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The Impact of a State-Based Workers' Compensation Insurer's Risk Control Services on Employer Claim Frequency and Cost Rates

Steven J. Wurzelbacher, PhD, Stephen J. Bertke, PhD, Michael P. Lampl, MS, P. Timothy Bushnell, PhD, MPA, David C. Robins, AAS, Steven J. Naber, PhD, and Libby L. Moore, PhD

Objective: This study evaluated the impact of a state workers' compensation (WC) insurer's onsite risk control (RC) services on insured employers' WC claim frequency and cost. **Methods:** We used two methods to model 2004 to 2017 claims data from 4606 employers that received RC visits over time and compare this claims experience to matching employers that did not receive RC services. **Results:** Relative total WC claim rates increased slightly after RC services, while relative lost-time claims rates either remained similar or decreased and WC cost rates decreased. The impact of RC services on reducing WC costs was cumulative up to the fourth visit but diminished thereafter. **Conclusions:** The insurer RC consultation program was effective in reducing WC cost rates for serviced employers. This is consistent with other research conducted on insurer RC services and related regulatory visits.

Keywords: consultation, enforcement, ergonomics, loss control, prevention effectiveness, risk control, safety, workers' compensation

In 2018, workers' compensation (WC) insurance covered over 142 million United States (US) workers at a total cost of \$98.6 billion to employers. Total benefits paid in 2018 were \$62.9 billion, including \$31.3 billion in payments to medical providers, and \$31.6 billion in benefits to workers.¹ WC insurer systems provide risk control (RC) services such as safety, ergonomic and industrial hygiene (IH) consulting.²⁻⁶ Several WC insurers also offer programs to provide insured employers funds to implement engineering controls and other prevention activities.^{5,7,8}

From the National Institute for Occupational Safety and Health, Cincinnati, Ohio (Dr Wurzelbacher, Dr Bertke, Dr Bushnell, and Dr Moore); Ohio Bureau of Workers' Compensation, Columbus, Ohio (Mr Lampl, Mr Robins, and Dr Naber). This research was supported by intramural National Institute for Occupational Safety and Health (NIOSH) funds. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Ethical Considerations and Disclosure(s): This work was performed at both the National Institute for Occupational Safety and Health (NIOSH) and the Ohio Bureau of Workers' Compensation. This study was internally reviewed by NIOSH and it was determined that it did not constitute human subjects research. Rather, the study involved the analysis of coded and previously-collected WC administrative claims data.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official positions of the National Institute for Occupational Safety and Health nor the Ohio Bureau of Workers' Compensation.

The authors report no conflicts of interest.

Clinical Significance: This study demonstrated that insurer onsite risk control (RC) consultation services can control or reduce workers' compensation lost-time claim frequency and costs for serviced employers. Insurers and occupational clinicians can further collaborate to improve workplace conditions through injury prevention, accommodation and post-injury stay-at-work or return-to-work programs.

Address correspondence to: Steven J. Wurzelbacher, PhD, National Institute for Occupational Safety and Health (NIOSH), 1090 Tusculum Ave, MS R-14, Cincinnati, OH 45226-1998 (Sr3@cdc.gov).

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Insurer RC consulting services range in the mode of implementation from remote consultation (via email, phone or video calls) to onsite risk assessment walkthroughs and training. Such onsite services may include detailed video-based safety/ergonomic job analyses, IH air/noise sampling, and physical hazard assessments. These services are provided for a number of reasons that vary depending on the type of insurer. Reasons include assessing risks to issue recommendations for eliminating workplace hazards and/or audit compliance for underwriting purposes to determine whether the client should be insured in the future.^{2,4} Services are also conducted to demonstrate the insurer's value for retention of current clients and marketing purposes for future clients. A dozen states also require that WC insurers provide RC services, usually at no additional cost beyond the insurance premium.⁵ Typical estimates of RC services are expressed as a percentage of written premium, with the general industry averaging 1% to 3% of premium per year.^{9,10}

The nature, quality, and quantity of RC services vary depending upon the insurer, the needs of the employer and the type of WC insurance policy.^{3,11-13} Some states (such as AR, MO, and TX) require insurers to document the professional certification of RC staff and the extent of services provided.^{4,5} Many insurers employ general safety consultants as well as specialists in ergonomics and IH. For example, Shockey et al (2018) surveyed all state-based WC insurers and a convenience sample of some of the largest WC private insurers regarding IH practices and staffing.³ All of the responding private insurers (50% response rate) and the majority of the state-based insurers (58% response rate) offered IH services to policy-holders and employed typically one to three certified industrial hygienists.

Most insurers provide onsite RC services only to some of their clients within a given year.^{5,6} The proportion receiving services depends on the size of the RC insurer staff and number of insured clients. According to a 2013 industry survey, insurers provided RC visits to 13% of large insurance clients annually, but this varied by industry group (eg, Manufacturing = 32%, Construction = 16%, Agriculture = 4%).¹⁴ The mean number of visits per year per field service consultant for insurers offering only WC coverage was 384, and the typical onsite visit lasted 2 hours. A more recent industry survey indicated that participating insurers employed an average of 4.7 full time RC staff per \$100M of direct premium written, which was a 10% decline from 2011.¹⁵ RC staff provided 59 visits per 1000 accounts overall and consultants conducted an average of 7 visits per week.

Insurers typically prioritize accounts for services based on certain criteria, such as employer size, premium amount, industry and employer loss history.^{2,4} Smaller employers below certain premium thresholds are often serviced through online training services, but they may receive visits upon request.⁴ The type of insurance policy also influences the frequency of RC services. Employers may be more likely to request services when they have a high-deductible policy (where the employer first pays up to a specified amount) or a dividend policy (where the employer can receive discounts based on performance).⁵

Insurer RC services are a main way that many employers are contacted by external third parties for safety/health purposes. These

RC services may help to augment compliance activities of regulators such as the US Occupational Safety and Health Administration (OSHA).^{16,17} Insurer RC staff were actually among the first consultants to provide safety services when the WC system was developed in the early 1900s in the US. For example, Travelers Insurance employed 220 inspectors who performed 235,000 inspections in 1915 alone.¹⁸ By 2001, it was estimated there were 7500 RC consultants in the US.¹⁶

In contrast, OSHA began inspections and external consultations to help smaller employers in the 1970s. OSHA programs are administered by the federal government (21 states), state government (24 states) or a combination of state and federal government (5 states). In FY 2019, federal OSHA conducted 33,393 inspections, 55% of which were unprogrammed inspections (based on employee complaints, injuries/fatalities, and referrals) and 45% were programmed, focused on higher-hazard industries.¹⁹ In addition, OSHA's On-Site Consultation Program, conducts approximately 26,000 visits annually.¹⁹ This means that less than 2% of establishments in these states received OSHA inspections or consultation visits.²⁰ Although many employers may never receive an OSHA visit, they may have regular contact with their insurer RC staff. As such, RC services staff are important intermediaries to reach employers, especially small businesses.²¹

Although WC insurers as a group are among the largest and longest-standing providers of third-party safety/health related services in the US, relatively few studies have been conducted to determine effectiveness of these services.^{22,23} There is some evidence that WC insurer-supported intervention engineering controls programs reduce WC claim frequency and cost^{8,24,25} and reported employee symptoms²⁶ and that WC insurer health risk management programs can improve employee health and productivity.²⁷ There is also some evidence from a small number of studies that WC insurer RC onsite consultative services can reduce future WC claim frequency and costs^{12,22,28-30} and that states with required RC insurer services have lower injury rates.²³ There are also a few related studies that have investigated the effectiveness of OSHA compliance and consultation visits³¹⁻³⁸ that have found such activities can reduce future workplace injuries and illnesses.

