



# Evaluation of Low Back Pain and Duty Equipment Wear Configurations in Police Officers

---

HHE Report No. 2017-0049-3367

January 2020



**Centers for Disease Control  
and Prevention**  
National Institute for Occupational  
Safety and Health

**Authors: Jessica G. Ramsey, MS, CPE**

**Judith Eisenberg, MD, MS**

Desktop Publisher: Jennifer Tyrawski

Editor: Cheryl Hamilton

Logistics: Donnie Booher, Kevin Moore

Medical Field Assistance: Marita Asmat

Keywords: North American Industry Classification System (NAICS) 922120 (Police Protection), Colorado, Low Back Pain, Police, External Vests, Duty Belts, Ergonomics

## **Disclaimer**

The Health Hazard Evaluation Program investigates possible health hazards in the workplace under the authority of the Occupational Safety and Health Act of 1970 [29 USC 669a(6)]. The Health Hazard Evaluation Program also provides, upon request, technical assistance to federal, state, and local agencies to investigate occupational health hazards and to prevent occupational disease or injury. Regulations guiding the Program can be found in Title 42, Code of Federal Regulations, Part 85; Requests for Health Hazard Evaluations [42 CFR Part 85].

## **Availability of Report**

Copies of this report have been sent to the employer and employees, at the department. The state and local health departments and the Occupational Safety and Health Administration Regional Office have also received a copy. This report is not copyrighted and may be freely reproduced.

## **Recommended Citation**

NIOSH [2020]. Evaluation of low back pain and duty equipment wear configurations in police officers. By Ramsey JG, Eisenberg J. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Health Hazard Evaluation Report 2017-0049-3367, <https://www.cdc.gov/niosh/hhe/reports/pdfs/2017-0049-3367.pdf>.

# Table of Contents

## Main Report

Introduction .....	1
Our Approach .....	1
Our Key Findings.....	2
Our Recommendations .....	3

## Supporting Technical Information

Section A: Workplace Information.....	A-1
History of Issue at Workplace.....	A-1
Workplace.....	A-1
Section B: Methods, Results, and Discussion .....	B-1
Methods: Policy Review and Observations .....	B-1
Results: Policy Review and Observations .....	B-1
Methods: Confidential Medical Interviews.....	B-2
Results: Confidential Medical Interviews.....	B-3
Methods: Injury Record Review.....	B-4
Results: Injury Record Review .....	B-4
Methods: Survey of Trial Group.....	B-4
Results: Survey of the Trial Group .....	B-4
Discussion .....	B-5
Conclusions .....	B-8
Section C: Tables.....	C-1
Section D: References.....	D-1

**This page left intentionally blank**

# Introduction

## Request

Management representatives at a police department requested a health hazard evaluation concerning low back pain and back injuries among police officers. The management asked us to evaluate if the pain and injuries could be related to officers wearing their duty equipment around their waist on leather belts.

## Workplace

At the time of our evaluation, the department consisted of 77 sworn officers (which includes patrol officers) and 7 unsworn community service officers.

All patrol officers and community service officers were required to wear a full uniform while on duty. The department's uniform standards required patrol officers to wear duty equipment that included a firearm, two additional ammunition clips for the firearm, a pair of handcuffs, flashlight, and radio. This equipment was usually worn on a leather duty belt. Patrol officers worked 10-hour shifts and community service officers worked 12-hour shifts, both working 4 consecutive days on and then having 3 consecutive days off.

Typical body armor for patrol and community service officers was an internal ballistic vest. This garment was worn under their uniform shirt and consisted of body armor panels in the front and back. Alternatively, officers could wear an external vest, which contained the same body armor panels as the internal vest but was worn over the uniform shirt. Patrol officers wearing the external vest were still required to carry their holstered firearm on the duty belt. Initially, the external vest was only available to officers participating in the department's trial program. After the initial external vest trial program ended, officers were required to obtain a medical necessity note for the department to purchase this item for them. Medical necessity waivers were already required for officers to be allowed to wear external suspenders to hold up the leather belt.

After 4 years on the patrol team, officers could apply for a transfer to another team; uniform and equipment requirements for officers on other teams varied.

**To learn more about the workplace, go to [Section A in the Supporting Technical Information](#)**

## Our Approach

We visited the police department on April 18–20, 2017. During the visit, we conducted these activities:

- Observed work processes, practices, and workplace conditions.
- Held confidential medical interviews with 52 of 54 officers assigned to work during our visit.
- Documented different belt and vest options used by officers.

- Reviewed uniform, equipment, and weapons policies.
- Observed the annual physical ability testing.

