more management-intensive, higher in cost, and also associated with targeting a wider spectrum of potential drug users within the company. The insurance carrier provided a premium discount for companies with testing programs. The data were collected by the carrier in this manner, thus there was no other way to separate the programs. Enough data and power were present that is was decided to keep the two separated.

2.4. Analysis

The claims and payroll data were used to estimate rates for overall injuries, lost-time injuries, medical-only injuries, and by mechanism of injury, type of injury, and cost of injury. Overall, lost-time, and medical claims analyses were further stratified by trade and union status. The effects of the different drug testing programs were evaluated by estimating rate ratios (RR) and 95% confidence intervals (CI) as a function of injury rate, using a Poisson regression model and accounting for time-dependent factors (Haenszel, Loveland, & Sirken, 1962). The hours at-risk of companies that transitioned from no testing to a drug testing program during the study time period were changed at month of the switch to the new categorization. Generalized estimating equations with an auto-regressive correlation structure were used to account for correlated observations within companies over time (Liang & Zeger, 1986). Overall claims, lost-time, and medical claims models included confounding covariates of company premium size, union status, and trade. Mechanism of injury, type of injury, and total claim dollar models include confounding covariates of company premium size and union status. All analyses were done using SAS (2011).

3. Results

During the study period, 1,360 companies compiled 185,808,952 hours of employee time at risk, representing approximately 92,882 full time equivalent employees (FTE) and 9,986 workers' compensation claims for an average claim rate of 10.54 per 100 FTE. Total incurred cost of claims during this period was $90,416,073. Companies ranged in size from one to one hundred employees. Companies that participated in any type of drug testing accounted for 20% of the companies and 20% of hours represented in the study. Claim rates varied among trade categories, and union companies and companies of larger premium size had higher injury rates (Table 1).

Compared to no testing, results for pre-employment/post-accident only or all four testing types of testing combined were, respectively: RR = 0.85 (CI = 0.72–1.0) and RR = 0.97 (CI = 0.86–1.10) for overall claims. RR = 0.79 (CI = 0.60–1.03) and RR = 1.02 (CI = 0.87–1.19) for lost time claims. RR = 0.86 (CI = 0.73–1.02) and RR = 0.96 (CI = 0.84–1.10) for medical-only claims. In all categories of claims, lower injury rates were observed with the pre-employment/post-accident testing programs as compared to no testing program (Table 2).

Analysis by specific trades revealed significantly lower rates of injury associated with drug testing programs in five of twenty-one trade categories including interior carpentry, heating/ventilation/air-conditioning (HVAC) and plumbing, flooring installation and flatwork, painting, and concrete and masonry. Flooring installation and flatwork exhibited lower rates with both pre-employment/post-accident and all four types of testing programs, but other trades had lower rates in only one testing category or the other, not both (Table 3). Other trades exhibited lower rates that were non-significant, no change in rate, or even higher rates of injury with use of a drug testing program. Upon further trade specific analysis of injuries that resulted in a lost-time injury, only flooring installation and flatwork and concrete and masonry had significantly lower rates with testing programs. Again, other trades exhibited lower rates that were non-significant, showed no change in rate, or even higher rates of injury with use of a drug testing program. Data were too sparse in some trades to complete a meaningful analysis (Table 4).

Upon stratification by union status, union companies had lower overall claim rates RR = 0.86 (CI = 0.72–1.02) and lost time injury RR = 0.80 (CI = 0.63–1.01) rates with the all four-type Pre/Post/Random/Reason program combination, although non-significant. Non-union companies had non-significant overall lower injury rate with the pre-employment/post-accident testing programs (RR = 0.85, CI = 0.69–1.03), but not with lost-time injuries. Neither union nor non-union companies illustrated significantly lower injury rate in medical-only claims with either type of testing program (Table 5).

