


Workers' compensation injury claims among workers in the private ambulance services industry—Ohio, 2001–2011

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Background: Ambulance service workers frequently transfer and transport patients. These tasks involve occupational injury risks such as heavy lifting, awkward postures, and frequent motor vehicle travel.

Methods: We examined Ohio workers' compensation injury claims among state-insured ambulance service workers working for private employers from 2001 to 2011. Injury claim counts and rates are presented by claim types, diagnoses, and injury events; only counts are available by worker characteristics.

Results: We analyzed a total of 5882 claims. The majority were medical-only (<8 days away from work). The overall injury claim rate for medical-only and lost-time cases was 12.1 per 100 full-time equivalents. Sprains and strains accounted for 60% of all injury claims. Overexertion from patient handling was the leading injury event, followed by motor vehicle roadway incidents.

Conclusions: Study results can guide the development or improvement of injury prevention strategies. Focused efforts related to patient handling and vehicle incidents are needed.

KEYWORDS

ambulance, emergency medical technicians, occupational injuries, surveillance, workers' compensation

1 | INTRODUCTION

The ambulance services industry provides medical care in combination with patient transport by ground or air. These services may respond to medical emergencies, but they are not limited to emergency responses.¹ Workers in this industry are exposed to stressful and hazardous work environments. They respond to calls in various

settings including private residences where space may be tight and/or cluttered with obstacles and can make moving patients difficult. In addition, they are regularly required to lift heavy equipment and patients during treatment and preparation for transport.

Injury risk may also be increased because of the work organization environment. Workers in this industry often work long shifts which can be associated with fatigue and increased risk for injury.^{2–4} They may work multiple jobs, which can further exacerbate the effect of extended shifts and fatigue.⁵ Finally, work in this industry is commonly done in teams with an assigned partner during each shift. The assigned

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partner can vary, resulting in less familiarity which has been associated with greater risk of injury.⁶

According to the United States (US) Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII), the private ambulance services industry has one of the highest rates of occupational injuries among private employers.⁷ In 2015, the rate of all employer-reported nonfatal occupational injuries and illnesses among the private ambulance services industry (6.8 per 100 full-time equivalents (FTE)) was more than two times greater than the rate for all private industries (3.0 per 100 FTE).⁷ In 2015 the private ambulance services industry incidence rates for nonfatal occupational injuries resulting in days away from work (DAFW) was 2.5 per 100 FTE, while the rate for all U.S. private industry was 0.9 per 100 FTE.⁷

From 2001 to 2011, the average annual injury rate for Ohio Bureau of Workers' Compensation (OHBWC) insured private ambulance services companies was more than two times higher than the injury rate for all OHBWC-insured private employers.⁸ This industry had the highest injury rate for BLS-defined ergonomic-related musculoskeletal disorders.⁹ Despite these high injury rates, only two studies from Australia have performed a detailed analysis of workers' compensation (WC) claims specific to EMS workers.¹⁰⁻¹¹

The current study analyzed OHBWC claims among private ambulance services workers to describe the magnitude and characteristics of occupational injuries and identify injury risk factors. To the best of our knowledge, this is the first study to examine in detail WC claims among private ambulance services industry workers in the US. The objective was to provide information that can guide future studies and inform the development of targeted intervention strategies within the ambulance services industry in Ohio, and in general, in the US.

2 | METHODS

Ohio is one of four US states (North Dakota, Ohio, Washington, and Wyoming) with an exclusive state-run WC system. All Ohio public and private employers (except sole proprietorships and partnerships) with less than 500 employees are required to be insured by OHBWC. Generally, employers with 500 or more employees may self-insure if they demonstrate strong financial stability and can directly pay compensation and medical costs for work-related injuries. As a result, OHBWC covers approximately two-thirds of workers in Ohio. OHBWC and the National Institute for Occupational Safety and Health (NIOSH) established a research partnership and developed a large database of OHBWC-insured businesses and claims of injury for the purpose of using WC data for surveillance of occupational injuries among Ohio workers in the private sector.⁸

The OHBWC database includes information on injured-worker demographics, industry, occupation, and diagnoses as well as a free-text narrative description of the injury incident. All claims were assigned single or multiple International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes, and one code was identified as an optimal return-to-work (RTW) code based on an OHBWC algorithm designed to identify the diagnosis

most likely to keep the injured worker off for the longest period of disability.¹² This analysis focused solely on the optimal RTW diagnosis codes to emphasize the injuries with the greatest worker and workforce impact.