To learn more about our methods, go to [Section B in the Supporting Technical Information](#)

## Our Key Findings

### Many officers reported having low back pain

- Nearly half (48%) of the 52 interviewed officers reported having low back pain in the preceding 3 months, but few were evaluated by a healthcare provider to determine if their symptoms were work-related.
- When asked to describe the severity of pain the last time they had low back pain, 60% reported a little, 8% reported a lot, and 32% reported between a little and a lot of low back pain.
- None of the interviewed officers had missed work or required a change in duty because of low back pain.
- Of the 21 officers who participated in the department's external vest trial program, only 5 were still wearing the trial vest during our site visit. Of these five, two specifically cited decreased low back pain as the reason for continued use of their external vest.

### Communication gaps existed between officers and management in several aspects of department operations including uniform policies

- No department policy document existed that specified what equipment was required versus what was optional for wear by officers on each team (i.e., patrol, investigations, etc.). As a result, some officers carried the weight of additional equipment they thought was required but was not.
- New officers did not receive any formal guidance on how they could wear or configure the required duty equipment.
- Officers were unaware they could suggest external duty vests or alternate clothing items to management.
- Officers were unclear on when management required a medical necessity waiver from their healthcare provider to be eligible for obtaining carriage assist devices like suspenders, nylon belts, and external duty vests.

### Back injury prevention training may need to be modified and periodically reinforced

- Low back injury prevention training was provided by the Colorado Intergovernmental Risk Sharing Agency (CIRSA), which provides workers' compensation coverage for Colorado State employees. The course provided general back injury prevention guidelines, such as office

workstation setup and lifting recommendations, but none specific to law enforcement duties or use of duty belts.

- Many officers could not recall if they had taken the CIRSA back injury prevention course, stating that because they are required to take so many online training courses in different subjects, they could not keep track of them all.

To learn more about our results, go to [Section B in the Supporting Technical Information](#)

## Our Recommendations

The Occupational Safety and Health Act requires employers to provide a safe workplace.

### Benefits of Improving Workplace Health and Safety:

- |  |  |
|--|--|
| ↑ Improved employee health and well-being  | ↑ Enhanced image and reputation              |
| ↑ Better workplace morale                  | ↑ Superior products, processes, and services |
| ↑ Easier employee recruiting and retention | ↑ May increase overall cost savings          |

The recommendations below are based on the findings of our evaluation. For each recommendation, we list a series of actions you can take to address the issue at your workplace.



We encourage the company to use a health and safety committee to discuss our recommendations and develop an action plan. Both employee representatives and management representatives should be included on the committee. Helpful guidance can be found in “*Recommended Practices for Safety and Health Programs*” at <https://www.osha.gov/shpguidelines/index.html>.

### Recommendation 1: Improve communication between officers and management regarding equipment and health and safety concerns

Why? Because of the lack of clear departmental policy on required and (approved) optional equipment, many officers may be carrying unnecessary weight. New officers received verbal guidance in lieu of a written policy. Many officers were uncertain about the need for a medical necessity waiver, configuration options, and how to join future external vest trials.

**How? At your workplace, we recommend these specific actions:**



#### Implement a joint officer/management health and safety committee.

- Include new officers as well as those with seniority and those in management positions.
- Discuss uniform and duty requirements, options, and changes.

- Conduct regular meetings to develop a more open and streamlined dialogue between officers at all levels.



### **Create clear departmental uniform wear policies and procedures.**

- Make a uniform wear policy that includes a list of required and optional equipment for each team.
- Create a resource document for new officers regarding duty equipment wear configurations based on input from current officers. This may also include a list of assist devices, such as suspenders or vests, which other officers have used and found helpful.
- Issue a policy that states when a medical necessity waiver is required to obtain devices, such as suspenders, to help redistribute duty belt weight.
- Initiate a formal process where officers can request the department include new equipment carriage devices in future equipment trials.

## **Recommendation 2: Restructure training and offer periodic training on back injury prevention strategies**

Why? Although nearly half of interviewed officers reported low back pain in the preceding 3 months, 44% (23 of 52) could not recall if they had taken the required CIRSA back injury prevention training modules.

### ***How? At your workplace, we recommend these specific actions:***



#### **Complete job safety analyses for the department.**

- Can be another role for the officer/management health and safety committee noted above.
- Identify specific ergonomic hazards associated with the job type and potential recommended actions to prevent back injuries.



#### **Use short in-service or preshift messages to serve as periodic refresher trainings based on the CIRSA low back injury prevention training module and job safety analyses.**

- Highlight information during preshift meetings that may be specific to officers, such as the best way to position monitors while working in vehicles and also at their desk.
- Include this training information in new officer information packets.