Of the twenty mechanisms of injury categories for this population, eight categories exhibited significantly lower rates with some type of drug testing program. The use of pre-employment/post-accident drug testing programs were associated with lower risk for strains (RR = 0.62, CI = 0.47–0.81), general slips, trips, and falls (RR = 0.70, CI = 0.50–0.96), struck by/flying objects (RR = 0.63, CI = 0.42–0.97), cumulative/repetitive trauma (RR = 0.32, CI = 0.19–0.53), and slips, trips, and falls from the same level (RR = 0.24, CI = 0.07–0.89). Use of all four types of drug testing programs were associated with lower risk for strains, not otherwise classified (RR = 0.79, CI = 0.62–1.00), powered and hand tools (RR = 0.65, CI = 0.47–0.88), and falls from ladders and scaffolding (RR = 0.49, CI = 0.31–0.76).

Drug testing programs illustrated lower rates in five out of twenty-five major injury types experienced by this population. Pre-employment/post-accident testing was associated with lower risk for following injury types: strains/sprains (RR = 0.73, CI = 0.59–0.91); bruises and contusions (RR = 0.45, CI = 0.27–0.75); foreign object in eye (RR = 0.69, CI = 0.45–1.04); penetration injuries (RR = 0.57, CI = 0.37–0.88); and dislocations (RR = 0.56, CI = 0.34–0.91). The combination of all four types of testing programs was also associated with reduced risk, although to a lesser degree: of strains/sprains (RR = 0.91, CI = 0.79–1.05); bruises and contusions (RR = 0.74, CI = 0.59–0.94); and penetration injuries (RR = 0.61, CI = 0.40–0.93).

Drug testing in the pre-employment/post-accident category was associated with lower injury rates within the lower total claim dollar amount categories. Lower injury rates occurred with >=$0 to <$1,000 (RR = 0.71, CI = 0.58–0.85), >=$1,000 to <$5,000 (RR = 0.69, CI = 0.54–0.88), and >=$10,000 to <$25,000 (RR = 0.68, CI = 0.45–1.03). No difference was seen for either category of drug testing in >=$5,000 to <$10,000, >=$25,000 to <$50,000, >=$50,000 and <$100,000 and >=$100,000.

4. Discussion

Through this analysis we observed that companies using drug testing programs generally exhibited lower, although often non-significant, injury rates than companies not using drug testing programs. The results vary by trade, union status, and type of testing program. Results also vary based upon the mechanism of injury, the type of injury, and the total dollar amount incurred on the injury claim.

Several potential limitations should be considered when interpreting the data. It is possible that not all injuries incurred during employment are captured by workers' compensation systems. Underreporting of injuries by employees or companies, for any reason, can confound results if it is occurs in a non-random manner and makes valid comparisons between groups difficult. The effect of this underreporting, however, is likely lower in TBG companies because TBG actively trains company owners and employees on the importance of reporting all injuries, as well as describing the consequences of non-reporting. TBG also collects information on all claims filed as "incident-only" claims, which do not end up having any medical or lost-time paid, but are a recordkeeping method. This aids a more complete capture of injury events.

In addition to the concern of injury underreporting in general, it is conceivable the employees' perceptions of possible consequences from being injured and potentially testing positive for drug or alcohol use may negatively influence injury reporting in companies with drug testing programs. Thus, the observation of lower injury rates in companies with drug testing programs could be due to reduced injury claims reporting, and not actual reduction in injury occurrence. However, Minnesota drug testing statutes (Minnesota Reliability and Fairness Safeguards, 2010) states that an employee cannot be fired nor can their workers' compensation claim be denied based on a positive drug test. The employer must offer the employee the chance to seek evaluation and treatment if they test positive while on the job. Only if an employee refuses, or does not follow and complete the prescribed treatment, can they then be terminated. Never the less, it is still possible that this could reduce reporting of claims in companies with drug testing programs because employees are not aware of the state statutes or still fear discipline and termination regardless of the statutes. They may also fear, in the event of termination, having to take a drug test to be hired elsewhere and being unable to find new employment.

Generalizability of our results is also a consideration. This analysis is limited to one workers' compensation insurer in one state. TBG is the largest insurer of construction companies in Minnesota and covers a substantial proportion of the small construction firms that work in the full spectrum of construction trades and types of building projects. While construction practices may vary regionally, overall the work methods and procedures done by this cohort of companies are very similar to operations nationwide.