Both lost-time (LT) claims and medical-only (MO) claims are included in the data. In Ohio, LT claims are those with eight or more days away from work while MO claims are those with only medical treatment expenses and/or seven or fewer lost work days. LT claims are used as a general proxy for claims with greater severity. Another measure of severity in the WC system is the type of disability payment, which characterizes the severity, extent, and duration of the disability. For example, permanent total disability payments indicate the most severe disability cases where the worker is unable to remain employed due to their injuries.¹³ Permanent partial disability payments indicate other serious cases where workers may not have the capacity needed to perform their former work duties or where they lose part or all of the function of a particular body part.¹⁴ Permanent partial disability cases are among the most costly and prevalent in many states.¹³

2.1 | Study population

Claims analyzed for this study were limited to OHBWC-insured, private ambulance services industry employers, as identified by North American Industry Classification System (NAICS) code 62191,¹ from 2001 to 2011. This study focused on industry rather than occupation because the denominator data necessary to calculate injury rates were only available at the employer's industry level. In addition, the WC claim occupation data were available only in text form and not consistently complete. The occupations represented within the industry include emergency medical services personnel (eg, doctors, nurses, and paramedics/emergency medical technicians) and emergency vehicle operators (eg, ambulance drivers and pilots). It also includes administrative workers, clerical workers, dispatchers, and mechanics. The ambulance services industry (NAICS 62191) is unique to the private sector and largely consists of the estimated one-quarter of EMS agencies that are private, non-hospital based.¹⁵ NAICS 62191 excludes EMS personnel employed in the public sector such as fire departments and other governmental agencies, which represent about 60% of all EMS agencies, as well as hospital-based ambulance services that are estimated to represent about 6% of all EMS agencies.¹⁵ Comparing the number of ambulance services employees reported by Ohio employment data¹⁶ and the number of ambulance services employees covered by OHBWC, we estimated that about 60% of the Ohio employees in NAICS 62191 were covered by OHBWC during 2001-2011.

2.2 | Data coding and processing

NIOSH assigned additional codes based on the injury narratives to facilitate analysis of the injury incidents. Each claim was assigned a BLS Occupational Injury and Illness Classification System (OIICS) version 2.01 event or exposure summary level code¹⁷ based on the narrative text describing the injury incident and the optimal RTW diagnoses

from the claim report. Because a NIOSH-developed auto-coder was used to apply the OIICS codes, the codes were limited to summary level, two digit codes rather than the more detailed four digit codes.¹⁸ These injury event codes are comparable to terminology such as cause, risk factor, hazard, or external mechanism. Following auto-coding, all private ambulance services claims were independently, manually coded by two researchers for quality assurance. Any code discrepancies between the manual and/or auto-codes were adjudicated by the manual coders in order to reach consensus.

A research assistant manually assigned detailed patient handling activity codes from the Occupational Health Safety Network (OHSN), an electronic occupational safety and health surveillance system for the healthcare sector,¹⁹ to all claims where the OIICS event or exposure code indicated the injury occurred from excessive physical effort exerted to move an object or person. In this coding system, the term "transfer" implies the patient is being moved from one surface immediately to another (eg, patient is moved from bed to stretcher). The term "transport" implies the patient is being moved from one location to another via the physical efforts of the ambulance services workers (eg, patient is moved from bedroom to ambulance). Modifications were made to a few of the OHSN codes to accommodate work activities that are unique to EMS and ambulance services and not specified in the existing code descriptions (eg, moving patient by stair chair was added to moving patient by wheelchair; moving patient in or out of an ambulance was added to transport involving moving a patient by stretcher). The codes assigned by the research assistant were reviewed by the primary author and any concerns were adjudicated with the research assistant. During the assignment of these patient handling codes, the research assistant also indicated, as a separate variable, whether the overexertion injury incident indicated the patient involved was excessively heavy. This was determined through the use of qualifiers (eg, obese, overweight, bariatric) and/or through the mention of a specific weight (generally more than 200 pounds) in the narrative. Because this was only identified when it was mentioned in the non-standardized injury narrative, this risk factor was likely underestimated.

Injury narratives for all cases classified as transportation incidents, violent incidents, or slips, trips, and falls were qualitatively reviewed to identify common contributing factors and/or activities specific to each injury event type. Each case was then manually reviewed and coded by a research assistant to indicate whether or not each contributing factor or activity was mentioned in the narrative. These codes were then reviewed by the primary author and any concerns were adjudicated with the research assistant. While these codes cannot be used to identify the precise number of injury factors and descriptors because the injury narrative information is not collected in a standardized way, they do provide a lower bound of the number claims involving each factor or descriptor.

OHBWC-insured WC claims for private employers from 2001 to 2011 were linked with Ohio unemployment insurance (UI) data for each employer.⁸ This allowed the assignment of NAICS codes to each claim and resulted in denominator data for the calculation of rates. The linkage method differed slightly depending on whether the employer

had single or multiple locations. Linkage methodology and other general data processing details can be found in Wurzelbacher et al.⁸

2.3 | Data analysis

All analyses were conducted using SAS version 9.3 (SAS Institute, Inc., Cary, NC). Data used in these analyses were current as of January, 2018. The results are presented as counts, percentages, and rates. Because more than 90% of the claims are for injuries rather than illnesses, data results are referred to as injury claims.

For claims with multiple diagnosis codes, we examined all diagnoses to understand the potential impact of the sole use of the optimal RTW codes. For this analysis, ICD-9-CM codes were grouped into larger diagnosis categories to ensure that highly related diagnoses were not counted more than once for individuals. For example, the category for back sprains/strains included the following ICD-9-CM codes: 846, 847.1-847.9, 739.2-739.4, and 724.1. The diagnoses categories are the same as used in Meyers et al.⁹ Nearly three-quarters of all injured workers (72%) had only one diagnosis category. Of the remaining workers, 19% had two diagnosis categories, 6% had three diagnosis categories, and 3% had four or more diagnosis categories.