**Develop a system to allow officers to see needed training as well as completed trainings.**

- Consider computer-based or online systems.
- Allow access to completed training for officers to review content.

**Recommendation 3: Improve health and safety reporting and response processes**

Why? Employees' health can be affected by a perceived lack of response to health and safety concerns.

***How? At your workplace, we recommend these specific actions:***



**Ensure that a formal procedure is in place for reports and responses.**

- Encourage officers to report low back pain and obtain a prompt medical evaluation so that the cause may be identified, corrective action implemented, and a treatment plan initiated to address reported low back pain.
- Ensure that a process is available to officers for submitting a confidential report on safety and health concerns.
- Inform officers of the steps taken to assess problems, including what is known and what remains to be determined. A combination of written reports and face-to-face meetings are effective for communicating to officers.

# Supporting Technical Information

---

Evaluation of Low Back Pain and Duty Equipment  
Wear Configurations in Police Officers

HHE Report No. 2017-0049-3367

January 2020

## Section A: Workplace Information

### History of Issue at Workplace

Prior to 2015, an agent for the department's loss and workers' compensation insurer, CIRSA, obtained anecdotal reports about officers experiencing low back pain while wearing duty belts. The agent informed us that, during mandatory on-site audit interviews, officers reported experiencing low back pain that they associated with daily wear of heavy duty belts. CIRSA also provided the department with low back pain prevention training modules and other safety training that officers were required to complete.

Because of the concerns with duty belts, in 2015, the police department started an external duty vest trial program, issuing 21 patrol officers vests on which some of their duty equipment could be worn. An officer could select equipment he or she wanted to carry on the vest and where those items were placed on the vest. The external vest manufacturer provided vest cutouts that officers customized with notations to indicate where they wanted extra loops and pockets. The department sent the cutout with the notations to the manufacturer, and each vest was custom made. Selection of officers for this trial was determined based on seniority. The department ordered external vests from three different manufacturers that were selected on the basis of research conducted by an officer workgroup that was set up solely to investigate external vest options. The 21 officers were randomly assigned a vest from one of the three manufacturers. The external vest trial program was suspended in November 2016 because of vest fit, wear, and maintenance issues. Some participants of the trial program who preferred wearing their duty equipment on their external vest continued wearing it.

### Workplace

At the time of our evaluation, the department consisted of 77 sworn officers and 7 unsworn community service officers. Sworn officers were those who attended a law enforcement academy and had the authority to carry a badge and firearm, as well as perform arrests. All sworn officers in this department started out as patrol officers. This department had the following teams of sworn officers: patrol, SWAT (Special Weapons and Tactics), crash and traffic, crime prevention, investigations (drug task force and auto theft task force), school resource (based in schools), and management. Unsworn community service officers were involved in animal control, park patrol, and nuisance code enforcement.

After 4 years on the patrol team, officers could apply for a transfer to another team, such as investigations. Officers working in investigations wore business casual clothes and were only required to wear their firearm and badge. These nonpatrol officers usually opted to wear their badge on a lighter weight civilian belt and used an underarm holster or a leg holster for their firearm. Investigations officers wore ballistic vests during special assignments or tasks. These officers were only required to wear their full uniform with the standard patrol equipment for specific official events. Investigation officers typically worked 9-hour shifts, Monday through Friday.

## Section B: Methods, Results, and Discussion

Our primary objectives were as follows:

- Review department policies.
- Observe work practices and procedures that may cause low back pain.
- Determine the prevalence of low back pain among officers and whether the pain could be associated with any particular duty equipment configuration.

### Methods: Policy Review and Observations

We observed the departments' annual physical ability testing and spoke to officers informally about items on their duty belts. We also reviewed policy documents on uniform equipment and personal appearance, weapons and ammunition, restraining devices, use of force, and the CIRSA back injury prevention program.

### Results: Policy Review and Observations

#### Policy Reviews

We reviewed policies to identify locations where duty belt item requirements or uniform requirements might be listed. We did not find one standard equipment list but found equipment recommendations or requirements included in several documents. The *Uniform Equipment and Personal Appearance* policy listed specifics for uniformity and standards of appearance. The document stated that officers could request, through the chain of command, new or alternative uniform items. Additionally, the policy stated that body armor would be replaced at 5-year intervals unless vests failed inspection of wear, cleanliness, and fit. This was in line with the manufacturers' specifications.

We also reviewed the *Uniform Specification* policy. This policy specified that an authorized firearm and dark-colored flashlight had to be worn on the duty belt. The *Uniform Specification* policy document included optional items that uniformed personnel might attach to or wear on their duty belts: black leather gloves, black leather surgical glove pouch, expandable baton, key holder, and other equipment as authorized by the Chief of Police.

