

Occupational injuries and illnesses among law enforcement officers, 2001–2019: Findings from the Ohio Bureau of Workers' Compensation

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Abstract

Background: Occupational injuries are common among law enforcement officers (LEOs) and can impact an agency's ability to serve communities. Workers' compensation (WC) data are an underutilized source for occupational injury surveillance in the law enforcement field.

Methods: LEOs WC claims from the Ohio Bureau of Workers' Compensation (OHBWC) from 2001 to 2019 were identified based on manual review of the occupation title and injury description. Worker, employer, incident, and injury characteristics were described by claim type—medical-only (MO) and lost-time (8 or more days away from work). Data are presented using injury claim counts.

Results: From 2001 to 2019, 50,793 WC claims were identified among Ohio LEOs. Of these, 68% were MO claims ($n = 34,622$). WC claims significantly decreased over the 19-year period ($p < 0.001$). Seventy-five percent of WC claims were from a LEO with more than one claim and of these, 34% were from a LEO with five or more claims during the study period. Male officers and those aged 25–54 years incurred the highest proportion of total claims (87.8% & 91.8%, respectively). Violence ($n = 17,247$; 34%), falls/slips/trips ($n = 9079$; 17.9%), and transportation events ($n = 7977$; 15.7%) were the leading events. Among the 50,793 claims, there were 79,637 unique clinical diagnosis groups. The most common injury diagnoses were sprains ($n = 32,796$; 41.2%) followed by contusions ($n = 13,529$; 17%).

Conclusions: Results can guide the development or improvement of workplace injury prevention strategies for LEOs. Efforts should be focused on better understanding and preventing violent injury events and sprains among LEOs, as well as preventing multiple injury events.

KEY WORDS

injuries, law enforcement officer, occupational safety and health, surveillance, workers' compensation

1 | INTRODUCTION

National occupational injury data sources consistently show law enforcement officers (LEOs) to be at high risk for both fatal and nonfatal injuries while on-duty. Protective service occupations (which includes LEOs) had a 32% increase in occupational fatalities between 2020 and 2021, with nearly half of the fatalities being homicides.¹ LEOs also have one of the highest nonfatal occupational injury rates of all US workers (584.2 per 100,000 full-time equivalents [FTEs]).² For comparison, the injury rate for all US workers was 120.7 per 100,000 FTEs.²

LEOs perform a wide range of occupational tasks that put them at an increased risk for an occupational injury. Physically strenuous activities such as foot pursuits or restraining uncooperative suspects may be associated with musculoskeletal sprains and strains—especially to the knee or shoulder.^{3,4} LEOs are also at risk for low back pain, which may be attributed to spending long periods of time in their patrol cars or due to load carriage.^{5,6} LEOs may be required to wear a range of items on their bodies including body armor, duty belts, baton, firearm, and handcuffs, weighing between 3 and 15 kg, that could also increase their risk for injury.⁷

On-duty injuries can impact LEOs, their fellow officers, their agencies, as well as the general public. Among LEOs, these injuries can be associated with pain, financial costs, increased risk for reinjury, reduction in functional abilities and occupational task performance, and even a shortened law enforcement career.⁸⁻¹⁰ On-duty injuries can also impact other officers. If a LEO is injured and required to miss work, this may require fellow officers to complete additional shifts, thereby increasing their risk for injury, potentially when already fatigued.^{11,12} At the agency level, on-duty injuries can lead to higher workers' compensation (WC) claim costs.^{13,14} On-duty injuries can also reduce an agency's ability to support and serve the public. Decreases in officers' physical performance or in the number of officers available could potentially lead to reduced protection and even public harm.^{15,16} For these reasons, efforts towards studying, understanding, and ultimately preventing on-duty injuries among LEOs should be expanded and strengthened.

The current study analyzed a single state's (WC claims for LEOs to describe the magnitude and characteristics of their occupational injuries. The Ohio Bureau of Worker's Compensation (OHBWC) is one of four exclusive state-funded WC systems in the United States. To date, there are only a handful of studies utilizing WC data to characterize occupational injuries among LEOs.^{13,17,18} These studies have limitations or are becoming outdated. While one recent analysis of OHBWC data examined injuries among Ohio's first responders, it was limited to musculoskeletal disorders.¹⁹ The current study builds upon that research by more broadly describing WC injury claims among LEOs in the state of Ohio.

2 | MATERIALS AND METHODS

2.1 | Ohio Bureau of Worker's Compensation Claims Data

The OHBWC is an exclusive state-run WC system and insures two-thirds of Ohio employers. Large employers (generally with 500 or more employees) may choose to be insured by OHBWC or may self-insure. Approximately 257,000 public and private employers are insured through the OHBWC, making it the largest state-run insurance system in the United States.²⁰ The National Institute for Occupational Safety and Health (NIOSH) has a formal agreement with the OHBWC to analyze WC data for research and surveillance of occupational injuries within Ohio.²¹ The agreement includes deidentified OHBWC WC claims data with variables on employee demographics, injury or illness diagnoses, employer characteristics, claim history, industry, location, industry type, and injury/illness narratives.²¹ This research was reviewed by the Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy.