The limitations of this analysis were offset by several unique strengths of this study. The data used for this study provide a more complete picture than workers' compensation data alone, with comprehensive information on the population at risk, injury and illness claims, and company policies pertaining to drug testing as a risk-reduction method. This data resource is unique in that data are available that characterize company practices

Table 1
Overall, Lost-Time, and Medical Claims and Claim Rates[†] by Trade, Union Status, and Premium Size.

Exposed	Overall Claims (n)	Overall Rates	Lost-Time Claims (n)	Lost-Time Rates	Medical Claims (n)	Medical Rates
Total Population	9,986	10.54	2,292	2.46	7,693	8.15
Trade						
Rough Carpentry	1,835	24.32	452	6.00	1,382	18.32
Interior Carpentry	336	20.53	77	4.79	259	15.92
Supervisors	259	5.31	60	1.24	199	4.09
Crane Operators	33	9.75	11	3.26	22	6.50
Sales and Retail	158	0.54	22	0.08	136	0.47
Shop, Yard, and Deliveries	1,240	7.56	238	1.46	1,002	6.11
Drywall	601	16.71	173	4.81	428	11.90
HVAC and Plumbing	1,304	26.22	259	5.21	1,045	21.02
Auto Repair	50	13.49	11	2.97	39	10.52
Roofing	94	31.12	27	8.95	67	22.21
Manufacturing	606	19.00	85	2.67	521	16.35
Flooring Installation and Flatwork	441	24.05	123	6.72	318	17.35
Trucking	19	7.82	5	2.06	14	5.76
Electric Installation	271	14.22	48	2.52	223	11.70
Painting	437	14.61	104	3.48	333	11.14
Concrete and Masonry	1,107	14.39	334	4.38	773	10.07
Iron and Steel	274	82.79	58	17.62	216	65.34
Roadwork and Equipment Operators	310	11.22	89	3.24	221	8.01
Garbage and Recycling	155	12.42	33	2.65	122	9.79
Nursery and Landscaping	287	23.96	54	4.53	233	19.46
Equipment Installation and Assembly	169	21.11	29	3.66	140	17.56
Union Status						
Non-Union	5,920	9.83	1,272	2.13	4,647	7.73
Union	4,066	11.86	1,020	3.07	3,046	8.94
Premium Size Classification						
$0–15K	788	7.23	198	1.83	590	5.42
$15,001–75K	4,226	9.49	940	2.13	3,285	7.40
$>75,001	4,972	12.76	1,154	3.02	3,818	9.83

[†] Rate per 100 FTE (200,000 hours).

prior to the injury events, and also through time, to track changes. The data capture small construction companies, including all companies insured by TBG so no survey or response methods are needed, and are detailed enough to be able to break down types of drug testing programs into distinct groups. The availability of company characteristics such as trade, union status, premium size, and additional injury descriptors provided a robust analysis.

There are multiple considerations when examining the effectiveness of a program or type of testing. The timeframe from implementation of a drug-testing program to the achievement of desired results may be highly varied and may be dependent on types of testing programs, number of new hires, and percentage of employees being tested randomly. The quality and consistency of testing could vary from company to company and obtaining more detailed data on how programs are administered would allow analysis on the effect difference would have on injury reduction. For some companies, there may be multiple issues creating injury problems; thus, a drug testing program may be just one option in a multifaceted approach to mitigate or reduce injuries, and may not be a quick fix to solve all injury problems. If the program is implemented specifically to target certain employees or groups of employees, the program may have inadequate ability to access target employees if they are already hired. This could happen when a problem individual is never picked at random for a test, does not act in a suspicious enough manners to be called out for testing, and/or escapes involvement in an accident/incident that triggers testing, yet continues to work under the influence.