The *Weapons and Ammunition* policy required that "uniformed personnel, while on-duty, shall carry their primary weapon fully loaded and with enough ammunition to fully reload the firearm two additional times." Therefore, officers were required to carry two additional ammunition clips for their primary firearm on their duty belt. The policy also stated that "Undercover personnel and plainclothes personnel are encouraged to carry sufficient ammunition to reload their firearm if needed." Officers could also wear a secondary weapon, but those weapons were required to be concealed from view while on duty.

Electronic control weapons (ECW) were also approved as optional equipment. The policy stated that "The ECW will be carried in an approved holster on the side of the body opposite the service handgun." The policy also stated that batons could be carried but should be kept in a "readily available" location in the patrol vehicle or on the duty belt in a baton ring.

The *Use of Restraining Devices* policy stated that the police department would issue officers one set of standard handcuffs, and the officer could purchase additional sets. We did not note a requirement for the number of handcuffs to be worn on the duty belt.

The *Use of Force* policy outlined when certain types of force were acceptable to use, which included other potential optional equipment items for wear. Pepper gas was listed as a force option; however, there was no required location listed where this should be stored.

The CIRSA back injury prevention program included general awareness items such as physical exposures (repetitive work, awkward postures, and overexertion), individual risk factors (obesity, age, and gender), office workstation evaluations, basic lifting techniques, and stretching. The program also included a guideline form for completing a job safety analysis that included specific job steps, potential hazards, and recommended actions. The program did not include specific items relating to officers, duty belts, or their hazards.

### **Duty Belt Items**

We spoke with patrol officers about their duty equipment. Most officers either retained the same equipment that was required during training or modified which equipment they carried based on conversations with senior officers. The duty belts were 2.25-inch wide leather belts. We noted standard items included gun with holster, two extra clips of ammunition, radio, handcuffs (usually two pairs), flashlight, baton, pepper spray, and gloves. The total weight of these items was approximately 20 pounds. Patrol officers also wore internal ballistic vests under their uniform shirt, but over a plain white t-shirt. Through our informal conversations, we learned that patrol officers were unaware that they could suggest or request changes to clothing items to management per the *Uniform Equipment and Personal Appearance* policy.

### **Physical Ability Examination**

Officers were required to complete an annual physical ability test. The test was performed on department property and monitored by fellow officers. Officers started by leaving the duty vehicle then proceeded through various stations, including running, going up and down stairs, scaling mock fences, negotiating through cones and under poles, and finally dragging a human mannequin over a designated distance. Officers were timed and were required to meet a standard time. The examination was noted in the *Uniform Equipment and Personal Appearance* policy. This annual test was meant to inform officers of their general physical condition. The test was not meant to identify employees with disabilities who were otherwise able to perform their assigned duties, with or without reasonable accommodations.

### **Methods: Confidential Medical Interviews**

All officers assigned to work during our visit, including patrol, community service, and investigations officers, were invited to participate in confidential medical interviews. The interviews included questions on work history (current and former teams), current method of carrying duty equipment, occurrence of low back pain in the previous 3 months, and any other health concerns they believed were work-related.

## Results: Confidential Medical Interviews

Of the 54 officers assigned to work during our site visit, 52 (96%) participated in the confidential interviews. The two officers who were unable to participate were working an active case and on mandatory field training. Of the 52 interviewed officers, 40 (77%) were male, with a median age of 46 years (range: 25–64 years).

### Work History

At the time of our site visit, the median duration of employment at this department was 12 years (range: 3–37 years). The median weekly work hours were 45 (range: 40–60 hours). Of the 52 interviewed officers, 25 (48%) were currently assigned to the patrol team, 16 (31%) were on the investigations team, 5 (10%) were on the management team, 2 (4%) were crime prevention officers, 2 (4%) were school resource officers, and 2 (4%) were community service officers.

All interviewed officers were asked if they had completed the CIRSA back injury prevention training in the past year: 9 (17%) responded no, 20 (38%) responded yes, and 23 (44%) were uncertain if they had or not. Several officers reported that it was difficult for them to keep track of what courses they had and had not completed because they took so many required training courses.

### Current Method of Carrying Duty Equipment

When asked what they were currently using to carry their duty equipment, 32 (62%) reporting using a leather duty belt, 13 (25%) reported using a “civilian belt” or “lightweight belt,” 2 (4%) reported using an external vest, and 4 (8%) reported “other.” The other responses included one of each of these: Safariland® drop holster, concealed gun holster, external suspenders, and none. One officer did not report using any equipment because they were on light duty and not required to wear it.