2.2 | LEO WC claim identification

Data analyzed in this study included accepted WC claims for public LEOs (state and local) from 2001 to 2019. LEO cases were selected using a stepwise process. First, a definition and specific exclusion criteria were developed. The LEO definition for this study included those occupations that normally carried a firearm, had full arrest powers, and could be considered "sworn." Occupational titles falling under this definition can vary from jurisdiction to jurisdiction. Using the Westlaw legal database, a two-step methodology was used to search the Ohio Revised Code and Administrative Code for occupational titles listed in WC claims and their variations. This was followed by an in-depth analysis of the descriptions provided by the statutory law referencing the occupational titles and their commensuration with the LEO definition used for the study. Exclusions in this study included: auxiliary officers, probation officers, parking enforcement officers, bailiffs, crossing guards, motor carrier officers, security guards, cadets/trainees/recruits, correctional officers, and any non-sworn individuals such as dispatchers and law enforcement agency administrative personnel. Officers under 21 years of age were also excluded from the analysis sample.

After the definition and exclusion criteria were developed, the occupation free text fields were manually reviewed for LEO titles that fall into common LEO job titles: "Police," "Sheriff," "Trooper," or "Detective." These cases were considered LEOs and included in the final data set for analysis. This claim identification step resulted in 48,818 claims. For the remaining WC claims, the accident text variable was searched using a predetermined list of common LEO work activity words such as "arrest," "resist," "chase," "pursuit," "suspect," "patrol, and

"apprehend." If the accident text variable included one of these LEO work activity terms, the case was manually reviewed by at least two coauthors with subject matter expertise and included if it appeared to be a LEO. This final step was taken to ensure that the sample for analysis included all LEOs, even those that had nonspecific information for the occupation name. This claim identification step resulted in an additional 1975 claims. During the case identification process, any questionable or unclear cases were reviewed by two coauthors before including the case in the analysis sample.

2.3 | Variable definitions

Both medical-only (MO) and lost-time (LT) injury claims were included in this analysis. LT claims are defined in Ohio as those requiring the worker to spend 8 or more days away from work. MO claims are those requiring 7 or fewer days away from work or those involving medical treatment only (with no time away from work). LT claims are generally considered to be a greater severity injury event than MO claims.

One variable included in this analysis was the leading injury event or exposure. WC claim incident narratives were auto-coded into two-digit event or exposure codes using the Bureau of Labor Statistics (BLS) Occupational Injury and Illness Classification System (OIICS, 2.01).²² This was performed using a NIOSH developed machine-learning auto-coder that has been previously described.²³ The auto-coding approach has recently been improved and been shown to have an overall positive predictive value (PPV) of 93% in applying one-digit event or exposure codes and 82% in applying two-digit codes.²⁴ To further increase the accuracy, LT claims with bottom 7% of auto-coder probability scores or financial costs above the 95th percentile were manually reviewed. This additional step improves the overall PPV to 95% at the one-digit level and 85% at the two-digit level.²⁴

Another variable included in this analysis is type of injury incurred by the LEO. A set of 57 mutually exclusive clinical diagnosis groups, such as sprains to the back, were previously developed using the International Classification of Diseases, Ninth and Tenth Revision, Clinical Modification (ICD-9-CM, ICD-10-CM) diagnosis codes by the OHBWC and NIOSH.^{24,25} These methods have recently been updated.²⁶ Each clinical diagnosis group was counted once per claim, but more than one distinct diagnosis group can be assigned to a single claim. For example, a LEO may have incurred both a knee sprain and upper extremity fracture in a single event. For this study, clinical diagnosis groups that represented <1% of all WC LT claims were collapsed into "All Other" group.

2.4 | Statistical analyses

All statistical analyses were conducted using SAS (V9.4). Because of the lack of valid LEO employee counts, injury rates were not calculated. All results are expressed as the occurrence of claims for the time period under study (2001–2019). Descriptive analyses were first used to

describe the frequency of claims by year, clinical diagnosis groups, and injury event or exposure. Descriptive analyses were also used to describe claimant demographics including gender and age. All results were stratified by type of claim (LT vs. MO). Poisson regression was then performed on the population of Ohio LEO claims to highlight differences over time for the number of claims by year and claim type.

3 | RESULTS

3.1 | Counts and demographics of Ohio LEO WC claims

From 2001 to 2019, there were a total of 50,793 identified WC claims among Ohio LEOs (Table 1). From 2001 to 2019, the number of total claims significantly decreased by 37% ($p < 0.001$). LT claims significantly decreased by 43% ($p < 0.001$), and MO claims decreased by 33.9% ($p < 0.001$) (Figure 1). MO claims represented over two-thirds of all WC claims (68.2%) (Table 1). Seventy-five percent of claims were from a LEO with more than one claim during our study period. Of those, 34% were from a LEO who had five or more claims during the study period. This is stark comparison to non-LEOs. For comparison purpose, among non-LEO WC claims, 55% were from a worker with more than one claim. And of these, 22% were from a worker who had five or more claims.