Given the considerable scale and scope of insurer RC consultation services, there is still a need to conduct additional research to evaluate effectiveness. This will assist insurers in developing programs that can increase impact in an efficient manner and increase understanding of how insurer RC and regulatory visits can work in tandem to reduce injuries and illnesses.

METHODS

The Ohio Bureau of Workers' Compensation (OHBWC) Consultation Program

OHBWC is the largest of four exclusive state-run WC systems in the US and provides WC insurance for approximately two-thirds of Ohio workers. OHBWC offers a number of prevention programs, training resources and onsite consultation services. Programs cover a wide range and include employer safety councils, industry specific safety programs, drug free safety programs and funded intervention programs. For example, since 1999 OHBWC has provided over \$100 million in matching funds to insured employers to implement occupational safety/health (OSH) engineering controls and measure effectiveness as part of the Safety Intervention Grant (SIG). OHBWC and the National Institute for Occupational Safety and Health (NIOSH) formed a partnership in 2010 with an overall aim to improve the safety and health of Ohio workers. One of the main specific goals was to evaluate the effectiveness of OHBWC prevention programs. This started with the SIG-related analyses and now is focused on other overall programs, including onsite RC consultations.

Onsite consultation services for safety, IH and ergonomics is one of the most popular OHBWC programs. From 2006 to 2017, the OHBWC Division of Safety and Hygiene (DSH) employed an average staff of 93, with 48 safety specialists, 25 IHS and 20 ergonomists that conducted 187,846 visits and provided 446,825 hours of services. The DSH staff averages 20.7 years of experience, and holds a variety of degrees in sciences, engineering, and OSH. Many of the DSH staff have certification from professional accrediting organizations including the Board of Certified Safety Professional, the American Board of Industrial Hygiene, and the Board of Certification in Professional Ergonomics as examples.

OHBWC specialists provide consultation by telephone, e-mail or during onsite visits to the insured employer. The employers are not charged additional fees for the consultation as the service is included as part of annual WC insurance premium. From 2006 to 2017, the OHBWC DSH budget was 1% of the written premium.³⁹

DSH consultants use a variety of techniques, including onsite walkthroughs, structured risk assessment checklists and video-based job task analysis, to develop reports for employers detailing advice to eliminate or reduce hazards. The types of hazards that are targeted differ depending upon the discipline of the consultant. Industrial safety specialists/engineers typically conduct walkthroughs onsite to conduct assessments related to machine guarding, electrical safety, lockout/tagout, powered industrial trucks, cranes and hoists, welding, slips/trips/falls and other workplace hazards. Construction safety specialists provide similar services specifically for construction employers and focus on providing assessments and advice related to trenching/excavation, scaffolding, crane safety, fall protection, electrical safety, tools and equipment, vehicular traffic and other jobsite hazards. Ergonomics specialists conduct assessments related to manual material handling, lifting, pushing, pulling, and carrying tasks, repetitive hand-intensive work, sedentary work, awkward work postures and other physical stressors. IH specialists use specialized equipment to conduct assessments of airborne contaminants, noise levels, vibration and thermal stress and also assess hearing protection programs and respiratory protection programs.

DSH consultants also provide general OSH management assessments and advice, help develop and provide training programs and provide assistance with OSH program development and documentation. Other services include safety culture assessment, behavior change process assistance and safety team/committee development and enhancement. DSH consultants also typically assist employers with understanding the eligibility requirements for funded intervention programs and aid in applications for the SIG programs.

OHBWC-insured employers are informed of the availability of RC services and other prevention programs upon WC policy initiation and renewal. The RC services are typically initiated by the employers by requesting them online or contacting their local customer service office for assistance. OHBWC also offers specialized safety and health compliance assistance services for public (government) employers through a Public Employment Risk Reduction Program. An OSHA On-Site Consultation Program provides assistance for small to medium employers in high hazard industries in Ohio, though this program is managed separately from the OHBWC RC services.

The RC services offered by OHBWC are likely different from typical competitive insurers for several reasons. As an exclusive state-fund, OHBWC does not compete with other insurers for a given employer's business. As such, there is less of a business directive to assess insured employers for underwriting purposes including risk selection and premium determinations. As a result, the OHBWC RC does not typically perform insurer-initiated underwriting-based risk assessments, but rather focuses on providing RC services to employers upon request. This frees OHBWC to dedicate

more time and personnel to actual onsite consultation and other prevention programs.

Data Analysis

OHBWC provided NIOSH with a database that included both employer-level claims and policy information for calendar years 2001 to 2017. This included data on the employers' industry, quarterly employee counts, participation in prevention programs, and consultation services history. Although RC services have been offered since at least 1935, OHBWC did not begin collecting systematic centralized RC information until 2006. At that time, each RC discipline began recording the number of visits and hours of service for each serviced employer policy. The OHBWC WC database has been augmented to include information from the state's unemployment insurance agency to identify each employer's North American Industry Classification System (NAICS) industry code, quarterly numbers of employees and estimated full-time equivalents (FTEs) as described in previous studies.⁴⁰

Study Population

We initially identified 15,884 private employers from year 2006 to 2017 that received an onsite RC services visit conducted by a Safety Consultant, Ergonomist, Industrial Safety Consultant Specialist or Engineer. Because RC services data were not collected before 2006, we did not have direct knowledge of whether employers received RC visits before this time. However, our analysis required that we observe claim rates and costs of each employer prior to receiving services. Therefore, we excluded 3388 employers who participated in the Safety Council or the SIG program before 2006 because these programs typically first involve onsite RC services or other engagement and it was likely the employers had at least one undocumented RC visit during this earlier period. This likely removed from analyses most employers who received RC services before 2006. Additional employers that were lacking NAICS industry information and/or were considered outlier employers based on employee counts and rates using the same criteria from previous studies⁴⁰ were also excluded. Because small employers tend to have low and variable claim counts, we restricted the study population to employers with at least 10 FTEs during the year of first RC visit, resulting in 7919 employers. This restriction was also used by other prior RC services evaluation studies.^{35,38}

To make before and after comparisons, we further restricted the sample to employers with sufficient data before their first RC visit. Sufficient data was defined as nine quarters before the quarter of the first visit. Nine quarters was chosen because preliminary analyses showed that employers receiving RC visits tended to have an increase in claim rates during the 6-month period including the quarter of their first visit and the immediately preceding quarter. Therefore, nine quarters gave 2 years (8 quarters) of data before this 6-month period, which we refer to as the "intervention period." This resulted in 4606 employers with an average of at least 10 FTEs per year that received onsite RC visits that were used for the subsequent analyses.