Industry-level injury rates are presented per 100 estimated FTE based on the number of hours worked, unlike previous methods that used hours paid.⁸⁻⁹ This accounted more accurately for the varying numbers of hours worked by ambulance service employees. The rate numerator was calculated by pooling together single- and multi-location WC claim data. The rate denominator was prepared using data from the BLS's Labor Productivity and Costs (LPC) programs²⁰ to adjust employee counts from UI data to estimate FTEs.⁸ The LPC adjusted FTEs were also used to classify the employer company size. Denominator data were not available by age and sex. Claims without corresponding quarterly employee counts in the UI data ($N = 11$), claims where the FTE equaled zero ($N = 1$), and claims from multi-location employers that could not be classified into a 5-digit NAICS code ($N = 42$) were excluded from the rate calculations. As a result, there were 5828 claims included in the rate calculations out of the total of 5882 claims.

Permanent total disability and permanent partial disability rates were calculated for all industries in the OHBWC database. The rates were calculated by dividing the number of claims with permanent total disability or permanent partial disability payment types by the number of FTE in each 5-digit NAICS industry. Claims with both payment types were only counted as permanent total disability cases. The resulting rates were ranked for comparison between industries. Claims were also examined by the three cause categories of musculoskeletal disorders; slips, trips, and falls; and other as they were defined in Bertke et al.²¹

2.4 | Human subjects

This research was approved by the NIOSH Institutional Review Board. The requirement for informed consent was waived because the study involved the analysis of previously collected WC data. All data were de-identified.

3 | RESULTS

From 2001-2011 there were a total of 5882 injury claims among private ambulance services industry employees in Ohio resulting in an

average rate of 12.1 per 100 estimated FTE (Table 1). LT injury claims represented nearly one-fifth of all injury claims. Rates varied over the 11 year period, but ultimately dropped a total of 26%, with the greatest decline occurring from 2007 to 2011 (Figure 1).

TABLE 1 Private Ohio ambulance services worker injury claim numbers and rates per 100 estimated FTE by workers' compensation claim type, demographics, employer size, and injury characteristics, 2001-2011

Characteristic	Lost-time injury claims ^a			Medical-only injury claims ^a			Total injury claims		
	N	%	Rate ^b	N	%	Rate ^b	N	%	Rate ^b
Total	1105	100	2.3	4777	100	9.9	5882	100	12.1
Sex									
Male	533	48.2	-	2659	55.7	-	3192	54.3	-
Female	572	51.8	-	2094	43.8	-	2666	45.3	-
Unknown	0	0	-	24	0.5	-	24	0.4	-
Age groups, in years									
<19	5	0.5	-	59	1.2	-	64	1.1	-
20-24	161	14.6	-	998	20.9	-	1159	19.7	-
25-34	394	35.7	-	1969	41.2	-	2363	40.2	-
35-44	313	28.3	-	1059	22.2	-	1372	23.3	-
45-54	150	13.6	-	491	10.3	-	641	10.9	-
55-64	66	6.0	-	166	3.5	-	232	3.9	-
65+	16	1.4	-	32	0.7	-	48	0.8	-
Missing	0	0	-	3	0.1	-	3	0.1	-
Employer size (% workforce employed) ^c									
1-10 (2%)	23	2.1	2.0	58	1.2	4.7	81	1.4	6.7
11-49 (29%)	241	21.8	1.7	787	16.5	5.7	1028	17.5	7.4
50-99 (28%)	317	28.7	2.3	1381	28.9	10.2	1698	28.9	12.5
100-249 (26%)	319	28.9	2.5	1554	32.5	12.3	1873	31.8	14.8
250+ (15%)	205	18.6	2.8	996	20.8	13.8	1201	20.4	16.7
Unknown (0%)	0	0	-	1	0	-	1	0	-
Leading injury events ^{d,e}									
Overexertion involving outside sources (71)	575	52.0	1.2	2116	44.3	4.4	2691	45.7	5.6
Roadway incidents with motorized vehicles (26)	190	17.2	0.4	536	11.2	1.1	726	12.3	1.5
Falls on same level (42)	99	9.0	0.2	284	5.9	0.6	383	6.5	0.8
Struck by object or equipment (62)	24	2.2	0.1	291	6.1	0.6	315	5.4	0.7
Needlesticks (61)	2	0	0.0	308	6.4	0.6	310	5.3	0.6
Leading optimal RTW diagnoses ^e									
Back sprains/strains	340	30.8	0.7	1450	30.4	3.0	1790	30.4	3.7
Arm sprains/strains	109	9.9	0.2	642	13.4	1.3	751	12.8	1.6
Contusions	53	4.8	0.1	623	13.0	1.3	676	11.5	1.4
Leg sprains/strains	91	8.2	0.2	449	9.4	0.9	540	9.2	1.1
Open wounds	5	0.5	0.0	508	10.6	1.0	513	8.7	1.1

^aLost-time injury claims have 8 or more days away from work; medical-only injury claims have 0-7 days away from work.