Male officers incurred the highest proportion of total claims (87.8%). Officers between 25 and 54 years old accounted for 91.8% of all claims. The majority of claims resulted from violence and other injuries by persons or animals (34%), followed by falls/slips/trips (17.9%), and transportation incidents (15.7%). Violence and other injuries by persons or animals were also a leading cause of LT claims (28.9%).

3.2 | Demographic characteristics of Ohio LEO WC claims by injury event

Table 2 displays the demographic characteristics of Ohio LEO WC claims by event or exposure. For both male and female LEOs, violence from persons or animals were the leading cause of injury claims (34.5% and 30.1%, respectively). For LEOs aged 21–54 years, violence from persons or animals was also the leading cause for a WC claim. However, for LEOs older than 55 years of age, falls/slips/trips were the leading cause of a WC claim. As the age of LEOs increased, so did the proportion of WC claims due to falls/slips/trips. In comparison, as the age of LEOs increased, the proportion of WC claims due to violence from person or animals gradually decreased.

3.3 | Ohio LEOs clinical diagnosis groups by claim type

Table 3 displays the distribution of Ohio LEO WC claims by claim type and clinical diagnosis groups. For the 50,793 LEO WC claims

TABLE 1 Sociodemographics and injury event of Ohio LEOs with a workers' compensation claim by claim type: OHBWC, 2001–2019.

Characteristics	Lost-time claims N (%)	Medical-only claims N (%)	Total claims N (%)
Gender ^a			
Female	1988 (12.3)	3861 (11.2)	5849 (11.5)
Male	14,152 (87.5)	30,439 (87.9)	44,591 (87.8)
Unknown	31 (0.2)	319 (0.9)	350 (0.7)
Age group			
21–24	271 (1.7)	1757 (5.1)	2028 (4.0)
25–34	5012 (31.0)	13,869 (40.1)	18,881 (37.2)
35–44	6574 (40.7)	11,891 (34.3)	18,465 (36.4)
45–54	3488 (21.6)	5775 (16.7)	9263 (18.2)
55–64	778 (4.8)	1229 (3.6)	2007 (4.0)
65 and over	48 (0.3)	101 (0.3)	149 (0.3)
Event or exposure			
Violence and other injuries by persons or animals	4667 (28.9)	12,580 (36.3)	17,247 (34.0)
Transportation incidents	3285 (20.3)	4692 (13.6)	7977 (15.7)
Fires and explosions	28 (0.2)	298 (0.9)	326 (0.6)
Falls, slips, trips	3563 (22.0)	5516 (15.9)	9079 (17.9)
Exposure to harmful substances or environments	138 (0.9)	1529 (4.4)	1667 (3.3)
Contact with objects or equipment	945 (5.8)	5385 (15.6)	6330 (12.5)
Overexertion and bodily reaction	3420 (21.1)	4384 (12.7)	7804 (15.4)
Nonclassifiable	125 (0.8)	238 (0.7)	363 (0.7)
Total	16,171 (31.8)	34,622 (68.2)	50,793 (100)

Abbreviation: OHBWC, Ohio Bureau of Workers' Compensation.

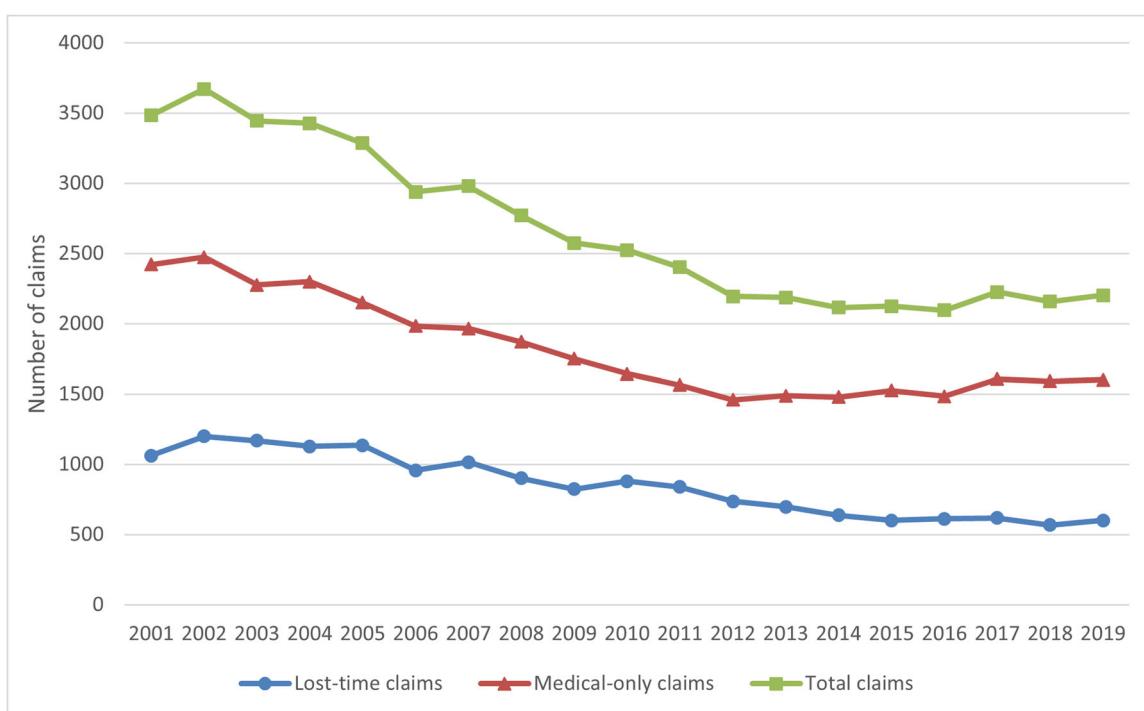
^aDoes not add to total because of missing values.**FIGURE 1** Workers' compensation claims counts among Ohio law enforcement officers by claim type and year: OHBWC, 2001–2019. OHBWC, Ohio Bureau of Workers' Compensation.