Statistical Analyses

In order to accurately measure the effect of the RC visits, an attempt was made to capture what would have happened had the visit not taken place. This is especially important because overall claim rates are known to be decreasing over time across the entire state,⁴¹ and therefore, any before and after comparison would show a decrease in losses that would reflect general trends that are not associated with the RC visit. Two methods were considered to evaluate the effect of the RC visits: 1) matching employers receiving RC visits to similar employers that did not receive an RC visit and 2) focusing only on employers receiving a RC visit, and estimating the

share of changes in claims and costs associated with calendar time versus the share of changes associated with RC visits.

Method 1: Matching to Similar Employers

Each of the 4606 employers that received an RC visit was randomly matched to a similar comparison employer. In order to be eligible to be a comparison employer, nine quarters of claims data had to be available before the quarter of the first visit of the matched serviced employer who received visits. In addition, comparison employers were chosen based on 3-digit NAICS industry code, size category (10–50, 50–250, 250+FTEs) and loss history. To measure an employer's loss history, its claim rate was calculated for the 2 years before the 6-month intervention period (quarter of the first RC visit and the immediately preceding quarter) and then assigned to one of four groups within the employer's 3-digit NAICS and employer size category: 0 claim rate and 3 tertiles among those with a non-zero claim rate. The comparison employer had to fall into the same claim rate group.

In addition to falling within the same claim rate group during this 2-year period, we also attempted to match on the occurrence or nonoccurrence of a "risk spike" (discussed above) during the 6-month intervention period. This is because we observed that, on average, there was a distinctive upward spike among employers who received visits, although only a minority of these employers experienced such a spike. For this match, a "risk spike" was defined as the occurrence of a claim during the 6-month intervention period resulting in \$5000 or more in paid costs an average of 24 months after injury. This final matching requirement resulted in 4178 employer treatment-comparison pairs for Method 1.

General estimating equations (GEE) of a Poisson regression with a random effect for the matched pair were performed to model claim rate, lost-time (LT) claim rate (for WC claims with 8 or more days away from work), and cost paid rate per 100 FTE to compare pre-post differences of employers receiving the RC visit (referred to as the treatment group) to pre-post differences of their matched comparisons. The pre-post differences were the difference between the 2-year period after the first visit and the 2-year period preceding the 6-month intervention period described above. The pre-post differences excluded the 6-month intervention period in order to avoid estimating a decline in claims and costs that is partly driven by reversion to the mean (RTM), in which the unusual increase among treatment group employers in the intervention period would be expected to be followed by a decline, regardless of any impact of the RC visits.

Method 2: Regression with a Time Trend

Because there was a rolling enrollment (with employers receiving visits between 2006 and 2017), a regression that includes a calendar time trend was used to allow employers who have received a visit to serve as their own controls. Regressions were performed using only the data for the 4606 employers who received a visit, controlling for calendar quarter with a restricted cubic spline (RCS) to allow flexibility in modelling the rate of decline in claims and costs over time. Also, instead of defining a single, 2-year after period as in Method 1, this method used all the data available following the first visit and estimated the additional impact of each additional visit using variables indicating the number of previous visits.

The time trend is constructed based on observed, quarter-to-quarter changes within the time periods used in the analysis (Before, Intervention, and each of the After periods defined by number of previous visits) but not including changes that span between these periods. Thus, this model assumes that RC visits may affect the level of claims and costs but not the general, background rate of decrease in claims and costs. As in Method 1, quarterly claim rate, LT claim rate and paid cost rate were modeled using GEE of a Poisson

regression with a random effect for each employer. This indirectly controls for size and industry since industry and size do not vary within an employer. The cumulative number of visits received up until each quarter (not including any visits in the current quarter) was the independent variable of interest. The time period with 0 visits (ie, two and a half years by definition) was split into two periods: 1) the 2 years (8 quarters) before the intervention period (labeled the “0 period” in this analysis), 2) the intervention period (labeled the “0.5 period” in analyses because it occurs after the “0 period” and before the “1 period,” which is the period after the quarter of the first visit).

Cost Valuation Approach

Because older WC claims have more time to develop costs than newer claims, paid costs were valued at 30 months after January 1 of each year of injury (24 months of average development). Costs included what had been paid to date for medical treatments and lost wages (indemnity). The cost data used did not include reserves, which are anticipated but uncertain future costs. This valuation method has been used in a past study to evaluate the impact of interventions over time.^{8,42} Adjustments for inflation were not used, because in Method 1, comparisons were made in the same year, and in Method 2, the models controlled for year.

OHBWC offers two programs that lower the cost of claims reported in their database. In the first program, employers can pay up to \$15k of medical-only claims⁴³ and only medical paid costs in excess of this limit are reported to OHBWC. In the second, employers may choose to pay indemnity costs,⁴⁴ which are not reported to OHBWC. A sensitivity analysis was conducted in which employers that participated in these two programs were removed. In Method 1, matched pairs in which either or both employers participated in at least one of these programs were removed, resulting in removal of 2211 treatment group employers and the comparison group employers to which they were matched. In Method 2 cost analyses, 2043 employers who participated in at least one of the programs were removed. Claims with \$0 in total paid costs (not impacted by the two programs above) were always included in both the frequency and cost analyses. Results are provided with and without these employers included.

Human Subjects

This study was internally reviewed by NIOSH, and it was determined that it did not constitute human subjects research. Rather, the study involved the analysis of coded and previously collected WC administrative claims and program evaluation data.

TABLE 1. Total Private Industry Employers and Onsite Risk Control Visits by Employer Size, 2006 to 2017

Employer Size Category (Full-Time Equivalents, FTEs)	% of Total Private Industry Employers	% Employers Receiving Onsite RC Services
Missing	2.3	5.9
0	2.4	0.2
>0 to <10	73.0	0.4
10 to 50	17.8	3.7
51 to 100	2.6	10.7
101 to 250	1.5	15.6
>250	0.4	14.1
Overall	100.0	1.7

RESULTS

Table 1 summarizes total employers and RC visits by employer size, 2006 to 2017. During this period, OHBWC provided RC services to an average of 4582 employers each year, which represented an average of 1.7% of the covered private employers. Larger employers received a greater proportion of RC visits.

Table 2 summarizes the employer size and industrial sector of employers in the original and final study population of employers that received RC visits. There were 4606 employers selected for this study that received at least one RC visit and with sufficient data before their first visit. Within this population, 93% of employers were single-location and 7% were multiple-location. An additional 4606 employers that did not receive a RC visit were selected to match the size, industry, and claims history of the final study population.

Method 1: Matching to Similar Employers

Each employer was matched to a similar employer based on employment size, 3-digit NAICS and loss history. Figure 1 depicts the overall losses (claim rate, LT claim rate and paid cost rate) of treatment group employers (the 4606 employers receiving a RC visit) and their matched comparison group employers over time, relative to the quarter of their first visit:

Claim rates and LT claim rates decreased over time for both treatment group employers and comparison group employers, demonstrating the need for a control group. Treatment group employers generally saw spikes in WC losses in the quarter of their first visit (year = 0) and the quarter immediately before (year = -0.25).

Figure 2 plots the results of the regression as rate ratios (RR) representing the difference between treatment group employers and comparisons. A RR of 1 indicates that treatment group employers were the same as their matched comparisons. The RR for the 2-year period before the quarter preceding the first visit (year -2.25 to -0.5) was then compared to the RR for the 2-year period after the first visit (year 0.25-2.0). This represents the difference in difference (DID), which estimates the change in claim and cost rates over and above what would have been expected with no RC visit (as estimated by the comparison group).