^bRates are limited to allowed claims that had reliable employee counts for the corresponding policy-year and could be classified into the 5-digit NAICS code of 62191 (lost-time injury claims = 1095; medical-only injury claims = 4733; total injury claims = 5828). Demographic rates were not provided because the denominator data do not include demographic characteristics.

^cBased on estimated FTE calculated from the Ohio unemployment insurance agency.

^dBased on two-digit OIICS injury event codes designated in parentheses.

^eLeading events and diagnoses were identified based on total injury claims only.

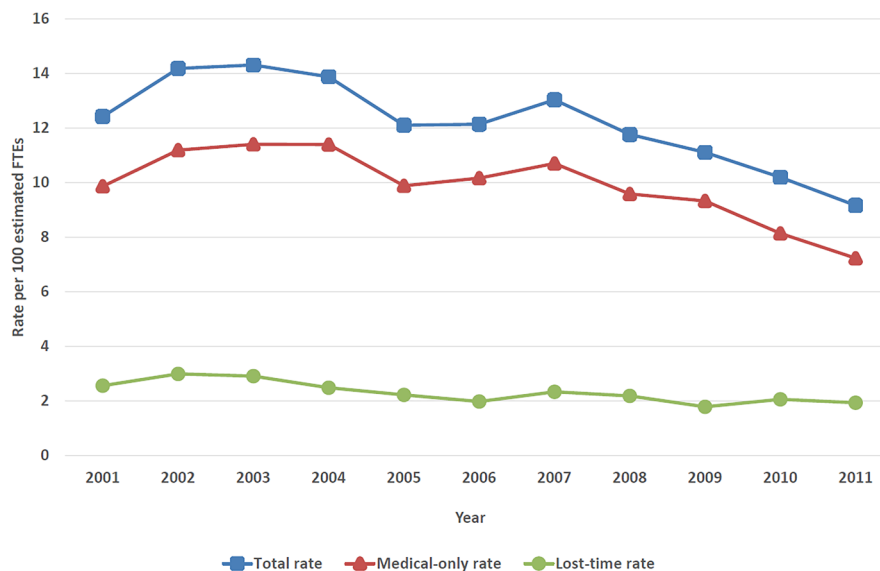


FIGURE 1 Private Ohio ambulance services worker injury claim rates by workers' compensation claim type^a, 2001–2011 [Color figure can be viewed at wileyonlinelibrary.com]. ^aLost-time claims have 8 or more days away from work; medical-only claims have 0–7 days away from work

While the number of LT injury claims were nearly equal for males and females, males accounted for a slightly greater proportion of MO injury claims (Table 1). Workers 34 years-old and younger accounted for 61.0% of all injury claims. They represented a higher proportion of MO injury claims (63.3%) than LT injury claims (50.7%). Conversely, workers 55 years-old and older represented more LT injury claims (7.4%) than MO injury claims (4.1%).

Sprains and strains accounted for 60.1% of all injury claims (data not shown). Specifically, sprains and strains to the back were the leading RTW diagnosis, representing about 30% of LT, MO, and total injury claims (Table 1). Other prevalent RTW diagnoses among all injury claims were contusions (11.5%) and open wounds (8.7%), which were primarily MO injury claims (Table 1). The top five leading LT injury claims, were back sprains and strains (30.8%), disc disorders (11.9%), arm sprains and strains (9.9%), leg sprains and strains (8.2%), and neck sprains and strains (5.5%) (some data not shown). A RTW diagnosis was missing for 5% of all cases ($N = 309$).

The rate for permanent total disability injury claims in private ambulance services (0.029 per 100 estimated FTE) was 1.5 times higher than the average rate for all 5-digit NAICS industries (0.019 per 100 estimated FTE) (data not shown). The permanent total disability rate for private ambulance services ranked higher than 77% of the rates among all industries (data not shown). The rate for permanent partial disability injury claims among private ambulance services (1.23 per 100 estimated FTE) was higher than the rates for 94% of all industries and 2.4 times higher than the average rate for all industries (0.51 per 100 estimated FTE) (data not shown). The primary influencing factors for the high permanent total and permanent partial disability rankings were the high rate rankings for injury claims attributed to musculoskeletal risk factors such as overexertion and repetitive motion and the high incidence of these injury claims within the ambulance services. Musculoskeletal-related injury claims had permanent total and permanent partial disability

rate rankings that were 87 and 96% higher than all other 5-digit NAICS industries.

There were 307 private ambulance services employers in Ohio during 2001–2011. Most employers ($n = 120$) had 11–49 employees. Only five employers had 250 or more employees (data not shown). Most employees were distributed among employers with 11–49 employees (29%), employers with 50–99 employees (28%), and employers with 100–249 employees (26%) (Table 1). Employers with less than 50 employees represented a larger proportion of LT injury claims (23.9%) than MO injury claims (17.7%) (Table 1). A slight upward trend in injury rate was observed with increasing employer size (Table 1). Total injury claim rates differed more substantially by employer size, with a 148% increase in the total injury claim rate from the smallest employers to the largest employers. Total injury claim rates among employers with 100 or more employees were at least double the rates of those with fewer than 50 employees.