TABLE 2 Sociodemographics of Ohio LEOs with a workers' compensation claim by selected injury event; OHBWC, 2001–2019.^a

	Violence from persons or animals N (%)	Transportation N (%)	Falls, slips, trips N (%)	Exposure to harmful substances N (%)	Contact with objects or equipment N (%)	Overexertion and bodily reaction N (%)	Total N
Gender							
Female	1760 (30.1)	951 (16.3)	1270 (21.7)	210 (3.6)	746 (12.8)	849 (14.5)	5849
Male	15,359 (34.4)	6967 (15.6)	7759 (17.4)	1442 (3.2)	5526 (12.4)	6916 (15.5)	44,591
Unknown	125 (35.7)	59 (16.9)	50 (14.3)	15 (4.3)	58 (16.6)	39 (11.1)	350
Age group							
21–24	782 (38.6)	359 (17.7)	262 (12.9)	98 (4.8)	272 (13.4)	227 (11.2)	2028
25–34	7187 (38.1)	3010 (15.9)	2873 (15.2)	678 (3.6)	2493 (13.2)	2379 (12.6)	18,881
35–44	6131 (33.2)	2801 (15.2)	3420 (18.5)	545 (3)	2247 (12.2)	3075 (16.7)	18,465
45–54	2625 (28.3)	1449 (15.6)	1946 (21)	266 (2.9)	1073 (11.6)	1781 (19.2)	9263
55–64	492 (24.5)	334 (16.6)	531 (26.5)	67 (3.3)	226 (11.3)	330 (16.4)	2007
65+	30 (20.1)	24 (16.1)	47 (31.5)	13 (8.7)	19 (12.8)	12 (8.1)	149
Total ^b	17,247 (34)	7977 (15.7)	9079 (17.9)	1667 (3.3)	6330 (12.5)	7804 (15.4)	50,793

Abbreviations: LEO, law enforcement officers; LT, lost-time; MO, medical-only; OHBWC, Ohio Bureau of Workers' Compensation.

^aBoth MO and LT claims included.

^bRow counts do not add to total because fires and explosions and unclassifiable are removed from the table.

identified in the study, there were 79,637 unique clinical diagnosis groups/claimant assignments, so that on average, a single LEO WC claim resulted in 1.57 clinical diagnosis groups (SD = 1.04). There were 34,388 diagnosis group assignments for the 16,171 LT WC claims and 45,249 codes assignments for the 34,622 MO WC claims. Overall, 41.2% of all LEO WC claims included a sprain and 17% included a contusion. More specifically, the two leading injury diagnoses were upper extremity strains (11.5%), followed by lower extremity sprains (10.6%). Sprains, contusions, open wounds, and superficial injuries were more commonly MO claims whereas sprains and musculoskeletal and connective tissue diseases were commonly LT claims.

3.4 | LT claims: Ohio LEOs clinical diagnosis groups by injury event

Table 4 displays the distribution of LT WC claims by selected injury event and clinical diagnosis groups. Violence and other injuries by persons or animals caused 27.4% of LT WC injuries. In these, the most common injury diagnosis groups were sprains (40.8%), followed by contusion (14.8%), and diseases of musculoskeletal and connective tissue (14.0%). More than a quarter of LT WC injuries were caused by a transportation incident (28.3%). In these, the three most common diagnoses were sprains (50.8%), contusions (12.4%), and diseases of musculoskeletal and connective tissue (11.4%). About a quarter of LT WC injuries were due to falls/slips/trips (22%). In these, the three most common diagnosis groups were sprains (48.4%),

diseases of musculoskeletal and connective tissue (16.4%), and contusions (13.9%).