Claim rates appear to have slightly increased, LT claim rates remained largely unchanged and paid cost rates dramatically decreased. It is estimated that costs paid per FTE decreased by 14% during the 2 years after the first RC visit. After excluding 2211 treatment-comparison group employer pairs that participated in the 15k and salary continuation programs, the decrease in paid cost per FTE became stronger [DID: -22% (-34%, -7%).

Method 2: Regression with a Time Trend

Table 3 reports descriptive data on employers by cumulative number of RC visits. All 4606 employers had zero cumulative visits for 2 years during the “0 period,” and all 4606 employers still had a total of 0 visits in previous quarters during the “0.5 period” which spans the quarter before the first visit and the quarter that included the first visit. Overall, 3200 employers appeared in the data during quarters in which a total of 1 visit had been received in a previous quarter. Employers who were in this category for at least one quarter spent a median of 5 quarters in this category before their representation in the data ended or until they had passed a quarter in which they received a second visit. A total of 1202 employers were represented in the data during quarters in which they had previously had 5 or more visits and were represented in that status for a median of 4 years. Note that some employers had two visits in one quarter and so immediately jump two categories in the following quarter

Figure 3 plots the time trends estimated by the model. The changes estimated to be associated with receiving RC consultation services were over and above changes due to these time trends. The

TABLE 2. Study Population Demographics

NORA Sector*	Employers with Onsite RC Visits 2006–2017 (Original Population)		Employers Not in SIG or SC Before 2006†		Employers with >= 10 FTE, NAICS and Non-outliers		Employers with 9 Quarters of Claim Data Prior to 1st RC Visit (Final Study Population)	
	n	%	n	%	n	%	n	%
AFF	122	0.8	106	0.8	72	0.9	45	1.0
CON	3,228	20.3	2,658	21.3	1442	18.2	790	17.2
HAS	1,391	8.8	945	7.6	773	9.8	487	10.6
MIN	40	0.3	27	0.2	19	0.2	14	0.3
MNF	3,775	23.8	2,684	21.5	2248	28.4	1148	24.9
OGE	67	0.4	60	0.5	36	0.5	18	0.4
PSS	291	1.8	179	1.4	57	0.7	32	0.7
SRV	4,151	26.1	3,512	28.1	1667	21.1	1,074	23.3
TWU	699	4.4	555	4.4	408	5.2	251	5.4
WRT	2,120	13.3	1,770	14.2	1197	15.1	747	16.2
Total	15,884	1	12,496	1	7919	1	4606	1

Employer Size Category (Full-Time Equivalents, FTEs)	Employers with Onsite RC Visits 2006–2017 (Original Population)		Employers Not in SIG or SC Before 2006†		Employers with >= 10 FTE, NAICS and Nonoutliers		Employers with 9 Quarters of Claim Data Prior to 1st RC Visit (Final Study Population)	
	n	%	n	%	n	%	n	%
Missing	1,213	7.6	790	6.3	–	–	–	–
0	56	0.4	45	0.4	–	–	–	–
>0 to <10	3,974	25.0	3,741	29.9	–	–	–	–
10–50	6,510	41.0	5,408	43.3	5407	68.3	3116	67.7
51–100	2,136	13.4	1,394	11.2	1394	17.6	826	17.9
101–250	1,568	9.9	885	7.1	885	11.2	525	11.4
>250	427	2.7	233	1.9	233	2.9	139	3.0
Total	15,884	1	12,496	1	7919	1	4606	1

NORA Sectors by North American Industry Classification System (NAICS) codes include: Agriculture, Forestry, Fishing/Hunting (AFF) = 11; Construction (CON) = 23; Health Care and Social Assistance (HAS) = 62, 54194, 81291; Manufacturing (MNF) = 31, 32, 33; Mining (MIN) = 21; Oil & Gas (OGE) = 211, 213111, & 213112; Public Safety (PSS) = 92212, 92214, 92216, 62191; Services, except Public Safety (SRV) = 51–56, 61, 71, 72, 81, 92; Transportation, Warehousing, Utilities (TWU) = 22, 48, 49; Wholesale Trade/Retail Trade (WRT) = 42, 44, 45. Only the private sector portion of the PSA sector is included in the current analyses (62,191, Ambulance Services).

*NORA, National Occupational Research Agenda.

†SC, Safety Council; SIG, Safety Intervention Grant.

ratio in each plot compares the value in that quarter to the value in first quarter of 2006.

Claim rates dropped by 60% over the period of 2006 through 2017. This trend is also reflected in the first panel of Figure 1, where over a 4.5-year period, claim rates dropped from about 1.4 per 100 FTE to about 1.05 (–25%). Figure 4 plots the results of the regressions that estimate the effect of each visit (relative to the quarters before any visits had occurred).

There does not appear to be an effect on overall claim rates, but there does seem to be a dose-response effect of RC consultation visits on LT claim rates and paid cost rates, with each additional visit having an additional effect. Quarters that had four visits prior saw paid costs almost 50% lower than the quarters with 0 visits. However, the dose–response pattern ended after that, with five visits estimated to have a lower impact than smaller numbers of visits. After excluding 2043 treatment group employers that participated in the \$15k and salary continuation programs, there was still a decrease in paid cost per FTE, though the effect was not as strong, as depicted in Figure 5.

DISCUSSION

This study used two distinct methods to evaluate the impact of RC services. Method 1 compared the loss experience of RC-serviced employers to matched non-serviced employers for a 4-year period (2 years pre-service, and 2 years post-service) while Method 2 evaluated the loss experience of only RC-serviced employers over a longer period of time. While Method 1 attempted to isolate the impact of the RC service, randomly matching to peer, nonserviced employers based on industry and prior loss history (including risk spikes that potentially prompt service requests), it can be difficult to identify “perfect” matches and this approach may not be ideal. That is, there is still likely to be something different about employers who requested a visit compared to those who did not. By requesting assistance, the serviced employer may have demonstrated a higher level of interest in improving safety. Method 2 partially addressed these concerns by only analyzing the data for employers receiving an RC visit and using their estimated background time trend in claims and costs as a baseline against which to measure the impact of RC visits. This effectively uses the group of employers requesting