Of note, the observed injury rates associated with drug testing were inconsistent across the types of testing programs. Lower rates were more often associated with the pre-employment and post-accident testing combination only, but not as frequently with all four types of testing. It would seem counterintuitive that fewer types of testing (pre-employment/post-accident only programs versus using all four types of testing programs) would result in lower rates of injury more often. There may be some underlying, unmeasured differences between groups that would pick one type of drug testing program over another and a possible explanation for some of these situations could be that an employer having a high amount of injuries, personnel, and/or safety issues may be more likely to implement all four types of testing to try to solve the issues; however, the drug testing alone may not be sufficient to combat the issues and injury rates do not decline. An alternate theory is those companies conducting all four types of testing simply are more organized, sophisticated, or have more safety programs in place and have lower risk of injury, thus, acquire less direct benefit from testing.

Lower risk of injury when utilizing some type of drug testing program occurred for some mechanism of injury categories and injury type categories that are of major concern for the construction population. This was especially notable for the mechanism of injury categories of strains, general slips, trips, and falls, cumulative/repetitive trauma injury, slips, trips, and falls from the same level, and falls from ladders and scaffolding. Besides occurring frequently in the population, all of these have the potential for severe or disabling injury, lost work time, and high claim costs. Falls are of particular concern in the

Table 2
Risk of Injury by Claim Type and Drug Testing Program.

	Testing Program	Hours	Claims	RR[†]	95% CI
Total	No Program	148,486,239	8,035	1.00	.
	Pre/Post	11,649,512	531	0.85	0.72–1.0
	Pre/Post/Random/Reasonable	25,673,201	1,420	0.97	0.86–1.10
Lost	No Program	148,486,239	1,844	1.00	.
Time	Pre/Post	11,649,512	118	0.79	0.60–1.03
	Pre/Post/Random/Reasonable	25,673,201	330	1.02	0.87–1.19
Medical	No Program	148,486,239	6,190	1.00	.
	Pre/Post	11,649,512	413	0.86	0.73–1.02
	Pre/Post/Random/Reasonable	25,673,201	1,090	0.96	0.84–1.10

[†] Controlling for Trade, Union Status, and Premium Size.

Table 3
Risk of Overall Injuries by Drug Testing Program and Trade.