About 4.4% of LT WC injuries were caused by contact with objects or equipment. The most common injury diagnosis was also sprains (24.7%). Finally, overexertion and bodily reaction events caused 16.6% of all LT WC injuries. The most common clinical diagnosis was also sprains (58.7%). The three most common LT WC injuries were lower extremity sprains due to overexertion injuries (21.2%), neck strains due to transportation events (17.7%), and contusions due to contact with objects or equipment (16.8%).

4 | DISCUSSION

This research provides a description of WC claims among Ohio LEOs from 2001 to 2019. The number of claims, both LT and MO, decreased significantly over the 19-year timeframe. Over two-thirds of the claims were due to three causes: violence by persons or animals, falls/slips/trips, and transportation incidents. Older officers had more WC claims for falls/slips/trips and younger officers had more violence claims. Overall, just over 40% of claims included a sprain. Seventy-five percent of claims were from a LEO with more than one claim during our study period compared to 55% among non-LEO claims.

The research findings reveal a significant decline in the frequency of LT, MO, and total claims among LEOs, which is consistent with other OHBWC-based studies of first responders such as firefighters and ambulance service workers.^{27,28} The observed decreasing trend

TABLE 3 Number and percentage of injured Ohio LEOs clinical diagnosis groups by claim type; OHBWC, 2010–2019.

Clinical diagnosis groups ^a	Lost-time claims N (%)	Medical-only claims N (%)	Total claims N (%)
Sprains ^a	16,275 (47.3)	16,521 (36.5)	32,796 (41.2)
Sprains—upper extremity	4213 (12.3)	4910 (10.9)	9123 (11.5)
Sprains—lower extremity except knee	3890 (11.3)	4579 (10.1)	8469 (10.6)
Sprains—back	3558 (10.3)	3232 (7.1)	6790 (8.5)
Sprains—neck	2652 (7.7)	2648 (5.9)	5300 (6.7)
All other sprains ^b	1962 (5.7)	1152 (2.5)	3114 (3.9)
Diseases of musculoskeletal & connective tissue (CT)	5139 (14.9)	1040 (2.3)	6179 (7.8)
Soft tissue/enthesisopathy	1902 (5.5)	702 (1.6)	2604 (3.3)
Disc disorders and spinal stenosis	1300 (3.8)	106 (0.2)	1406 (1.8)
Diseases of musculoskeletal & CT NEC	997 (2.9)	115 (0.3)	1112 (1.4)
All other diseases of musculoskeletal & CT ^c	940 (2.7)	117 (0.3)	1057 (1.3)
Contusion with intact skin surface	4109 (11.9)	9420 (20.8)	13,529 (17.0)
Fractures	2264 (6.6)	1000 (2.2)	3264 (4.1)
Fracture—upper extremity	982 (2.9)	551 (1.2)	1533 (1.9)
Fracture—lower extremity	757 (2.2)	180 (0.4)	937 (1.2)
All other fractures ^d	525 (1.5)	269 (0.6)	794 (1)
Superficial injury	1232 (3.6)	4803 (10.6)	6035 (7.6)
Open wounds NEC	1218 (3.5)	6662 (14.7)	7880 (9.9)
Intracranial injury	494 (1.4)	371 (0.8)	865 (1.1)
Mental, behavioral, neurodevelopmental disorders NEC	447 (1.3)	8 (<0.1)	455 (0.6)
Diseases of the nervous system and sense organs NEC	398 (1.2)	420 (0.9)	818 (1.0)
Dislocation	382 (1.1)	191 (0.4)	573 (0.7)
All other ^e	2430 (7.1)	4813 (10.6)	7243 (9.1)
Total	34,388 (43.2)	45,249 (56.8)	79,637 (100)

Abbreviations: LEO, law enforcement officers; OHBWC, Ohio Bureau of Workers' Compensation.

^aClinical diagnosis groups were ordered based on the number of lost-time clinical diagnosis groups.

^bIncludes knee sprains or tears and sprain, NEC.

^cIncludes joint disorders, knee derangements, spinal osteoarthritis, congenital abnormalities NEC, perinatal conditions.

^dIncludes fractures of neck and trunk, head, and fractures, NEC.