All interviewed officers reported that they had ever worn body armor. Patrol officers, crime prevention officers, community service officers, and school resource officers reported wearing body armor during the entire shift of each shift worked. Officers on investigations and management teams reported wearing body armor on the rare occasions when they were required to be in full uniform for official functions.

### Occurrence of Low Back Pain in the Previous 3 Months

Of the 52 interviewed officers, 25 (48%) reported having low back pain in the previous 3 months. Most of those who reported low back pain in the previous 3 months were patrol officers ( $n = 13$ , 52%), followed by investigations officers ( $n = 9$ , 36%). Any officer who reported having low back pain in the previous 3 months was asked a series of follow-up questions to better understand their symptoms. These characteristics are reported in Table C1. Some officers were seen by a healthcare provider. At least 32% of those reporting back pain during the interview stated that their healthcare provider felt their back pain was work-related; however, the number of officers with work-related pain could be higher.

Six (11%) participants reported ever filing a workers’ compensation claim for the low back pain. No participant reported missing any work because of the low back pain or having to change jobs or work duties as a result of the low back pain. Three officers also reported waist, hip, and/or upper leg pain where duty equipment put pressure or rubbed against those areas.

## **Any Other Work-related Health Concerns**

Interviewed officers were asked if they had any other concerns regarding how their work may be affecting their health. Of the 52 interviewed officers, 10 officers (19%) reported work-related stress with 4 officers reporting insomnia as a result. Officers reported having other support systems, such as family, friends, recreational activities, hobbies, and other coworkers, to help them handle their stress.

## **Methods: Injury Record Review**

We also reviewed CIRSA records of all police department workers' compensation claims related to back injuries in the state of Colorado between 2012–2016 and all reported back injuries to police in 2016. This department uses CIRSA injury reports in place of the Occupational Safety and Health Administration's (OSHA) Form 300 Log of Work-Related Injuries and Illnesses to record officer injuries.

## **Results: Injury Record Review**

Between 2012–2016, CIRSA received 77 workers' compensation claims from police departments throughout Colorado related to back pain. Four of the 77 came from officers working in the police department we evaluated. Only one of these claims mentioned use of the duty belt in association with low back pain. The other claims involved low back pain that started when practicing ground control maneuvers used in subject apprehension, removing lug nuts when changing a flat tire on the patrol car, and bending down to push paper down into a shredding bin.

In 2016 alone, nine reports of back injuries were reported by officers affiliated with Colorado police departments. These records did not include information on officers' department affiliation. Of these nine reports, one report was from back pain caused by the weight of wearing the duty belt. The remaining cases involved injuries from various activities including motor vehicle accidents, training events, subject apprehension, dog attack, and entrance into a patrol car.

## **Methods: Survey of Trial Group**

A few weeks after the site visit, we emailed a survey to all 21 officers who were issued an external vest during the department's trial program. The emailed survey included two questions: (1) did the officer currently wear duty equipment using the external vest issued by the department, and (2) if they did not wear duty equipment using the external vest, please explain why.

## **Results: Survey of the Trial Group**

Of the 21 officers who were emailed the survey, we received responses from 12 officers, including two who were not listed in department records as taking part in the trial program. Five officers who responded to the survey had been previously interviewed during the site visit, but only one was still wearing the vest.

Of the 12 responding officers, 5 (42%) reported currently wearing the vest. Out of these five, two officers mentioned that the use of the vest reduced back pain, and one officer mentioned improved comfort with the vest.