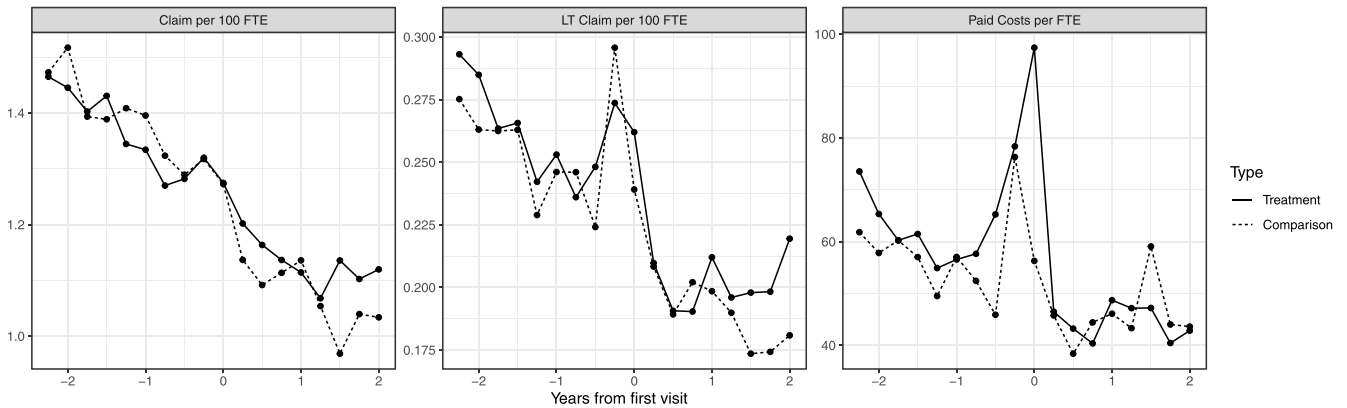


FIGURE 1. Outcomes for Risk Control Serviced Employers (Treatment) versus Nonserviced Employer (Method 1). The 0 on the X axis represents the calendar year and quarter of the intervention for the treatment group. That same calendar year and quarter is 0 for the comparison group. For example, if an employer received a first RC visit in quarter 1 of 2015, then quarter 1 of 2015 is also the 0 quarter for the non-serviced, matched comparison employer.

RC services as their own control group. In addition, Method 2 estimates any additive effect from receiving additional RC visits.

Despite differences in design, the two evaluation methods produced similar results. Total WC claim rates increased slightly (but not significantly) after RC services under both methods. LT claims rates either remained similar (Method 1) or decreased dramatically (Method 2). The differences in impact on LT claims between the two methods could be due to the fact that the decline in LT claims after RC service was found in Method 2 to occur after the 2nd and subsequent RC visits. In Method 1, a number of employers only received 1 RC visit (45.4%) or 2 RC visits (19.6%) in the 2-year follow-up period, thus possibly minimizing the measured impact of service.

Costs paid per FTE decreased dramatically under both methods, and the impact of RC services was cumulative (Method 2) to a point, with quarters that had four visits prior having paid costs almost 50% lower than the quarters with 0 visits. After excluding employers that participated in the \$15k and salary continuation programs, the decrease in paid cost per FTE became stronger with Method 1 but was less evident with Method 2.

A post hoc cost-benefit analysis was performed for these findings. There were a total of 12,736 RC visits totaling

20,678 hours during the 2-year post period in Method 1 that cost OHBWC a total of \$1,240,680 based on \$60 per hour for consultant time (from OHBWC records). The total paid WC claim costs in the 2-year post period were \$74,446,445. If we assume an effect of -14% (point estimate from Method 1), there was a benefit of \$12,119,188 in avoided WC claim costs due to the RC service. This results in a simple benefit to cost ratio for the RC services of 9.7. To break even on the cost of RC services, the impact would have had to reduce paid costs by 2%, which is near the low end of the estimated effect range using either Method 1 or 2.

The results from this study suggest that among participating employers, the insurer RC consultation program was effective in controlling or reducing WC LT claim frequency and reducing WC claim cost rate for serviced employers. These findings are discussed below in context with other studies that have evaluated the impact of insurer RC consultation visits and related regulatory consultation/enforcement visits.

Comparisons to Prior Insurer RC Studies

The current study’s findings are largely consistent with prior research that demonstrated insurer RC onsite consultation services

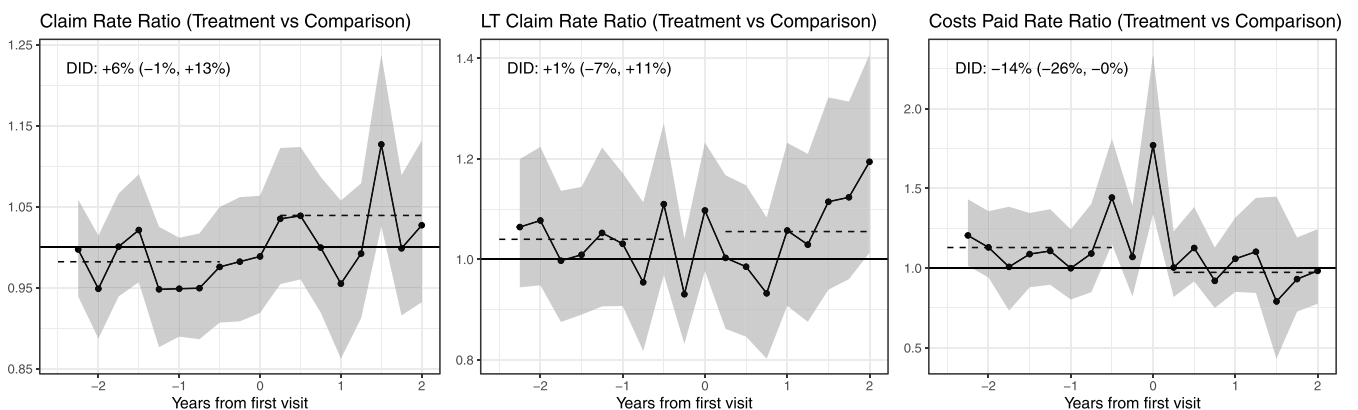


FIGURE 2. Outcomes for Risk Control Serviced Employers (Treatment) versus Non-Serviced Employers: Relative Rates Before and After Services* (Method 1). *The difference in difference (DID) method compares the pre- to post-intervention change in outcome for the treatment and comparison groups. The DID is represented by the difference between the two dashed lines. The y-axis gives values of a ratio in which the numerator is the outcome for the treatment group, and the denominator ratio is the outcome for the comparison group. Dashed lines represent averages for the before and after periods. The shading represents 95% CI calculated from the repeated measure GEE Poisson regression models controlling for the matched pair. The dashed lines represent modelled data and may appear differently from the dotted points which represent actual data.

TABLE 3. Employers by Risk Control Visit Categories (Method 2)

Visit Category (Cumulative Number of Previous Visits)	Number of Employers Appearing in Visit Category	Median Years in Visit Category (Inter- Quartile Range, IQR)
0	4606	2 (2, 2)
0.5*	4606	0.5 (0.5, 0.5)
1	3200	2 (0.5, 5.25)
2	1868	1.25 (0.25, 3.75)
3	1213	0.75 (0.25, 2.75)
4	915	0.75 (0.25, 2.5)
5+	1202	4 (2.5, 6.25)

*0.5 is used as a label within the cumulative visits category even though cumulative number of visits in previous quarters is still zero. This differentiates it from the preceding 0 category.

can reduce WC claim rates^{12,22,28–30} and costs.^{12,28,29} In addition, it is also consistent with these earlier studies’ findings that increased quality and frequency of service visits could further reduce WC claims to a degree before there are diminishing returns.^{12,22,28,30}

Schofield et al²⁸ is the most comparable prior study in terms of study design, scale, and timeframe. The study evaluated the impact of repeated, voluntary RC consultation services provided by a single insurer on employer WC claims experience over a 5-year period among 1360 construction industry policyholders. Schofield et al reported a 27% decrease in LT claims (defined by MN WC law to be 4 or more days away from work) with one RC visit, and a 41% decrease with two visits compared to no RC visits. The decrease attenuated to 28% after three or more visits. Although the current study found a smaller decrease in LT claim rate, LT claims are defined by OHWC law to be 8 or more days away from work, so the measures are not directly comparable. Both studies did find a cumulative impact of RC services, with some attenuation after 3 or 4 onsite visits. Unlike the current study, Schofield et al did not analyze the impact on total WC claims and only included employers in a single industry.