^eIncludes carpal tunnel syndrome; other and unspecified effects of external cause NEC; diseases of the circulatory system NEC; mental disorders from brain damage; hernia; cellulitis or abscess; internal or blood vessel injuries NEC; injury to nerves & spinal cord; diseases of the respiratory system NEC; complications of surgical & medical care NEC; symptoms, signs, abnormal clinical or laboratory findings NEC; crushing injury; burn; diseases of the digestive systems NEC; poisoning & toxic effects; diseases of the skin & subcutaneous tissue NEC; infectious & parasitic diseases; acute myocardial infarction/heart failure; diseases of the genitourinary system; amputation; pneumoconiosis, resp. cond. due to external agents; contact dermatitis & eczema; endocrine, nutritional & metabolic diseases; foreign body, eye; neoplasms; diseases of the blood & blood-forming organs; congenital spondylolisthesis; foreign body, not eye; unknowns.

among LEOs is also likely indicative of an overall decline in claim counts and rates within the OHBWC database.^{25,29} A similar decline in occupational injury counts and rates over time has also been noted using national data sources including the BLS SOII data.² Though, another possible reason for the decline in claim counts is a possible decrease in sworn LEOs in the state of Ohio. A national agency survey by the Police Executive Research Forum in 2022 found that across the US, agencies are losing officers faster than they can hire

new ones, and total sworn staff is significantly declining.³⁰ A 2019 survey by the International Association of Chiefs of Police found that 25% of agencies were forced to reduce or eliminate policing units and positions because of recruiting difficulties.³¹

Injury rates could not be calculated due to the lack of reliable employment data for LEOs in the state of Ohio. In the state of Ohio, the OHBWC does not insure all Ohio law enforcement agencies, such that using statewide LEO employment estimates would not be

TABLE 4 Number and percentage of injured Ohio LEOs lost-time clinical diagnosis groups (N = 34,464) by injury event; OHBWC, 2010–2019.^a

Clinical diagnosis groups	Violence from persons or animals N (%)	Transportation incidents N (%)	Falls/slips/trips N (%)	Contact with objects or equipment N (%)	Overexertion & bodily reaction N (%)
Sprains	3849 (40.8)	4937 (50.8)	3672 (48.4)	369 (24.7)	3342 (58.7)
Sprains—upper extremity	1592 (16.9)	880 (9.1)	838 (11.1)	129 (8.6)	747 (13.1)
Sprains—lower extremity except knee	769 (8.2)	477 (4.9)	1305 (17.2)	107 (7.2)	1205 (21.2)
Sprains—back	600 (6.4)	1616 (16.6)	641 (8.5)	43 (2.9)	634 (11.1)
Sprains—neck	424 (4.5)	1724 (17.7)	317 (4.2)	46 (3.1)	126 (2.2)
All other sprains ^b	464 (4.9)	240 (2.5)	571 (7.5)	44 (2.9)	630 (11.1)
Diseases of musculoskeletal and connective tissue	1317 (14.0)	1109 (11.4)	1243 (16.4)	163 (10.9)	1274 (22.4)
Soft tissue/enthesopathy	553 (5.9)	295 (3)	467 (6.2)	80 (5.3)	498 (8.7)
Disc disorders and spinal stenosis	253 (2.7)	481 (5)	246 (3.2)	20 (1.3)	292 (5.1)
Diseases of musculoskeletal and connective tissue NEC	240 (2.5)	177 (1.8)	280 (3.7)	32 (2.1)	257 (4.5)
All other diseases of musculoskeletal and connective tissue ^c	271 (2.9)	156 (1.6)	250 (3.3)	31 (2.1)	227 (4.0)
Contusion with intact skin surface	1399 (14.8)	1207 (12.4)	1055 (13.9)	252 (16.8)	160 (2.8)
Fractures	811 (8.6)	531 (5.5)	574 (7.6)	138 (9.2)	192 (3.4)
Fracture—upper extremity	501 (5.3)	113 (1.2)	230 (3)	95 (6.4)	34 (0.6)
Fracture—lower extremity	165 (1.8)	163 (1.7)	249 (3.3)	28 (1.9)	147 (2.6)
All other fractures ^d	145 (1.5)	255 (2.6)	95 (1.3)	15 (1)	11 (0.2)
Superficial injury	458 (4.9)	400 (4.1)	256 (3.4)	69 (4.6)	34 (0.6)
Open wounds NEC	546 (5.8)	265 (2.7)	114 (1.5)	250 (16.7)	19 (0.3)
Intracranial injury	94 (1)	320 (3.3)	56 (0.7)	16 (1.1)	1 (<0.1)
Mental, behavioral, and neurodevelopmental disorders NEC	134 (1.4)	152 (1.6)	74 (1)	7 (0.5)	62 (1.1)
Diseases of the nervous system and sense organs NEC	105 (1.1)	116 (1.2)	58 (0.8)	22 (1.5)	56 (1.0)
Dislocation	139 (1.5)	62 (0.6)	110 (1.5)	16 (1.1)	53 (0.9)
All other ^e	572 (6.1)	616 (6.3)	370 (4.9)	194 (13)	499 (8.8)
Total	9424 (27.4)	9715 (28.3)	7582 (22.0)	1496 (4.4)	5692 (16.6)

Abbreviations: LEO, law enforcement officers; NEC, not elsewhere classified; OHBWC, Ohio Bureau of Workers' Compensation.

^aClinical diagnosis groups were ordered based on the number of lost-time clinical diagnosis groups.

^bIncludes knee sprains or tears and sprain, NEC.