3.1 | Injury claims by event

The leading injury events among all injury claims, based on 2-digit OIICS event summary level codes, were overexertion involving an outside source (eg, lifting, pushing, or carrying patients or equipment) (45.7%), motor vehicle roadway incidents (12.3%), same level falls (6.5%), struck by objects or equipment (5.4%), and needlesticks (5.3%) (Table 1). Among LT injury claims, the proportion of overexertion injury claims increased to 52.0%, motor vehicle roadway incidents increased to 17.2%, and same level falls increased to 9.0%. The fourth and fifth leading LT injury claim events became slips and trips without falls (5.0%) and falls to lower levels (3.9%) (data not shown). From 2001–2011, total overexertion injury claim rates declined by 15.6% with the biggest decline occurring between 2007 and 2011 (Figure 2). Total motor vehicle injury claim rates declined by 31.1% with the largest decline occurring between 2003 and 2005 (Figure 2). Total injury claim

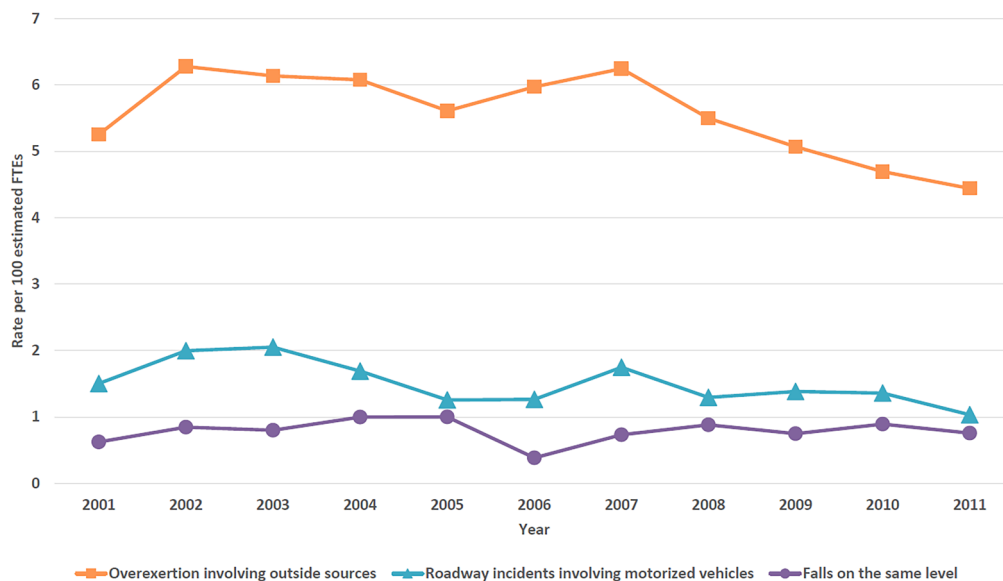


FIGURE 2 Private Ohio ambulance services worker total injury claim rates by leading injury events, 2001–2011 [Color figure can be viewed at wileyonlinelibrary.com]

rates for same level falls exhibited little change beginning at 0.63 per 100 estimated FTE and ending at 0.76 per 100 estimated FTE.

From 2001–2011, overexertion injury claims had an annual average rate of 5.6 per 100 estimated FTE (Table 1). These injury claims involved outside sources, most often patients and/or equipment. Most of these injury claims (85.2%) resulted in sprains and strains (data not shown), 50.1% of which occurred to the back (Table 2). In 30.5% of overexertion injury claims, the narrative injury description specified that the worker was moving an obese, overweight, or heavy patient at the time of injury (data not shown). Additionally, 43.1% of overexertion injury claims indicated that, when the worker was injured, they were transporting a patient via a stretcher or cot (eg, from the home to the ambulance). Most of these narratives specified the use of a cot. Lifting and lowering the cot was considered part of transport.

Fall-related injury claims included same level falls (49.2%), slips or trips without a fall (28.2%), and lower level falls (22.6%) (Table 3). Nearly half of falls resulted in leg sprains or strains, or contusions (Table 3). Non-standardized narrative injury descriptions indicated ice or snow was on the walking surface in 27.3% of falls (data not shown). Another 10.1% involved liquid on the ground, commonly water (data not shown). One-fifth of narratives (20.2%) indicated the worker was moving a patient at the time of injury and 21.8% indicated the fall involved ambulance ingress or egress (data not shown). Finally, 13.5% of fall narratives specified that the worker was going up or down stairs when injured (data not shown).

Injury claims due to motor vehicle incidents include both roadway (eg, highways, streets, and roads) and non-roadway (eg, parking lot and commercial premises) incidents, with 99.2% of these injury claims in private ambulance services classified as roadway incidents. About half of these incidents resulted in sprains and strains of the neck and back (Table 3). Information in the non-standardized injury narratives indicated that at least 54.2% of these incidents involved a collision

with another vehicle (data not shown). Collisions were more commonly indicated in the narratives for LT injury claims (62.0%) compared to the narratives for MO injury claims (51.5%) (data not shown).

