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Q2 Implementing risk management to reduce injuries in the U.S. Fire Service

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A B S T R A C T

Introduction: Risk management, a proactive process to identify and mitigate potential injury risks and implement control strategies, was used to reduce the risk of occupational injury in a fire department. The objective of this research was to study the implementation of the risk management process for future replication. A second objective was to document changes in fire personnel's knowledge, attitudes, and behaviors related to the selected control strategies that were implemented as part of the risk management process. *Method:* A number of control strategies identified through the risk management process were implemented over a 2-year period beginning in January 2011. Approximately 450 fire personnel completed each of the three cross-sectional surveys that were administered throughout the implementation periods. Fire personnel were asked about their awareness, knowledge, and use of the control strategies. *Results:* Fire personnel were generally aware of the control strategies that were implemented. Visual reminders (e.g., signage) were noted as effective by fire personnel who noticed them. Barriers to use of specific control strategies such as new procedures on the fireground or new lifting equipment for patient transfer included lack of knowledge of the new protocols, lack of awareness/access to/availability of the new equipment, and limited training on its use. Implementation challenges were noted, which limited self-reported adherence to the control strategies. *Conclusions:* Fire personnel generally recognized the potential for various control strategies to manage risk and improve their health and safety; however, implementation challenges limited the effectiveness of certain control strategies. The study findings support the importance of effective implementation to achieve the desired impacts of control strategies for improving health and safety. *Practical applications:* Employees must be aware of, have knowledge about, and receive training in safety and health interventions in order to adopt desired behaviors.

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50 1. Introduction

51 1.1. Problem

52 Firefighting is a risky occupation, posing risks to firefighters while
53 fighting fires, during rescue and response, or when training for their
54 job (U.S. Fire Administration, 2014). According to data from the National
55 Fire Protection Association, there are over 1.1 million firefighters in the
56 United States. In 2014, a total of 64 firefighters died and over 63,350 in-
57 juries occurred to firefighters while on-duty (Fahy, LeBlanc, & Molis,
58 2015). Nearly 43% of these injuries occurred during fireground opera-
59 tions (Haynes & Molis, 2015). According to data from the National

Institute of Standards and Technology, the estimated cost in 2002 dol-
60 lars of addressing firefighter injuries and of efforts to prevent them
61 was estimated to be upwards of \$7.8 billion (TriData Corporation, Q6
62 System Planning Corporation, 2005).

63
64 Around the world, proactive risk management is being adopted as a
65 strategy to identify and mitigate potential injury risks, and implement
66 control strategies. Risk management is a formal proactive approach to
67 improving workplace safety and health. It creates a structure for em-
68 ployees to develop solutions to the risks faced, based on the surround-
69 ing work environment, conditions and contexts, equipment, and
70 personnel involved (Joy, 2004; Poplin et al., 2015). One defining char-
71 acteristic of risk management is the involvement of workers in identifying
72 the risks and resulting control strategies. In several places, including the
73 United Kingdom (U.K.) fire service, proactive risk management is re-
74 quired by regulation (Burgess et al., 2014; Poplin et al., 2015). Although
75 proactive risk management is not required by legislation for the U.S. fire
76 service, even a voluntary approach could have significant benefits.

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1.2. Background to risk management intervention

In 2009, researchers partnered with a metropolitan fire department to introduce and apply a risk management approach for workforce health and safety (Poplin et al., 2015). This process led to the identification of 45 hazard-specific interventions, several of which were later implemented. Results from a process evaluation of the risk management approach revealed that the process was well accepted by the fire department (Poplin et al., 2015). Fire personnel who participated in the process emphasized the value of risk management, especially the participatory approach; usefulness of risk management for identifying potential risks; and the potential of risk management for reducing firefighter injury (Poplin et al., 2015).

In order to realize the potential of risk management to reduce injury in the fire service, it is critical to understand how the risk management process was implemented, in addition to the specific identified control strategies. Currently, there is a dearth of literature on the implementation of risk management overall, and especially in the U.S. fire service. Addressing this gap in knowledge will generate important lessons for acceptability, sustainability, and future replication. In this study, multiple cross-sectional surveys were administered to fire personnel from a single department to document knowledge, attitudes, and behaviors related to the selected control strategies that were implemented as part of risk management.

2. Methods

2.1. Design

The study design and methods of the risk management process applied to the specific fire department has been previously described (Poplin et al., 2015). In summary, the risk management process involved three-phases: hazard scoping, risk assessment, and implementation of prevention controls. These phases were systematically conducted over a three-year period, followed by a one-year observation period to document impacts. Approximately 34 individuals were part of three teams, each involving a full cross-section of fire personnel (firefighters and medics) from all ranks, to assess the hazards and injuries related to three specific tasks: physical exercise, patient transport, and fireground activities and operations (Poplin et al., 2015). These tasks were selected because they accounted for a significant proportion of injuries during the six year pre-intervention period (Poplin, Harris, Pollack, Peate, & Burgess, 2012). At the conclusion of the risk assessment phase, nine of 45 potential controls were recommended for implementation. Ultimately, eight controls were selected by the risk management teams and department leadership for implementation. These control strategies were implemented over a 24-month period, beginning January 2011.