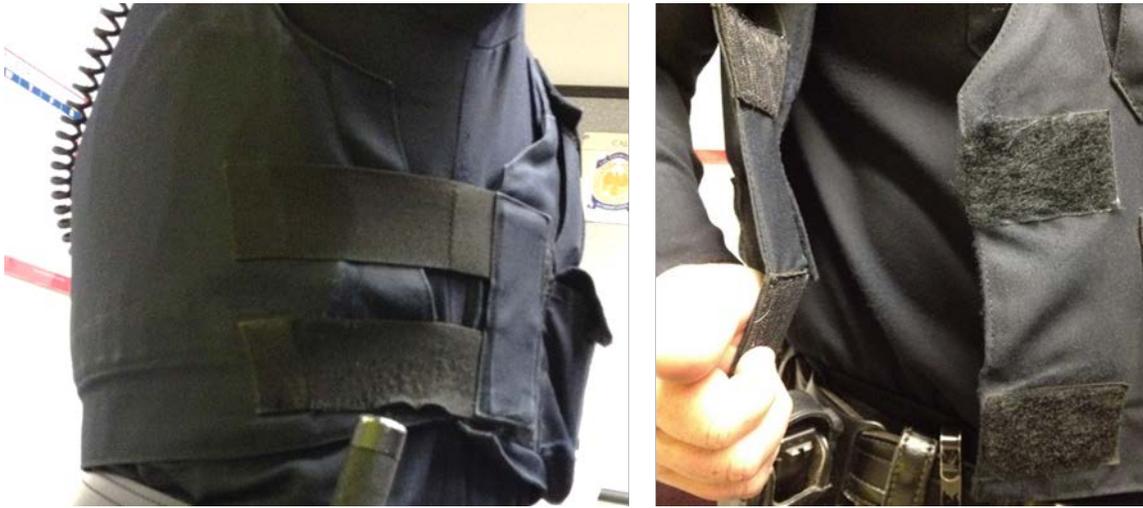


Figure B1. Intact side Velcro closure on external vest (left). Unsecured side of external vest due to worn Velcro pads (right). Photo by NIOSH.

Some of the reasons the seven responding officers gave for discontinuing external vest use were (1) uncomfortable fit once personalized and (2) highly specialized care instructions, making it difficult to keep clean without damaging the vest. Additionally, participants reported that the Velcro on the vests wore out, making the vests unwearable (Figure B1), and this worn out Velcro allowed pocket contents to easily fall out. Some of the vest pockets were reportedly not made deep or wide enough for a standard officer notebook (Figure B2). Officers also reported difficulty with external vest upkeep and cleaning. One participant in the trial program reported waiting approximately 10 weeks to get their vest back from the manufacturer when it was sent back to them for cleaning as per the care instructions. This officer had to return to wearing items on the duty belt in the interim.

Two female officer trial program participants also commented that they felt that the vests were helpful alternatives for reasons other than low back pain relief. They stated they did not have the same waist circumference as their male counterparts, which made it difficult to fit all their equipment on the belt. The external vest provided them with additional space on which to place their duty equipment.

## Discussion

Low back pain in police officers has been previously described in literature going back at least 20 years. The lifetime prevalence rate of low back pain in Canadian police officers was reported to be 33%–75% [Brown et al. 1998]. An evaluation of low back pain in U.S. police officers in one county found that



Figure B2. External vest pocket containing standard patrol notebook showing pocket top unable to reach Velcro pads to secure pocket contents.

60% of officers reported low back pain [Arts 2006]. Data collected in the 2009–2010 National Health and Nutrition Examination Survey revealed a 13% prevalence of low back pain in adults aged 20–69 years in the general U.S. population [Shmagel et al. 2016].

Low back pain in police officers may be due to many factors including total weight of duty equipment worn, manner in which equipment weight is distributed on the officer, and strenuous job components such as subject foot pursuit and apprehension. The duration of time spent sitting in patrol vehicles was also considered a separate risk factor for low back pain [Filtness et al. 2014; Gruevski et al. 2013; Gyi and Porter 1998; Holmes et al. 2013]. Officers who carry duty equipment primarily on their belts often must contort their body at odd angles in order to clear the steering wheel and seat belt mechanisms to enter/exit vehicle. Additionally, officers may be required to twist in the patrol vehicle seat to operate a computer located in the center console of the vehicle.

Body armor can be quite heavy, weighing up to 18.8 pounds (8.5 kg) [Burton et al. 1996]. Duty equipment worn on top of this armor may add another 20 pounds for officers in this department. This weight covering the torso decreases mobility and can interfere with balance recovery, resulting in an increased risk for low back strain due to rapid, twisting motions to correct balance [Dempsey et al. 2013]. A study found nearly double the annual incidence of low back pain in officers in Northern Ireland who wore body armor weighing 18.7 pounds compared with British officers who did not wear body armor (8.2% versus 4.3%). This study noted these findings were comparable with low back pain assessments of other occupations in which heavy equipment is required for daily wear [Burton et al. 1996]. A previous U.S. study showed that, among police officers reporting low back pain, 54% attributed it to wearing their duty belt, and 55% attributed it to excessive time spent sitting in their patrol vehicle [Arts 2006]. These studies identified important risk factors for low back pain in police officers, including the total weight carried (i.e., body armor, other duty equipment), forced poor posture while sitting, awkward postures when entering/exiting a vehicle, and finally, duration of time spent seated in a patrol vehicle. However, these studies also highlighted the difficulty in determining the degree of contribution that these risk factors have on causing low back pain in police officers.