Nave and Veltri¹² randomly sampled a small group (n = 82) of employers who received RC consultation services from a single CA-based insurer to examine changes over time and also compared this group versus a smaller sample (n = 45) also receiving different types of RC services. The study was not a comparison of RC consultation versus no RC services, but only types of RC (standard versus flexible). Flexible services focused more on operations assessment, incident investigation and supervisor-training activities than standard services. Nave and Veltri found that the flexible RC

consultation approach produced claim rates and loss ratios 19% lower, severity rates 30% lower. Unlike the current study, the Nave and Veltri study did not control for industry and size of employer.

Two doctoral dissertations have also examined the impact of insurer RC services. Buresh³⁰ surveyed 1081 randomly selected employers in Oregon to collect information about the utilization and perceived effectiveness of consultation services provide by OR state OSHA, WC insurers, and private consultants. Among the 582 (54%) employers that responded, 291 employers reported using WC consultation. Among WC consultation users, the vast majority of employers reported that the WC services were instrumental in reducing losses (73%), that there were no adverse impacts on business from implementing RC recommendations (95%) and that they would use the services in the future (94%). Compared to OSHA and private consultants, these responses were all higher for insurer RC services. Employers also reported that WC RC had shorter response times to request services (6.4 days) compared to other providers and greater numbers of average visits per year (ranging from 1.8 for small employers to 3.8 visits per year for large employers). Although researchers did not ask employers to provide actual WC claim or other injury information or documentation, researchers concluded that the insurer RC consultations services did “meet the needs of the corporations they served.”

A more recent doctoral dissertation Thygeson et al²² examined the impact of insurer RC services provided by a single insurer to 229 manufacturing employers from 2012 to 2016 in Utah. The study was limited to those employers with at least \$20k in annual premiums, because these larger employers were typically the target of the insurer’s provided RC services. Researchers stratified RC services into three categories: no service, 1 to 19 visits, and 20 or more visits. Furthermore, researchers categorized whether the RC services provided recommendations, whether recommendations were closed (meaning the risk issue was addressed or no longer present) and whether the employer had a full-time OSH professional on staff. Outcomes included WC claim frequency rate and cost rate per \$1M in premium. The study indicated that only the number of RC services significantly impacted claim rate, with the 1 to 19 visit group reducing rates to greater degree compared to the 0 visit group. There appeared to be some attenuation as the 20+ visit group did not reduce claim rates as much as the 1 to 19 visit group. None of the variables (RC visits, recommendations, or employer safety staff) significantly impacted claim severity. The authors did not describe how costs were actually evaluated nor provide the rationale behind the categorization of visits (1–19 vs 20+).

Taken together, the above studies indicate that onsite RC services can be effective in reducing injuries and costs, providing some justification to continue or expand services where possible.

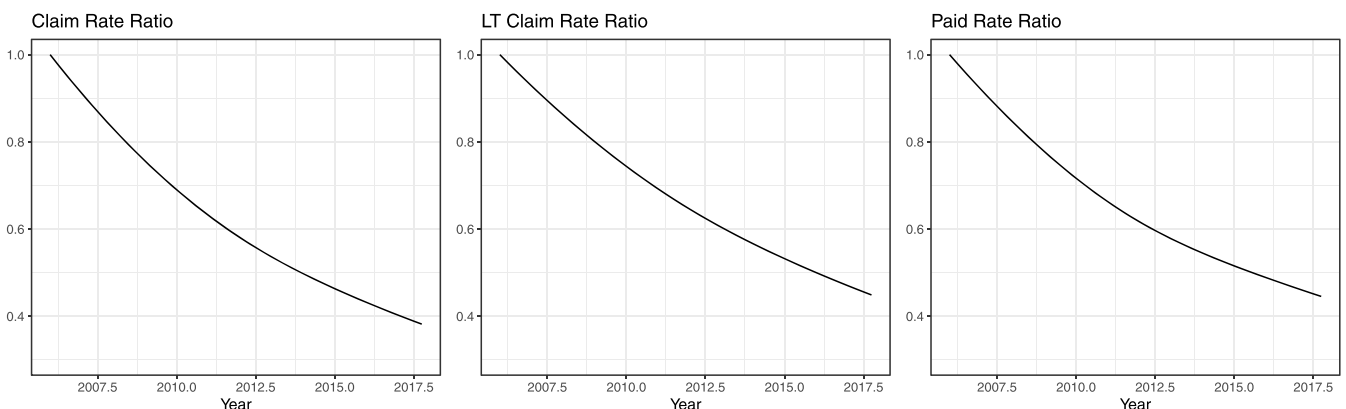


FIGURE 3. Modelled time trends for each claims outcome (Method 2).

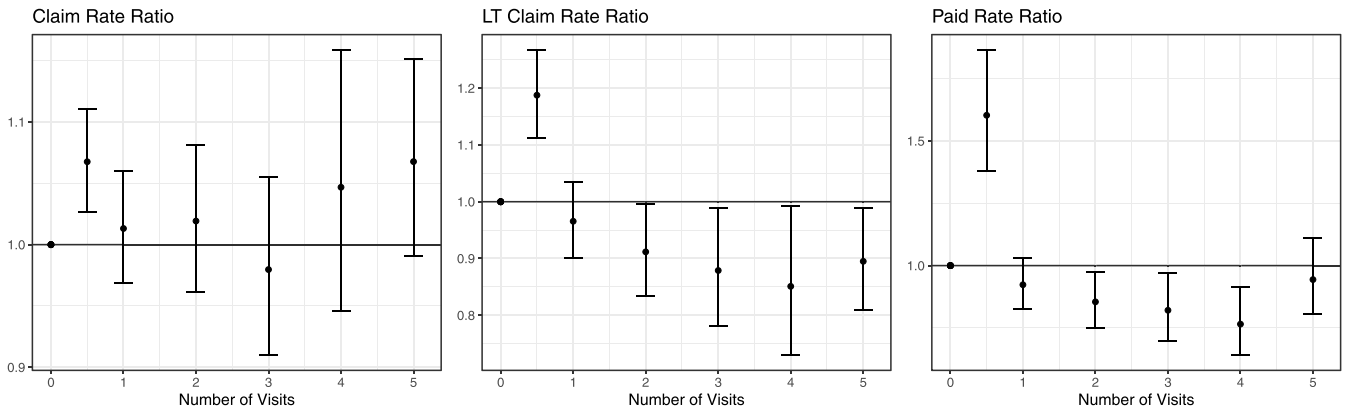


FIGURE 4. Modelled Effect of Risk Control Visit (Method 2). Ratios represent percent change associated with risk control visit compared to baseline time trend. Error bars represent 95% CI calculated from GEE Poisson regression models controlling calendar year and quarter.