2.2. Control strategies

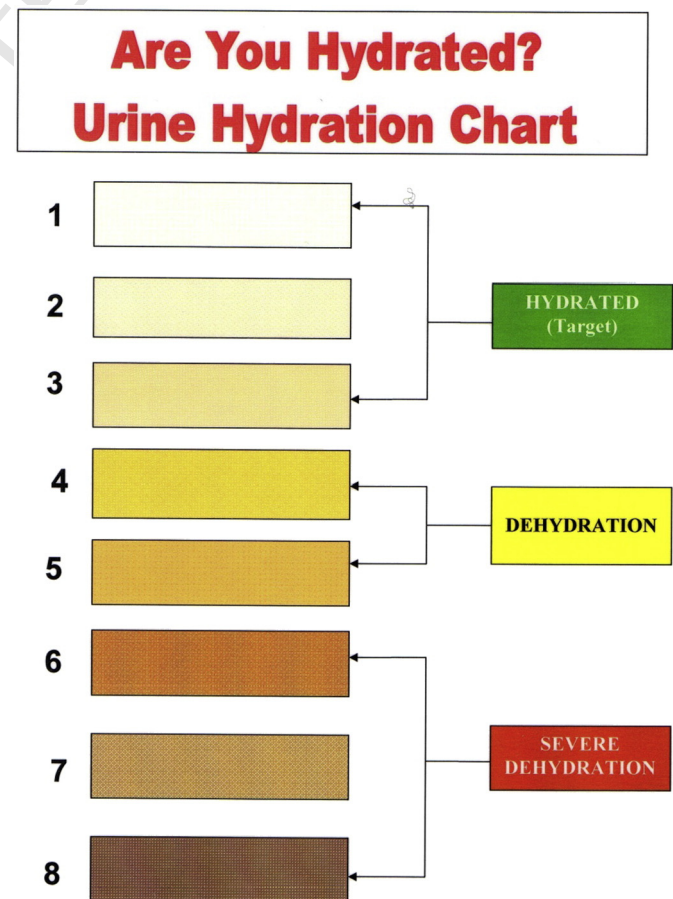
Control strategies to address physical exercise included updating exercise equipment, removing equipment not meeting department standards, and conducting monthly maintenance inspections on a standardized form. The role of Peer Fitness Trainers (PFTs) was also expanded to assist recruits and probationary officers, as well as commissioned individuals to promote appropriate exercise. The standard operating procedure describing the requirements for physical fitness was also updated. These new changes to physical exercise were intended to promote being "fit for duty" via mobility exercises (as opposed to static stretching), for example, and conditioning exercises.

A slide board, introduced in collaboration with investigators at the Ohio State University (Weiler et al., 2013), and a carry strap for patient lift assist were implemented as control strategies to improve access to and help reduce lifting loads and risk of strain injuries during patient transfer. In addition, as part of a separate, but related effort, ambulances

were outfitted with new electronic lift assist gurneys to further reduce the repetitive strains of vertical lifting of increasingly heavier patients. The learning module for patient transfer was also updated to provide probationary firefighters and medics with instruction on the new equipment earlier in their training. Finally, changes were made to cardiopulmonary resuscitation (CPR), which was viewed as fatiguing activity, often performed in awkward and prolonged static positions. The standard operated procedure was updated to include rotating CPR responsibility every 200 compressions (approximately 2 min) when appropriate personnel are available and prepared.

Control strategies addressing activities on the fireground emphasized personal protective equipment (PPE), including empowering the safety officer to remove a firefighter from scene if not wearing appropriate PPE. In addition, the standard operated procedure for rehab (a period of rest and recovery from fire suppression activities), including empowering the rehab paramedic, and positioning the rehab location further away from the on-scene activities so that firefighters undergoing rehab remain separated from the tactical operations. Additional changes to the procedures included adding paramedics in the rehab area for multi-alarm fire responses, and employing active cooling using forearm immersion in cold water for 15 min for heat-stressed firefighters.

Visual reminders (e.g., posters, placards, and signage) were implemented to reinforce awareness of some of the identified fireground risks, and to help improve adherence to the new procedures. For example, one of these reminders promoted hydration awareness, and a "urine hydration chart" was placed in all fire station bathrooms (Fig. 1). Another visual reminder stated, "Save your joints, use 3-points"



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Fig. 1. Hydration chart visual reminder.*

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