^cIncludes joint disorders, NEC, knee derangements, spinal osteoarthritis, and congenital abnormalities NEC and perinatal conditions.

^dIncludes fractures of neck and trunk, head, and fractures, NEC.

^eIncludes carpal tunnel syndrome; other and unspecified effects of external cause NEC; diseases of the circulatory system NEC; mental disorders from brain damage; hernia; cellulitis or abscess; internal or blood vessel injuries NEC; injury to nerves and spinal cord; diseases of the respiratory system NEC; complications of surgical and medical care NEC; symptoms, signs, abnormal clinical, or laboratory findings NEC; crushing injury; burn; diseases of the digestive systems NEC; poisoning and toxic effects, medical or nonmedical; diseases of the skin and subcutaneous tissue NEC; infectious and parasitic diseases; acute myocardial infarction/heart failure; diseases of the genitourinary system; death, cause unknown; amputation; pneumoconiosis, resp. cond. due to external agents; contact dermatitis and other eczema; endocrine, nutritional and metabolic diseases; foreign body, eye; neoplasms; diseases of the blood and blood-forming organs; congenital spondylolisthesis; foreign body, not eye; and unknowns.

accurate. Also, in other statewide databases, employee counts for agencies include both sworn and non-sworn employees, again making potential counts inaccurate. Therefore, it must be noted that the extent to which the observed decrease in injury claim counts among LEOs represents an actual reduction in injuries remains unclear. While the reduction in claims suggests a potential positive trend in occupational safety, additional research is needed to explore the underlying factors that contributed to this trend.

Our study found that sprains accounted for 41% of all diagnoses among LEOs, aligning with a Kentucky WC analysis that also reported sprains and strains as the leading type of injury among public LEOs (47%).¹⁸ Similarly, several non-WC studies have consistently reported sprains and strains as a leading injury among LEOs, with proportions ranging from 30% to 60%.^{3,32-37} Although this study could not always determine the specific work task at the time of injury, Tiesman et al. reported that officers commonly incur sprains and strains while chasing, detaining, arresting, or pursuing suspects.³ Other activities that can lead to occupational sprains include running, jumping, climbing, repetitive movements like handcuffing, prolonged equipment operation, and working in challenging environmental conditions such as uneven terrain and adverse weather.³⁸

Research suggests that higher levels of physical fitness are associated with a reduced risk of musculoskeletal injuries among LEOs.^{16,39-41} Thus, law enforcement agencies could consider implementing exercise programs and providing athletic trainers to support LEOs in maintaining their physical fitness, enabling them to safely carry out their duties and better serve their communities. These programs have shown potential benefits in preventing injuries. A supervised employer-based minimal exercise program for LEOs resulted in improved physical fitness over a 6-month timeframe.⁴² These programs can also significantly reduce costs related to injury treatment, time loss, and labor. A small city reported savings of nearly \$900,000 over a 5-year period by employing an athletic trainer for police and fire.⁴³ Similarly, an agency in Fairfax reported an 86% reduction in medical care costs related to musculoskeletal injuries with the help of athletic trainer services.⁴⁴

This analysis also showed that violence-related injuries remains a significant issue for LEOs, identifying violence as the leading injury event for both MO (36.3%) and LT (28.9%) claims during the study period. For comparison, only 2.5% of LT claims from private industry employers in the OHBWC database were violence-related.²⁹ These results are consistent with data from prior studies that describe nonfatal injuries resulting from workplace violence among LEOs. An analysis of data obtained from the Work Supplement of the National Electronic Injury Surveillance System (Work-NEISS) estimated that 669,100 LEOs were treated in US emergency departments for nonfatal injuries between 2003 and 2014 with the leading injury event being assaults and violent acts.³⁶ The Federal Bureau of Investigation's (FBI's) Law Enforcement Officers Killed and Assaulted (LEOKA) database, a system that relies upon voluntary reporting, identified that over a million local, state, and tribal LEOs were assaulted while performing their duties between 2001 and 2019 ($n = 1,065,200$).⁴⁵ Of this number, approximately 28% of the assaults

resulted in injuries ($n = 297,817$).⁴⁵ Finally, a recent government report using data from five national surveillance systems reported that LEOs had one of the highest average annual rates of nonfatal workplace violence of all occupations at 82.9 per 1000 workers.⁴⁶ Only correction officers and security guards had higher rates.⁴⁶

These results could assist in the development or improvement of current workplace injury prevention strategies for LEOs. More specifically, efforts towards a better understanding and prevention of violence-related injuries and musculoskeletal injuries should be made. First, the International Association of Police Chiefs maintains and offers several resources related to the reduction of violence against police. These resources include best practices, procedures, and model policies for preventing and mitigating the risk of death and injury of LEOs.⁴⁷ Law enforcement leaders could also consider injury prevention training funded by the Bureau of Justice Assistance such as the Violence Against Law Enforcement Officers and Ensuring Officer Resilience and Survivability (VALOR) initiative.