This is also consistent with prior research that indicated that states with required RC insurer services had lower injury rates.²³ Although the current study was the only one to note a slight increase in WC claims after RC services, this is not surprising, because such visits may increase employee awareness of safety hazards and encourage early reporting of minor incidents and musculoskeletal symptoms. Also, past researchers have suggested that RC services tend to focus most on exposures related to more severe claims, such that RC

services impact on more minor claims may not necessarily be expected.³⁰

The apparent cumulative association between number of RC visits and reduced claim cost and LT claim frequency noted by the current study and other researchers above provides some support that services work best once the RC consultant and employer have had sufficient time to develop collaborations as suggested by Morin et al.⁴ Morin also suggested RC consultants may be viewed initially

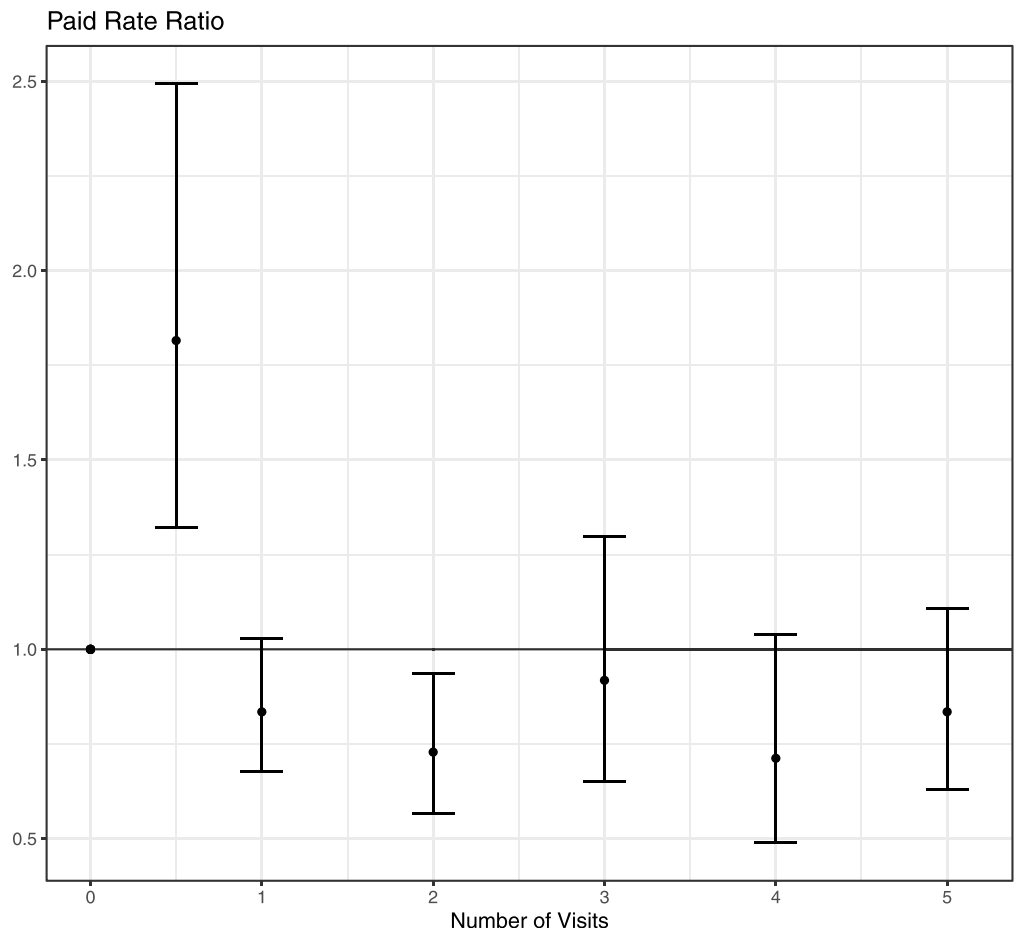


FIGURE 5. Modelled Effect of Risk Control Visit for Paid Rate Ratio after Exclusion of Employers in Cost Programs (Method 2). Ratios represent percent change associated with risk control visit compared to baseline time trend. Error bars represent 95% CI calculated from GEE Poisson regression models controlling calendar year and quarter.

by employers as regulatory inspectors, which can slow RC services requests and the control recommendation implementation process. As the exclusive WC insurer in Ohio, OHBWC and other state-based insurers may have an advantage in developing longer-term relationships compared to commercial WC carriers operating in competitive states, where insurance policies are renewed annually. The decision by the employer and insurer to renew insurance policies in competitive states typically involves consideration of price and services provided, and this can be greatly influenced by economic cycles. The term “soft market” is used to describe business markets where employers are generally seeking lower premiums, versus “hard markets,” where insurers can charge higher premiums and focus more on RC services.⁴⁵

In either market type, some insurers use RC services as a way “to promote retention of favorable policyholders through effective service.”⁴⁴ For example, innovative risk control has become an emphasis of some insurers such as MEMIC (the ME state-based insurer), which spends ~5% of premium towards RC services and specializes in reducing losses in higher-risk industries such as healthcare through targeted safety and ergonomic consultation.⁴⁶

Comparisons to Other Prior Consultation and Enforcement Studies

The above research findings about the effectiveness of insurer RC services can also be compared with prior related research that examined the impact of onsite consultation and enforcement activities conducted by other external organizations, including regulatory agencies such as OSHA. Such regulatory visits may be conducted in response to a severe injury or fatality for compliance purposes or conducted on a voluntary, consultative basis.

A systematic review of studies that evaluated the effectiveness of a number of OSH regulatory approaches found a number of studies supporting the impact of onsite inspection and enforcement visits but less evidence for impact of consultative visits.³² Several of the studies that Tompa et al. reviewed were specifically designed to compare the relative merits of different approaches (regulatory enforcement versus participatory consultation) to improve workplace safety/health and are discussed further below.

A series of studies have investigated the impact of WA State OSHA onsite activities. Baggs et al³⁸ compared WC LT (4 or more days away from work) claim rates among employers who received onsite enforcement inspection and consultation visits from 1997 to 2000, versus employers who received no visits. Foley et al³⁵ conducted a subsequent larger comparison from 1999 to 2008. Both studies found that enforcement did reduce WC LT rates more than no visits among all employer types, but especially among fixed-site employers (which work from the same physical location, such as manufacturers). Neither study determined that consultation reduced rates among fixed-site employers, but Foley et al found that consultation had an even greater WC LT claims reduction impact than enforcement activities among non-fixed-site workplaces (such as construction sites).

Haviland et al³⁶ conducted a large retrospective analysis to examine the impact of OSHA inspections in PA from 1997 to 2005. Authors found that over a 2-year period, there was an 8.2% decrease in injury types related to OSHA standards and a 14.4% decrease for injury types defined as less related to standards (such as overexertion), after controlling for other annual trends. Previous work in PA on an earlier time period (1979–1998) found similar reductions.³⁷ Li et al³¹ conducted a similar study to evaluate the impact of OSHA’s Site-Specific Targeting (SST) plan using data from 1996 to 2011 among 61,702 establishments in 29 states with federal OSHA jurisdiction and six states with state OSHA programs. The SST used the rate of cases that involve days away from work, job restrictions and job transfers (DART) as a cut-off for targeting establishments for inspection. Researchers found that the average

DART rate was reduced “20% relative to the post-inspection DART rate near the cutoff.” Inspection impacts varied by industry and were generally higher in manufacturing and lower in health services.