Injury claims due to violence were the least common event analyzed with a total of 155 injury claims from 2001 to 2011, ranging from 10 to 21 injury claims reported per year (data not shown). Whereas LT injury claims represented 18.8% of all injury types, only 10.3% of all violence-related injury claims were LT injury claims (data not shown). Violent incidents most commonly resulted in contusions (28.4%), arm sprains and strains (19.4%) and superficial injury claims (13.5%) (data not shown). Non-standardized injury narratives indicated that 85.2% of the perpetrators were patients, 9.0% were someone other than a patient, and 5.8% did not identify the perpetrator (data not shown).

4 | DISCUSSION

From 2001 to 2011, total injury claim rates among ambulance service workers declined as did the total injury claim rates among all industries.⁸ However, the annual total injury claim rates for the private ambulance services ranged from 1.7 to 3 times higher than the annual overall injury claim rates for all private industries,⁸ indicating that despite the decline, injury claims within private ambulance services continued to be high.

We assessed severity based on lost-time injury claims as well as disability indemnity payment rates. Lost-time injury claims were used as a proxy for severe injuries, postulating that these cases are more likely to have greater impact on the worker and the employer as well as they result in higher costs. From 2001 to 2011, the annual lost-time injury claim rates within private ambulance services were at least twice as high as the annual lost-time rates for all private industries.⁸ Likewise, 2015 BLS data indicated that the private ambulance services worker

TABLE 2 Overexertion^a injury claim characteristics of private Ohio ambulance services workers by workers' compensation claim type, 2001-2011

Characteristic	Lost-time injury claims ^b (N = 575)		Medical-only injury claims ^b (N = 2116)		Total injury claims (N = 2691)	
	N	%	N	%	N	%
Sex						
Male	291	50.6	891	42.1	1182	43.9
Female	284	49.4	1216	57.5	1500	55.7
Unknown	0	0	9	0.4	9	0.3
Age groups, in years						
<19	2	0.3	27	1.3	29	1.1
20-24	89	15.5	490	23.2	579	21.5
25-34	220	38.3	891	42.1	1111	41.3
35-44	161	28.0	481	22.7	642	23.9
45-54	69	12.0	176	8.3	245	9.1
65+	27	4.7	41	1.9	68	2.5
Missing	7	1.2	8	0.4	15	0.6
Employer size (% workforce employed) ^c						
1-10 (2%)	5	0.9	11	0.5	16	0.6
11-49 (29%)	106	18.4	278	13.1	384	14.3
50-99 (28%)	155	27.0	596	28.2	751	27.9
100-249 (26%)	189	32.9	737	34.8	926	34.4
250+ (15%)	120	20.9	494	23.3	614	22.8
Leading optimal RTW diagnosed						
Back sprains/strains	226	39.3	1122	53.0	1348	50.1
Arm sprains/strains	67	11.7	478	22.6	545	20.3
Leg sprains/strains	29	5.0	120	5.7	149	5.5
Other sprains/strains	15	2.6	133	6.3	148	5.5
Disc disorders	96	16.7	15	0.7	111	4.1
Leading activities at the time of injury ^{d,e}						
Cot/Stretcher transport ^f	279	48.5	882	41.7	1161	43.1
Patient handling, other	43	7.5	477	22.5	520	19.3
Lateral transfer	51	8.9	225	10.6	276	10.3
Bed or chair transfer	30	5.2	156	7.4	186	6.9
Wheelchair transport	38	6.6	112	5.3	150	5.6
Moving equipment	27	4.7	105	5.0	132	4.9
Transfer, other	80	13.9	30	1.4	110	4.1

^aOverexertion due to outside sources (OIICS = 71).

^bLost-time injury claims have 8 or more days away from work; medical-only injury claims have 0-7 days away from work.

^cBased on estimated FTE calculated from the Ohio unemployment insurance agency.

^dLeading diagnoses and activities were identified based on total injury claims only.

^eLeading activity codes were applied based on information in narrative injury descriptions. They describe the primary activity the worker was performing at the time of injury. These mutually exclusive codes only reflect lower bound estimates as not all activities are clearly reflected in the non-standardized narratives. Lateral transfer code was given priority when narrative stated patient was being moved between two horizontal surfaces, including a bed.

^fMost injury claims in this activity specified use of a cot.

rate for injuries involving at least one day away from work was more than twice that for all private industry workers.⁷

Claims that resulted in permanent total or permanent partial disability payments were also used as indicators for relatively severe

injuries. Private ambulance services had high rates for permanent total disability payments and permanent partial disability indemnity payments among all private industries. This indicates that ambulance services workers are more likely to incur a permanent impairment from

TABLE 3 Fall^a and motor vehicle^b injury claim characteristics of private Ohio ambulance services workers by workers' compensation claim type, 2001-2011