In addition, the OHBWC and the Ohio Attorney General offer safety grants to Ohio law enforcement agencies to support efforts to reduce occupational injuries. OHBWC offers Safety Intervention Grants to assist law enforcement agencies (and other Ohio employers) to purchase equipment to enhance worker safety. In past years, the OHBWC's Workplace Wellness Grants has provided funds for employers to create and deliver workplace wellness programs that address employees' health-risk factors to reduce workplace injuries and illnesses. OHBWC also offers the Better You, Better Ohio program, which offers health and wellness resources and services to workers from small employers (250 employees or fewer). The Ohio Attorney General offers the Law Enforcement Body Armor (OLEBA) Grant Program to assist eligible law enforcement organizations to purchase new body armor or to replace outdated equipment worn by officers to reduce officer injuries. Many of these grant initiatives are commensurate with prevention of high-frequency injuries identified in this analysis such as violence, overexertion, and bodily reactions. Future research could focus on examining the effectiveness of these grants and resultant programs and purchased equipment on occupational injury prevalence.

Another important finding that needs to be further examined is the high prevalence of multiple WC claims among LEOs. LEOs were twice as likely as non-LEOs to have five or more WC claims between 2001 and 2019. For this analysis, we did not examine the nature of these additional claims, but future analyses will determine if these claims were a reinjury of the same body part or an unrelated claim for another occupational injury or illness. Other avenues for future research include a comprehensive cost analysis of the WC claims and an analysis of injury rates using a reliable and stable source of denominator data.

Several limitations should be noted. First, it should be noted that this analysis focused on WC claims and does not present a comprehensive injury risk profile. The use of WC claims data remains an under-utilized tool for occupational injury surveillance, but likely excludes less significant injuries. Additionally, workers may not file WC claims for occupational injuries for a host of reasons including

fear of repercussion, lost work time, and a lack of understanding of the WC system.^{48,49} While we used a systematic case-finding methodology to identify LEO WC cases, it is possible that cases were inadvertently missed. Also, while the OHBWC data includes the vast majority of Ohio's law enforcement agencies, it should be noted that Police Departments in several Ohio cities are self-insured. Thus, these data include most, but not all Ohio-based agencies. Also, the generalizability of the data to other states, jurisdictions, or the US is unknown. Most importantly, this analysis did not include injury rates due to the lack of appropriate employment data for the state of Ohio. This limited the study's ability to make comparisons over time and within occupational or demographic subgroups such as gender. Because of this limitation, interpreting risk from the number of injuries is not possible.

This study used a single state's WC claim database to enumerate and describe occupational injuries among state and local LEOs over a nearly 20-year time period. The majority of prior research on LEO injuries have focused on fatalities with very few studies addressing nonfatal injuries.⁵⁰ State-run WC systems are an excellent data source to help improve understanding of LEO nonfatal injuries. This study found that sprains were the most common injury diagnosis and violence-related events were the most common injury event. Additionally, significant declines in overall, LT, and MO WC claims occurred during the study time period. Unfortunately, it cannot be determined whether this decline indicates a true reduction in injury risk. Future injury prevention strategies and research efforts should focus on these injuries. Agencies could consider the use of a certified athletic trainer to provide clinical assessments, wellness training, and injury rehabilitation to reduce musculoskeletal injuries.³ An important finding that needs to be further explored is the high percentage of LEOs with multiple WC claims. A more extensive analysis is underway to better understand injury and sociodemographic trends and patterns among LEOs with multiple WC claims. Finally, more research is needed in scientifically evaluating workplace injury prevention programs, policies, and practices. Preventing injuries among LEOs is a crucial step in preserving and ensuring the safety and health of a shrinking workforce.

AUTHOR CONTRIBUTIONS

Hope M. Tiesman designed the project, interpreted the data, and drafted the manuscript. Srinivas Konda analyzed the data, interpreted the data, and assisted in drafting the manuscript. Steven J. Wurzelbacher assisted in designing the project, interpreting the data, and drafting the manuscript. Steven J. Naber assisted in designing the project, interpreting and analyzing the data, and drafting the manuscript. Wesley R. Attwood assisted in interpreting the data and drafting the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest.

DISCLOSURE BY AJIM EDITOR OF RECORD

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

DATA AVAILABILITY STATEMENT

Research data are not shared. The data that support the findings of this study cannot be shared and are not available due to privacy and ethical issues.

ETHICS APPROVAL AND INFORMED CONSENT

This work was performed at the National Institute for Occupational Safety and Health and the Ohio Bureau of Workers' Compensation. This research was reviewed by the Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy (see e.g., 45 C.F.R. part 46; 21 C.F.R. part 56; 42 U.S.C. §241(d), 5 U.S.C. §552a, 44 U.S.C. §3501 et seq.).

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 (NIOSH), Centers for Disease Control and Prevention (CDC), or the Ohio Bureau of Workers' Compensation (OHBWC). Mention of any company or product does not constitute endorsement by NIOSH, CDC. In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date.

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