Trade	Testing Program	Hours	Claims (n)	RR†	95% CI
Rough Carpentry	No Program	13,375,077	1,624	1.00	.
	Pre-Employment/Post-Accident	507,843	63	0.96	0.70–1.33
	Pre/Post/Random/Reason	1,193,401	148	0.94	0.65–1.36
Interior Carpentry	No Program	2,519,330	277	1.00	.
	Pre-Employment/Post-Accident	335,753	19	0.51	0.28–0.95
	Pre/Post/Random/Reason	357,853	40	1.00	0.66–1.52
Supervisors	No Program	7,725,836	176	1.00	.
	Pre-Employment/Post-Accident	421,446	18	1.83	0.96–3.46
	Pre/Post/Random/Reason	1,542,853	65	1.98	1.29–3.03
‡Crane Operators	No Program	346,022	21	1.00	.
	Pre-Employment/Post-Accident	182	0	1.00	.
	Pre/Post/Random/Reason	329,711	12	1.00	.
Sales and Retail	No Program	46,944,257	137	1.00	.
	Pre-Employment/Post-Accident	3,717,600	6	0.58	0.23–1.41
	Pre/Post/Random/Reason	7,156,884	15	0.79	0.45–1.38
Shop, yard, and Deliveries	No Program	26,226,549	976	1.00	.
	Pre-Employment/Post-Accident	1,667,846	57	0.93	0.53–1.61
	Pre/Post/Random/Reason	4,814,739	207	1.09	0.83–1.43
Drywall	No Program	6,044,573	516	1.00	.
	Pre-Employment/Post-Accident	610,836	47	0.77	0.54–1.10
	Pre/Post/Random/Reason	535,778	38	0.87	0.56–1.35
HVAC and Plumbing	No Program	8,079,458	1,089	1.00	.
	Pre-Employment/Post-Accident	560,109	92	1.21	0.99–1.48
	Pre/Post/Random/Reason	1,302,241	123	0.69	0.53–0.90
Auto Repair	No Program	464,159	34	1.00	.
	Pre-Employment/Post-Accident	100,023	4	0.85	0.50–1.43
	Pre/Post/Random/Reason	175,654	12	0.98	0.41–2.33
Roofing	No Program	544,192	81	1.00	.
	Pre-Employment/Post-Accident	20,634	9	1.00	.
	Pre/Post/Random/Reason	38,423	4	1.00	.
Manufacturing	No Program	4,744,171	412	1.00	.
	Pre-Employment/Post-Accident	133,399	9	0.79	0.31–2.05
	Pre/Post/Random/Reason	1,478,566	185	1.23	0.78–1.95
Flooring Installation and Flatwork	No Program	2,765,899	361	1.00	.
	Pre-Employment/Post-Accident	131,273	9	0.40	0.22–0.72
	Pre/Post/Random/Reason	762,373	71	0.46	0.27–0.77
‡Trucking	No Program	311,875	6	1.00	.
	Pre-Employment/Post-Accident	.	.	.	.
	Pre/Post/Random/Reason	174,537	13	7.23	0.86–5.27
Electric Installation	No Program	3,242,309	234	1.00	.
	Pre-Employment/Post-Accident	228,718	15	1.08	0.80–1.46
	Pre/Post/Random/Reason	337,082	22	0.95	0.54–1.69
Painting	No Program	4,757,715	354	1.00	.
	Pre-Employment/Post-Accident	629,966	36	0.73	0.59–0.90
	Pre/Post/Random/Reason	592,976	47	1.01	0.66–1.55
Concrete and Masonry	No Program	11,640,161	897	1.00	.
	Pre-Employment/Post-Accident	1,510,854	73	0.59	0.40–0.86
	Pre/Post/Random/Reason	2,093,159	137	0.84	0.62–1.14
‡Iron and Steel	No Program	536,480	169	1.00	.
	Pre-Employment/Post-Accident	.	.	.	.
	Pre/Post/Random/Reason	121,692	105	0.63	0.19–2.05
Roadwork and Equipment Operators	No Program	3,604,441	212	1.00	.
	Pre-Employment/Post-Accident	760,879	32	0.59	0.35–1.01
	Pre/Post/Random/Reason	1,133,121	66	1.00	0.65–1.55
Garbage and Recycling	No Program	1,787,875	116	1.00	.
	Pre-Employment/Post-Accident	92,600	6	0.67	0.43–1.04
	Pre/Post/Random/Reason	606,078	33	0.88	0.56–1.39
Nursery and Landscaping	No Program	1,942,568	242	1.00	.
	Pre-Employment/Post-Accident	24,237	2	0.89	0.26–3.05
	Pre/Post/Random/Reason	419,060	43	0.91	0.47–1.76
Equipment installation and Assembly	No Program	883,292	101	1.00	.
	Pre-Employment/Post-Accident	195,315	34	1.39	0.70–2.78
	Pre/Post/Random/Reason	507,022	34	0.63	0.29–1.36

† Controlling for company premium size and union status.
‡ All hours at-risk in No Program or All Four Drug Testing Programs.

construction industry, and strain and cumulative trauma injuries are a major issue for an aging American workforce.

When examining total claim value, drug-testing programs were associated with lower rates of injury (all around 30%) in two of the lower dollar value categories, and one low to mid-level dollar category. Assuming injury reporting is being done consistently, reducing rates in the $10,000–$25,000 category is notable because those injuries involve more complex medical care and are severe enough to create lost time from work for the injured employee.

There were some instances where a testing program was associated with higher rates of injury within a trade category. This could be a case of an employer implementing a program because they had a underlying injury and safety issue within a company that they were trying to mitigate with a drug testing program, and the program did

Table 4
Risk of Injuries Resulting in Lost Work-Time by Drug Testing Program and Trade.