Characteristic	Lost-time fall injury claims (N = 197) ^{a,c}		Total fall injury claims (N = 779) ^a		Lost-time motor vehicle injury claims (N = 192) ^{b,c}		Total motor vehicle injury claims (N = 732) ^{b,c}	
	N	%	N	%	N	%	N	%
Sex								
Male	105	53.3	396	50.8	99	51.6	335	45.8
Female	92	46.7	381	48.9	93	48.4	394	53.8
Unknown	0	0	2	0.3	0	0	3	0.4
Age groups, in years								
<19	1	0.5	8	1.0	1	0.5	10	1.4
20-24	25	12.7	109	14.0	29	15.1	152	20.8
25-34	68	34.5	285	36.6	60	31.3	288	39.3
35-44	53	26.9	192	24.6	57	29.7	168	23.0
45-54	26	13.2	110	14.1	32	16.7	77	10.5
65+	22	11.2	65	8.3	7	3.6	29	4.0
Missing	2	1.0	9	1.2	6	3.0	8	1.1
Employer size (% workforce employed) ^d								
1-10 (2%)	8	4.1	18	2.3	8	4.2	15	2.0
11-49 (29%)	54	27.4	162	20.8	53	27.6	124	16.9
50-99 (28%)	69	35.0	236	30.3	56	29.2	234	32.0
100-249 (26%)	40	20.3	219	28.1	41	21.4	223	30.5
250+ (15%)	26	13.2	144	18.5	34	17.7	135	18.4
Leading optimal RTW diagnoses ^e								
Contusions	17	8.6	187	24.0	12	6.3	129	17.6
Leg sprains/strains	31	15.7	196	25.2	4	2.1	26	3.6
Back sprains/strains	38	19.3	140	18.0	64	33.3	222	30.3
Arm sprains/strains	21	10.7	69	8.9	10	5.2	51	7.0
Leg fractures	13	6.6	23	3.0	5	2.6	7	1.0
Neck sprains/strains	4	2.0	22	2.8	29	15.1	143	19.5

^aIncludes slips and trips without a fall (OIICS = 41; total N = 220), same level falls (OIICS = 42; total N = 383), and falls to a lower level (OIICS = 43; total N = 176).

^bIncludes roadway incidents (OIICS = 26; total N = 726) and nonroadway incidents (OIICS = 27; total N = 6).

^cLost-time injury claims have 8 or more days away from work.

^dBased on estimated FTE calculated from the Ohio unemployment insurance agency. One case of unknown establishment size in total motor vehicle claims was excluded.

^eLeading diagnoses were identified based on total injury claim numbers only.

an injury and, consequently, experience personal productivity loss at work and home²² when compared to workers in other industries. Additionally, given that most work in the private ambulance services industry is physically demanding with limited or no options for light or modified duty work, returning to work after an injury can be challenging.

We found that total injury claim rates among private ambulance services workers increased with increasing employer size. Total injury claim rates among employers with 100 or more FTE were double the rates among employers with less than 50 FTE. From 2012 through 2015, the same pattern was found nationally in data on total

Occupational Safety and Health Administration (OSHA) recordable cases within the private ambulance services industry. Employers of 50-249 employees and 250-999 employees had OSHA recordable rates that were almost double or more than double those of employers with 11-49 employees.⁷ In comparison, total injury claim rates for all Ohio industries exhibited a different pattern by employer size, with the highest rates among employers of 100-250 FTEs followed by employers with 50-100 FTEs.⁸ LT injury claim rates within the private ambulance services industry experienced only a slight increase corresponding with the increase of employer size. This may indicate that private ambulance services workers employed at agencies of

varying sizes are injured at similar rates, but those working for smaller employers are potentially underreporting medical-only injuries. A Canadian study found that injured workers at smaller employers were less likely to file a claim than those who work for large employers.²³ The same study also determined that workers were more likely to submit claims for injuries that required time off from work, offering insight into why the lost-time injury rates among ambulance industry workers exhibited little change among all employer sizes. The observed increase in injury claim rates with increased employer size may also be impacted by the higher call volumes typically experienced among larger employers, resulting in more frequent exposure to injury risk factors.

While all EMS providers are responsible for the care, treatment, and transport of patients, it is important to recognize that the work tasks and hazards vary between the private and public sector workforces. In the largest cities in the U.S., prehospital emergency medical responses are most commonly provided by public sector fire departments.²⁴ Private ambulance services are more likely to be involved in non-emergency transports and critical inter-facility transfers, requiring a specialty level of medical care.²⁵ Thus, while the most common injury incidents are similar to those noted in other studies of the entire EMS workforce,²⁶⁻²⁷ some of the differences in our study may be attributed to the sole capture of ambulance services workers in the private sector.

Like many recent studies of nonfatal injuries to EMS providers,^{10,26-28} the most common injury event among all OHBWC private ambulance services workers was overexertion related to moving patients and/or equipment which most commonly led to back sprains and strains. In our study, we identified that at least 31% of these injury claims were related to lifting heavy patients, possibly related to the increased prevalence of obesity that between 1999 and 2014, affecting more than one-third of U.S. adults.²⁹ Nearly half of the OHBWC claim injury narratives indicated the worker was injured while moving a patient on a cot. Use of electrically powered cots has been shown to decrease injury rates³⁰ and WC claims.³¹ Electrically powered cots are most successful when the cots eliminate all weight-bearing requirements on the part of the EMS worker.³² While powered cots can reduce the potential for worker overexertion when lifting and lowering, and during ambulance loading and unloading, they are also notably heavier than non-powered cots.³³ Consequently, they can increase the injury risk to workers who manually lift them. Powered cots are also not the comprehensive solution to preventing lift injuries as they are generally not used in patient homes if space is tight or stairs are involved. Stretchers, backboards, and stair chairs are used to move patients in their homes and can involve the workers lifting excessive amounts of weight and maneuvering around tight spaces. Unlike public ambulance services where fire fighters may be called upon to assist with lifts, EMS workers in the private ambulance services often must rely solely on themselves and their partner to accomplish patient transfers and transports. Additional research is needed to establish recommendations for safe patient transfer and transport within homes involving stairs and/or tight spaces, with special consideration given to patient handling and transport activities

involving overweight or obese patients. Adding a standard data element to record patient weight in electronic patient care reporting software would facilitate analyzing the linkage between patient weights and EMS lifting injuries and enable monitoring of the effectiveness of injury prevention efforts.