Our evaluation showed that 48% of officers in this department reported low back pain in the previous 3 months. This is lower than a previous research study examining low back pain in police officers in Michigan, which found that 60% reported low back pain “at some point in their lives.” Reports of low back pain from those officers increased with increasing years of work as a police officer [Arts 2006]. Although none of the interviewed officers required transfers or missed work because of back pain, it may impact overall quality of life and career longevity [Douma et al. 2017]. All but three of the patrol officers we interviewed reported using the duty belt alone to wear their equipment. Of the three remaining patrol officers, two reported using an external vest, and one wore internal suspenders in addition to the duty belt. These three officers reported that wearing their duty equipment with the vest or internal suspenders reduced low back pain. This is comparable to a Canadian study on the use of duty belt suspenders that found a noticeable reduction in reported discomfort or pain while wearing the suspenders [Arnold 2000].

We did not find many formal studies to date that have compared external vest equipment configurations with duty belt equipment configurations, with respect to the occurrence of low back pain

in police officers. A recent study assessing low back pain in vehicle-based patrol officers found that those officers wearing a load-bearing vest instead of a duty belt to carry most of their duty equipment had less low back discomfort but higher upper back discomfort [Larsen et al. 2019]. Some external vest manufacturers claim increased overall officer comfort as a benefit to use of their product but decreased low back pain is not specifically mentioned [Blauer 2013]. This area could clearly benefit from additional research. In the meantime, external vest manufacturers need to address the fit, maintenance, and wear issues that resulted in some trial program participants discarding the vest.

We found one article that provided limited recommendations for the type of duty belt and location of items on the belt [Espinoza 2010]. Narrow nylon belts with plastic buckles were recommended over traditional leather belts with metal buckles. Smaller belts conform better to the body, and plastic buckles are easier to adjust and customize to the officers' size. Additionally, this article recommended officers avoid placing hard items, such as handcuffs, on the back of the duty belt to reduce pain, pressure, and discomfort on the back when seated in the patrol vehicle. Instead, the back of the belt should be reserved for soft items such as a glove pouch [Espinoza 2010]. The author also recommended suspenders and vests as alternatives to the traditional duty belt. Vests were recommended because they could reduce reaching for equipment located toward the back by providing equipment storage space on the chest and abdominal areas. Storing duty equipment along the back area of the duty belt requires officers to twist their upper bodies to reach those items and also contributes to discomfort while in the patrol vehicle because the equipment forces the officer into an abnormal seated posture. Another benefit of the vest was reported by officers with small waist circumferences in that the vest provided more equipment storage area than they had using the duty belt alone. Suspenders were recommended because they can distribute weight over the shoulders and chest.

We found some indications that departmental policy documentation regarding uniform components could be improved. Specifically, there was no single policy document that listed what equipment was mandatory versus what was optional for officers on different teams to carry. If total weight carried by officers is a risk factor for developing low back pain, then there may be cases of officers carrying unneeded equipment because of the lack of clear guidance. Officers acquired information on possible uniform wear options by word-of-mouth from other officers rather than from a formalized departmental resource material. This was especially true with new officers joining the department immediately after graduation from the police academy. Having current officers contribute suggestions to a document illustrating possible duty equipment wear configurations may be especially helpful to newer officers.

If an external vest is still permitted for use, then the conditions of obtaining that vest outside of the discontinued trial program should be addressed. Additionally, the department's uniform policy document should clearly outline permitted assist devices to distribute the belt weight, such as internal suspenders, and how officers can obtain them. For example, we noted confusion between officers on when a medical necessity waiver was required to be permitted to wear the item or have the department purchase the item.

We found that many interviewed officers could not recall if they had completed the required low back pain prevention training module. If officers could not recall completing the training, then it is possible,

even if they had completed it, that they may not be able to recall enough of the material to implement the low back pain prevention strategies covered in that module. The department may want to assess their overall training structure to improve officer retention of module material and implement a better tracking system for completion of training. One option may be to implement a dashboard listing of all required modules showing the officer's completion status and date. Refresher training on more frequently encountered issues and their prevention strategies, such as low back pain, may be indicated.

## **Conclusions**

We found that nearly half of all officers in this department reported low back pain in the previous 3 months. Department policy should clearly state what equipment is required versus what is optional. Although data are insufficient about using external vests versus standard leather utility belts to reduce low back pain, the department should provide officers with examples of different wear configurations, including options for internal suspenders and external vests, and clarify when medical necessity waivers are required to obtain all equipment.