Trade	Testing Program	Hours	Claims (n)	RR[†]	95% CI
Rough Carpentry	No Program	13,375,077	402	1.00	.
	Pre-Employment/Post-Accident	507,843	15	0.97	0.59–1.58
	Pre/Post/Random/Reason	1,193,401	35	0.87	0.51–1.49
Interior Carpentry	No Program	2,519,330	63	1.00	.
	Pre-Employment/Post-Accident	335,753	5	0.53	0.22–1.27
	Pre/Post/Random/Reason	357,853	9	1.06	0.47–2.38
Supervisors	No Program	7,725,836	41	1.00	.
	Pre-Employment/Post-Accident	421,446	4	1.65	0.59–4.59
	Pre/Post/Random/Reason	1,542,853	15	1.89	0.92–3.86
[‡]Crane Operators	No Program	346,022	7	1.00	.
	Pre-Employment/Post-Accident	182	0	1.00	.
	Pre/Post/Random/Reason	329,711	4	1.00	.
[‡]Sales and Retail	No Program	46,944,257	19	1.00	.
	Pre-Employment/Post-Accident	3,717,600	0	1.00	.
	Pre/Post/Random/Reason	7,156,884	3	1.00	.
Shop, yard, and Deliveries	No Program	26,226,549	186	1.00	.
	Pre-Employment/Post-Accident	1,667,846	13	1.14	0.58–2.25
	Pre/Post/Random/Reason	4,814,739	39	1.10	0.70–1.74
Drywall	No Program	6,044,573	143	1.00	.
	Pre-Employment/Post-Accident	610,836	16	0.90	0.49–1.65
	Pre/Post/Random/Reason	535,778	14	1.16	0.43–3.15
HVAC and Plumbing	No Program	8,079,458	210	1.00	.
	Pre-Employment/Post-Accident	560,109	18	1.26	0.66–2.40
	Pre/Post/Random/Reason	1,302,241	31	0.91	0.57–1.45
[‡]Auto Repair	No Program	464,159	8	1.00	.
	Pre-Employment/Post-Accident	100,023	0	1.00	.
	Pre/Post/Random/Reason	175,654	3	1.00	.
[‡]Roofing	No Program	544,192	23	1.00	.
	Pre-Employment/Post-Accident	20,634	2	1.00	.
	Pre/Post/Random/Reason	38,423	2	1.00	.
[‡]Manufacturing	No Program	4,744,171	58	1.00	.
	Pre-Employment/Post-Accident	133,399	0	1.00	.
	Pre/Post/Random/Reason	1,478,566	27	1.00	.
Flooring Installation and Flatwork	No Program	2,765,899	94	1.00	.
	Pre-Employment/Post-Accident	131,273	3	0.59	0.42–0.83
	Pre/Post/Random/Reason	762,373	26	0.81	0.56–1.18
[‡]Trucking	No Program	311,875	1	1.00	.
	Pre-Employment/Post-Accident	.	.	.	.
	Pre/Post/Random/Reason	174,537	4	1.00	.
Electric Installation	No Program	3,242,309	44	1.00	.
	Pre-Employment/Post-Accident	228,718	1	0.41	0.04–4.12
	Pre/Post/Random/Reason	337,082	3	0.70	0.39–1.25
Painting	No Program	4,757,715	83	1.00	.
	Pre-Employment/Post-Accident	629,966	6	0.62	0.29–1.30
	Pre/Post/Random/Reason	592,976	15	1.38	0.91–2.08
Concrete and Masonry	No Program	11,640,161	283	1.00	.
	Pre-Employment/Post-Accident	1,510,854	20	0.30	0.10–0.90
	Pre/Post/Random/Reason	2,093,159	31	0.60	0.37–0.97
[‡]Iron and Steel	No Program	536,480	38	1.00	.
	Pre-Employment/Post-Accident	.	.	.	.
	Pre/Post/Random/Reason	121,692	20	1.00	.
Roadwork and Equipment Operators	No Program	3,604,441	61	1.00	.
	Pre-Employment/Post-Accident	760,879	9	0.60	0.24–1.54
	Pre/Post/Random/Reason	1,133,121	19	1.01	0.50–2.03
Garbage and Recycling	No Program	1,787,875	22	1.00	.
	Pre-Employment/Post-Accident	92,600	1	0.55	0.11–2.84
	Pre/Post/Random/Reason	606,078	10	1.41	0.80–2.51
[‡]Nursery and Landscaping	No Program	1,942,568	42	1.00	.
	Pre-Employment/Post-Accident	24,237	0	1.00	.
	Pre/Post/Random/Reason	419,060	12	1.00	.
Equipment installation and Assembly	No Program	883,292	16	1.00	.
	Pre-Employment/Post-Accident	195,315	5	1.74	0.65–4.69
	Pre/Post/Random/Reason	507,022	8	0.96	0.26–3.49

[†] Controlling for company premium size and union status.
[‡] Not enough data for analysis.

not have the ability to target and resolve the problem during the course of the study time period.