The second most common injury event identified among private ambulance services workers was motor vehicle roadway incidents. These results are similar to a national study that identified such incidents as the third most common nonfatal injury event among private sector emergency medical technicians and paramedics.²⁸ Among both public and private sector EMS workers, motor vehicle roadway incidents are one of the leading causes of fatality, but they are not a leading cause of nonfatal injuries.²⁷ The fact that nearly one-fifth of LT injury claims within the OHBWC private ambulance services data were related to motor vehicle roadway incidents may reflect the relatively high frequency with which critical long- distance inter-facility transfers are assigned to private ambulance services, resulting in a greater proportion of their time on the road. However, other potential contributing factors may include poor ambulance design,³⁴ loose or unrestrained equipment,³⁵ and lack of seat belt use.³⁶ Mitigation strategies include improving ambulance design and increasing use of seat belts.³⁷

Same level falls were the third most common injury event among all injury claims and LT injury claims, with relatively steady rates from 2001 through 2011. Maguire and Smith²⁸ found that same level falls were identified as the second most common injury event resulting in days away from work. We found that slips and trips without falls and lower level falls were the fourth and fifth leading LT injury claim events. With more than one-third of falls in our study involving snow, ice, or some sort of liquid on the walking surface, one prevention strategy is wearing durable, slip resistant footwear.³⁸⁻³⁹ Other strategies for preventing falls on snow and ice are the provision of ice cleats, winter weather email warnings, and bins in ambulances with ice melting chemicals that can be used as needed.⁴⁰ More than one-fifth of fall-related injury claims involved ambulance ingress and egress. A federally sponsored ambulance design guidebook contains engineering recommendations to improve safety during ingress and egress.⁴¹

While our study provides a unique perspective on injuries occurring to workers in the private ambulance services industry, it also has several limitations. First, the focus was on workers in NAICS code 62191 and did not include EMS providers in fire department and hospital-based services. Second, detailed claims-level data on large private employers who chose to self-insure were not available. Third, capturing data based on industry rather than occupation results in inclusion of workers beyond direct care providers. Fourth, the use of WC data limits the data to injuries requiring more than first aid and does not include any injuries for which a claim was not approved or not filed. Work-related injuries may not be filed through workers' compensation for multiple reasons, including fear of repercussions on the job, lack of benefits to cover lost work time, lack of understanding of the workers' compensation system, and directives received from employers.⁴² More specific to EMS workers, incidents may not be filed because some workers treat themselves or seek

informal treatment from colleagues. Fifth, the best available data to enumerate the Ohio private ambulance services industry does not capture worker demographics, prohibiting the interpretation of proportional demographic injury data relative to population data. Finally, our methods for rate calculations (ie, denominator adjustment, FTE estimation, pooling single-, and multiple-location) may have affected injury claim rate estimates. Previous sensitivity analyses indicate that the impact on the industry FTE estimates and, consequently, the rates was likely to be relatively minor.⁸ However, the use of FTE estimates limits the ability to truly ascertain worker risk based on exposure (eg, number of calls).

5 | CONCLUSIONS

A previous study showed that workers in the private ambulance services industry are at high risk for injury as evidenced by total and LT injury claim rates that are higher than the claim rates for all industries combined.⁸ Our study found that sprains and strains are the most common diagnosis and overexertion from lifting patients and equipment is the most common injury event. Prevention of these injuries could be addressed by improving patient transfer and transport equipment as well as patient handling techniques and procedures. Other common injury events that deserve focused prevention efforts are motor vehicle roadway events and falls.

Ultimately preventing injuries among these workers is a crucial step in preserving and growing a workforce that is anticipated to have faster than average employment growth.⁴³ Analysis of data such as workers' compensation claims identifies opportunities for preventing similar injuries. However, it is also important that employers actively monitor worker injuries and near misses within their own agencies to help effectively target and monitor prevention efforts.

AUTHORS' CONTRIBUTIONS

Conception of the work and methods development: CW, SJW, IST, PTB, ARM, AAR, SK; data acquisition: DCR, MPL, SJW, IST; data analysis and interpretation: SK, CT, AAR, SJW; drafting initial manuscript: CW, AAR, SK; led co-author and peer review process: AAR; all authors participated in the development and editing of the manuscript or providing critical revisions to important intellectual content; and all authors agree to be accountable for all aspects of the work.

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DISCLOSURE (AUTHORS)

The authors declare no conflicts of interest.

DISCLOSURE BY AJIM EDITOR OF RECORD

Steven B. Markowitz declares that he has no competing or conflicts of interest in the review and publication decision regarding this article.

DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

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