## Section C: Tables

Table C1. Characteristics of low back pain reported in the last 3 months by interviewed officers

Characteristic	No. (%) officers who reported low back pain (n = 25)
Frequency	
Every day	4 (16%)
Most days	7 (28%)
Some days	14 (56%)
Severity	
A lot	2 (8%)
Between a lot and a little	8 (32%)
A little	15 (60%)
Work-related determination by healthcare professional	
Yes	8 (32%)
No	14 (56%)
Don't know	3 (12%)

## Section D: References

### Discussion

- Arnold J [2000]. “Millennium backsaver” duty belt suspender. Technical Memorandum. Canadian Police Research Centre, TM-01-2000, [http://publications.gc.ca/collections/collection\\_2007/ps-sp/PS63-1-2000-1E.pdf](http://publications.gc.ca/collections/collection_2007/ps-sp/PS63-1-2000-1E.pdf).
- Arts GA [2006]. Low back pain in police officers. Master’s thesis. Allendale, MI: Grand Valley State University.
- Blauer [2013]. Advantages of a police outer vest carrier. October 8, <https://www.blauer.com/dispatch/advantages-of-a-police-outer-vest-carrier/>.
- Brown JJ, Wells GA, Trotter AJ, Bonneau J, Ferris B [1998]. Back pain in a large Canadian police force. *Spine* 23(7):821–827, <https://doi.org/10.1097/00007632-199804010-00017>.
- Burton KA, Tillotson KM, Symonds TL, Burke C, Mathewson T [1996]. Occupational risk factors for the first onset and subsequent course of low back trouble: a study of serving police officers. *Spine* 21(22):2612–2620, [https://journals.lww.com/spinejournal/Fulltext/1996/11150/Occupational\\_Risk\\_Factors\\_for\\_the\\_First\\_Onset\\_and.11.aspx](https://journals.lww.com/spinejournal/Fulltext/1996/11150/Occupational_Risk_Factors_for_the_First_Onset_and.11.aspx).
- Dempsey PC, Handcock PJ, Rehrer NJ [2013]. Impact of police body armour and equipment on mobility. *Appl Ergon* 44(6):957–961, <https://doi.org/10.1016/j.apergo.2013.02.011>.
- Douma NB, Cote C, Lacasse A [2017]. Quebec serve and protect low back pain study: a web-based cross-sectional investigation of prevalence and functional impact among police officers. *Spine* 42(19):1485–1493, <https://doi.org/10.1097/BRS.0000000000002136>.
- Espinoza [2010]. Ergonomics and police duty belts: easing their load. American City and County. February 2010, <https://www.americancityandcounty.com/2010/02/05/ergonomics-and-police-duty-belts-easing-their-load/>.
- Filtness AJ, Mitsopoulos-Rubens E, Rudin-Brown CM [2014]. Police officer in-vehicle discomfort: appointments carriage method and vehicle seat features. *Appl Ergon* 45(4):1247–1256, <https://doi.org/10.1016/j.apergo.2014.03.002>.
- Gruevski KM, McKinnon CD, Dickerson CR, Callaghan JP [2013]. The impact of mobile data terminal use on posture and low-back discomfort when combined with simulated prolonged driving in police cruisers. *Int J Occup Saf Ergon* 19(3):415–422, <https://doi.org/10.1080/10803548.2013.11076998>.
- Gyi DE, Porter JM [1998]. Musculoskeletal problems and driving in police officers. *Occup Med* 48(3):153–160, <https://doi.org/10.1093/occmed/48.3.153>.
- Holmes MWR, McKinnon CD, Dickerson CR, Callaghan JP [2013]. The effects of police duty belt and seat design changes on lumbar spine posture, driver contact pressure and discomfort. *Ergonomics* 56(1):126–136, <https://doi.org/10.1080/00140139.2012.739206>.

Larsen LB, Ramstrand N, Tranberg R [2019]. Duty belt or load-bearing vest? Discomfort and pressure distribution for police driving standard fleet vehicles. *Appl Ergon* 80:146–151, <https://doi.org/10.1016/j.apergo.2019.05.017>.

Shmagel A, Foley R, Ibrahim H [2016]. Epidemiology of chronic low back pain in US adults: data from the 2009–2010 National Health and Nutrition Examination Survey. *Arthritis Care Res* 68(11):1688–1694, <https://doi.org/10.1002/acr.22890>.

# Delivering on the Nation's promise: Promoting productive workplaces through safety and health research

## Get More Information

Find NIOSH products and get answers to workplace safety and health questions:

1-800-CDC-INFO (1-800-232-4636) | TTY: 1-888-232-6348

CDC/NIOSH INFO: [cdc.gov/info](https://www.cdc.gov/info) | [cdc.gov/niosh](https://www.cdc.gov/niosh)

Monthly *NIOSH* eNews: [cdc.gov/niosh/eNews](https://www.cdc.gov/niosh/eNews)