The lower rates of injury that were exhibited in parts of this research agreed with reports of others in that drug testing programs appeared to be associated with reduced injury rates and/or risk, although non-significant. A study that showed a particularly strong association between drug testing programs and injury reduction examined only the construction industry; experience modification rates of companies' pre-drug testing implementation and post-implementation injuries were compared, and it showed the average company dropped its injury incidence rate by 51% within two years of implementation of drug testing (Gerber & Yacoubian, 2002). In a study of workers' compensation data from Washington State, injury rates were monitored over a seven-year period between firms enrolled in a drug-testing program and those not

Table 5
Risk of Injury Claims by Drug Testing Program and Union Status.

Claim Type	Union Status	Testing Program	Hours	Claim (n)	RR[†]	95% CI
Total	Non-Union	No Program	99,121,824	4,933	1.00	.
		Pre-Employment/Post-Accident	6,569,471	285	0.85	0.69–1.03
		Pre/Post/Random/Reasonable	13,689,150	702	0.99	0.86–1.14
	Union	No Program	49,364,415	3,102	1.00	.
		Pre-Employment/Post-Accident	5,080,041	246	0.82	0.64–1.06
		Pre/Post/Random/Reasonable	11,984,051	718	0.86	0.72–1.02
Lost-Time	Non-Union	No Program	99,121,824	1,043	1.00	.
		Pre-Employment/Post-Accident	6,569,471	58	0.85	0.63–1.14
		Pre/Post/Random/Reasonable	13,689,150	171	1.21	0.97–1.5
	Union	No Program	49,364,415	801	1.00	.
		Pre-Employment/Post-Accident	5,080,041	60	0.69	0.44–1.07
		Pre/Post/Random/Reasonable	11,984,051	159	0.80	0.63–1.01
Medical	Non-Union	No Program	99,121,824	3889	1.00	.
		Pre-Employment/Post-Accident	6,569,471	227	0.87	0.70–1.07
		Pre/Post/Random/Reasonable	13,689,150	531	0.95	0.82–1.09
	Union	No Program	49,364,415	2301	1.00	.
		Pre-Employment/Post-Accident	5,080,041	186	0.88	0.70–1.11
		Pre/Post/Random/Reasonable	11,984,051	559	0.87	0.71–1.07

[†] Controlling for trade and company premium size.

enrolled in a drug testing program. The results showed a significant decrease in injury rates for three industry groups, including construction. Construction had the largest observed change in the injury rates, a difference of 4.78 injuries per 100 person-years (Wickizer, Kopjar, Franklin, & Joesch, 2004).

5. Summary

Drug testing programs may result in lower injury rates in small construction firms, including those for more severe, lost-time claims, in high-risk trades, and for frequent and major contributors to injury. However, results were inconsistent across categories and drug testing programs. Although many observed rates were lower, they were often non-significant or only border-line significant. Variations in a drug testing program's effect and magnitude are based upon multiple factors. Underreporting is a concern whenever workers' compensation data is utilized, and there was the additional potential for reduced injury reporting due to fear of testing and. Underlying, unmeasured differences in the baseline safety level of companies the population must be considered.

6. Impact on industry

Identifying practical methods to prevent injuries in an underrepresented population is an important goal in construction safety research. Focusing on modifiable characteristics, such as a drug-testing program, is key to translating research findings into actionable practices in the construction industry for both small and large contractors. Companies using drug testing programs exhibited lower rates of injury in many categories, but results were modest and were not consistent across trades or types of programs. Care should be taken to ensure that testing programs do not promote non-reporting of injuries as the mechanism to produce workers' compensation results. The underlying safety level and drug testing program administration quality and consistency of a company using a drug testing program should also be taken into consideration.

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