Finally, two experimental design studies evaluated the impact of enforcement and consultative visits. Hogg-Johnson et al³³ conducted an effectiveness study that was similar in scale and time-frame to the current study but included a randomized study design. This study targeted 2153 high-risk firms in Canada from 2003 to 2005 while tracking WC claims outcomes and randomly assigned each to receive one of three treatments: 1) consultation; 2) targeted enforcement inspections; or 3) no targeted services. After controlling for industry and employer size, researchers found no significant differences in WC outcomes between treatment groups. Authors noted that participation in interventions may have been limited and that outcome measures may not have been sufficiently sensitive. The targeting of only high-risk firms is a fundamentally different approach from the OHBWC RC services model, although many clients in Ohio did have an increase in losses prior to RC consultation. Another study investigated the impact of state OSHA enforcement activities in CA. Levine et al³⁴ compared the WC claim outcomes among 409 randomly inspected employers compared to matched controls. Researchers determined that the inspected employer establishments had 9.4% lower injury rates and 26% lower injury costs compared to controls.

In summary, prior studies suggest that both OSHA regulatory approaches (primarily enforcement-based) and insurer consultative RC services may reduce injuries, especially those that are more severe and costly. Repeated services may have a cumulative impact in reducing losses, though studies have noted some diminishing returns after a greater number of visits. Additional research is needed to understand the impact of RC services provided by competitive WC state funds and private WC insurers as well as OSHA consultation and enforcement services on reducing future injuries and illnesses. Further research similar to that conducted by Smitha et al²³ is needed to understand how statewide workplace safety laws and policies (such as those requiring employer safety/health programs and regulating OSHA and WC RC services) can work in concert to reduce injuries.

Limitations

The current study examined the RC services provided by a single, exclusive state-based insurer in Ohio. As such, the RC services model is different from competitive state funds or private insurers. The RC services from OHBWC are conducted primarily at the request of the employer to identify areas for risk reduction and are not required by the insurer for underwriting purposes. Other studies have noted that the quantity and quality of RC services varies between carriers.^{11,13} For this reason, the findings may not be generalizable to all insurers. There are several other limitations associated with this study that may limit generalizability.

Selection Bias

First, RC onsite consultation was provided to employers on a voluntary basis such that the treatment group was self-selected, and the findings may not be generalized to employers who do not request such services. OHBWC personnel involved in the program suggest that employers who participate in OHBWC programs have above-average commitment to improving safety. Thus, results may be most generalizable to employers that have demonstrated some prior safety success and interest. We also limited the study to private industry employers and further restricted analyses to employers with more than 10 employees as other previous researchers have done to control for rate volatility and keep the focus on employers that insurers would likely service based on employer size.^{35,38} A sensitivity check was performed using Method 2 where employers

with less than 10 FTEs were included, and results were similar (results not shown).

Reversion to the Mean (RTM)

Among the RC-serviced employers, 30% saw an increase in paid cost rates between the baseline period and the intervention period. The remaining 70% had either an unchanging rate (ie, 0 rate before and during the 6 month intervention period) or saw a decrease in paid rates. However, considered as a group, the RC-serviced employers saw a large spike in rates during the intervention period. This indicated that a portion of any subsequent decline in WC outcomes would likely be due to RTM. This was largely addressed in both analyses by removing the 6-month period of increased costs from the baseline rates. However, the RC-serviced employers still tended to have slightly higher losses in the baseline period than the comparison employers to which they were matched. For this reason, an RTM effect could still have contributed to the observed relative decline in losses among the RC-serviced employers.

Difference in Losses of Serviced and Nonserviced Employers in the Intervention Period

Although the intervention period was excluded from the analysis, there was still some concern that the relatively high losses of RC-serviced employers in that period indicated some difference between these employers and their matched comparison employers that could affect their prospects for future losses. That is why we attempted to control for the difference in intervention period losses by also matching employers based on the presence or absence of a claim resulting in \$5000 or more in paid costs during this period. This made losses of serviced and non-serviced employers much more similar in this period, but a substantial difference remained. Those serviced employers who did experience a significant increase in losses in the intervention period might have had different future losses for a couple reasons. First, the increase could have given them a somewhat greater motivation to improve safety. If so, this would suggest that greater motivation as well as the RC services themselves could be partly responsible for subsequent improvements. This just underlines the basic self-selection limitation mentioned above. Second, their higher losses in the intervention period might signal a real increase in safety hazards. If so, the observed cost reduction seen in Method 1 could actually underestimate RC service impacts, since the observed cost reduction would then have been achieved despite increased hazards.

Impact of RC Services Versus Other OHBWC Services

It is likely that some of the impact observed with the onsite RC consultations may have also been due in part to participation in other OHBWC safety programs. Although this was partially addressed during modelling, most employers that participate in other programs also have RC consultation. For example, the employer may join certain programs (such as regular Safety Councils) to receive premium discounts and then request RC consultation. Based on the RC consultation, the employer may request other programs including a SIG. A recent study demonstrated that while the SIG was effective in reducing WC claims and costs for the affected workgroup it did not appear to have much impact on overall employer loss experience, probably due largely to the fact that the SIG-impacted workgroup was typically only about 15% of the total workforce.⁸ This gives some support to the notion that the observed effectiveness of RC visits at an employer level may have been due to a combination of RC onsite consultations and other programs but that the SIG alone cannot likely account for a large share of the overall loss decline that we observed.

Influence of Prior RC Services

Because RC visit information was only available beginning in 2006, we limited the study population to only employers that did

not participate before 2006 in other OHBWC programs (Safety Council or SIG) that typically involve onsite consultations or other engagement. This reduced the potential that employers had received prior undocumented insurer RC services. It is possible that employers received other outside consultation from either OSHA or private consultants, but this is true for all employers, not just those receiving OHBWC services, such that the impact should influence results to the null.

Study Design

Finally, this study used a pre-post design that lacks randomization and a comparison group in Method 2. The drawbacks of this design are mitigated by the fact that RC visits occurred over a wide range of dates, such that there is no common, independent change at a point in time that coincides with the visit.

Future Insurer RC Studies

The nature, quality and quantity of RC services vary depending upon the insurer,^{11,13} and additional research is needed to understand how onsite consultation can be optimized. A fundamental question remains about how best to offer onsite RC services to serve a large population of employers efficiently and effectively with a limited service staff. For example, insurers may use prior loss history of certain industries and employers to focus services, while still allowing employers to voluntarily request services. Leveraging WC claims data can also help insurers understand what particular type of RC services are needed and direct ergonomic, safety and IH services accordingly through targeted marketing efforts.

Research is needed to understand the relative impact of different types of services and activities performed, such as training, job evaluations, and whether recommendations are provided and the impact on the hours of services versus the number of service visits. The nature of RC services is also changing. Although onsite employer RC services are still considered the best approach to engage employers, recent developments in technology (such as Google Glass and other video based systems, drones, and wearable sensors) may allow remote RC services to be offered to a greater number of employers. The recent COVID pandemic highlighted the need to access employers remotely and may have accelerated the development of such services. Additional studies are needed to understand the relative impact of these new approaches.

CONCLUSIONS

The study results suggest that the WC insurer RC consultation program was effective in controlling or reducing the WC LT claim frequency and reducing the WC claim cost rate for serviced employers. This finding is consistent with the limited research conducted on insurer RC services and related regulatory visits. Additional research is needed to understand the impact of different RC services and activities provided by competitive state fund and private insurers as well as OSHA consultation services and enforcement inspections on reducing future injuries and illnesses.

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