Fatigue Risk Management for First Responders: Current Landscape of Perspectives, Policies, and Practices

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Executive Summary

Objective for CSSP-2018-CP-2366

Our objective is to develop a consensus-based, evidence-informed national Standard on First Responder Workplace Fatigue Risk Management that will provide an approach to systematically preventing and managing workplace fatigue by addressing it in a strategic, coordinated approach, and as part of a broad organizational management framework.

How this milestone supports the objective for CSSP-2018-CP-2366

This milestone will contribute to the development of a Seed Document that will be used to develop a national Standard, in accordance with CSA Groups' accredited standards development process. This report describes the "Research and Synthesis of Evidence" phase, specifically key informant interviews of first responder personnel of their lived experience with fatigue, its impact on their health and performance, organizational policies, practices, and programs, and both personal and organizational risk mitigation strategies. The objective of this scoping review was to broadly identify relevant research pertaining to fatigue risk management and synthesize the research to inform aspects of risk management model known as the RACE model (recognize hazards, assess risks, implement controls, and evaluate effectiveness of controls) that will be integrated into a broader management system framework using Plan-Do-Check-Act (PDCA).

Background

First responders are at high risk of suffering from decrements in neurocognitive and physical performance related to fatigue. Such performance decrements endanger not only the personal health and safety of these responders but also the health and safety of their fellow responders and the public they serve. Fatigue may also be a precursor to adverse longer-term outcomes, such as musculoskeletal disorders, cardiovascular disease, and mental health disorders. Appropriate management, policymaking, standards, guidance, and research activities can reduce the exposure to these fatigue-related risks and hazards before they pose significant problems during emergency response operations.

Methods

We conducted a needs assessment by interviewing key informants to discuss their perspectives on fatigue, workplace policies, and both personal and organizational practices to mitigate fatigue risk. Participants represented three first responder occupations across Canada: firefighting, police services, and paramedic services. Participants were frontline personnel or managers. Interviews were audio recorded, transcribed, and analyzed for overarching themes.

General Findings

The lived experiences of key informants were analyzed into themes that were organized into a broad management systems model using the Plan-Do-Check-Act framework. Participants attributed fatigue to sleep and mental exhaustion, physical fatigue during work, and burnout. Outcomes of fatigue included deficits in work performance, impacts on their health and wellness, and challenges in their personal and family life. Specific and comprehensive workplace written policies often do not exist; participants who have limited fatigue policies in their workplace expressed the need for improvements to address content and implementation deficiencies. All participants believed fatigue was worth addressing in their workplace and that fatigue risk management should be a shared responsibility between employees and employers. Identifying and education personnel and management on the potential impact or outcome of fatigue may help motivate the organization to support a fatigue risk management system. Participants identified three broad types of risk factors: shift duration and pattern, task and work environment, and staff level. Assessment tools were primarily informal, based on self-assessments and partner-observations of the signs and symptoms of fatigue, and formal incident investigations were common. Risk mitigation strategies ranged from administrative (provisions for napping, shift schedules, support programs), personal (regimented sleeping habits, improved sleep quality at home, short-term solutions), and employee recruitment and training. All key informants indicated that there is no follow-up of prevention activities nor are there any policies, programs, or practices of corrective and preventative activities after implementing a risk control action.

Conclusion

Obtaining key informant insight towards the extent, impact, and management of fatigue contribute to the development of a Canadian fatigue risk management standard for first responders. Although participants understood the potential consequences of fatigue and expressed the desire to reduce its effects, current workplace strategies for fatigue risk management are reactionary, risk assessment tools are informal, and control strategies are much to be desired. Recommendations ranged from providing space within a base to facilitate restful sleep, offering a range of shift patterns to match an individual's chronotype, and improving the training for personnel during early education, support throughout employment, and training for managers. Participants recommended that training should be delivered by individuals who are credible (with similar lived experience) and knowledgeable.

Fatigue

Fatigue has been described as a multidimensional construct, affecting the overall state of the whole organism, and is associated with physical, psychological, socioeconomic, and environmental factors (Barker & Nussbaum, 2011; Saito, 1999). In the short term, fatigue at the workplace is linked to reduced performance, lowered productivity, deficits in work quality, and increased incidence of accidents and human errors. To support this, a recent systematic review demonstrated that fatigue was a frequent issue in the human factors and manufacturing quality relationship (Kolus et al., 2018); fatigue may explain up to 42% of variance in quality deficits (Yung et al., 2020). In the longer term, fatigue may lead to compromised immune function and adverse health outcomes, including myalgia, chronic fatigue syndrome, and burnout (Kajimoto, 2007). Fatigue may also be a precursor to WMSDs – work-related musculoskeletal disorders (Iridiastadi & Nussbaum, 2006).

Fatigue has different institutionalized meanings across different scientific groups, and not surprisingly, there is no succinct and widely accepted definition. For years scientists have sought, but unsuccessfully, a single definition of fatigue (Aaronson et al., 1999). A single and possibly dogmatic definition, although convenient for scientific investigation, may instead confirm our own biases and misrepresent the reality of fatigue (Marino et al., 2011). Such is the case with the erroneous usage of the "lactic acid theory", a phenomenon that persists despite current flaws in our understanding of metabolic acidosis (Marino et al., 2011). Additionally, given the complex redundancy in most biological systems, a single mechanism unlikely explains fatigue under all conditions. Consequently, as Weir et al (2006) suggested, the search for a grand unifying theory of fatigue, based on reductionist approaches, may be futile. A single definition cannot describe the complex interaction of biological processes, behavioural manifestations, and psychosocial phenomena (Aaronson et al., 1999); and a single theory cannot explain all observations of performance decrement (Weir et al., 2006). It is perhaps the integration of different perspectives and disciplines that may lead to a greater understanding.

An integrative approach on fatigue has long been recognized. Ash (1914) stated: "Fatigue is a comprehensive term which in its widest application embraces all those immediate and temporary changes, whether of a functional or organic character, which take place within an organism or any of its constituent parts as a direct result of its own exertions, and which tend to interfere with or inhibit the organism's further activities."

Ultimately this integrative approach, as advocated by Marino and colleagues (2011), may result in a new conceptual landscape to better understand the aetiology and establish possible interventions to reduce, prevent, or minimize the effects of fatigue. Case in point, in terms of aetiology, Evengård (2007) suggested that biological and psychological data could be co-analyzed with social data and environmental factors of potential influence for the pathology.

A workshop hosted by Ontario's Centre of Research Expertise for the Prevention of Musculoskeletal Disorders (CRE-MSD) was convened in 2012 to critically evaluate occupational fatigue from different research disciplines and perspectives. In the workshop, the panel of experts discussed the concept of fatigue which was described as a balance between inhibitory and facilitatory effects, and possible adaptive and maladaptive behaviour of biological tissue. It was also stated that no single biomarker could determine whether the fatigue response will lead to an adaptive or maladaptive effect or a reversible or chronic effect; and fatigue may only be problematic when coupled with another risk factor. Despite

the many considerations when defining fatigue and its effects, the panel agreed that fatigue over a working day might impact performance and quality at work. Fatigue over multiple days, accumulating over time, may be more indicative of longer-term health outcomes. Consequently, a broad definition of fatigue was developed to include neuromuscular, emotional, and mental aspects, under the framework of occupational work. CRE-MSD definition of workplace fatigue (Yung, 2016): Fatigue is a process that results in the impairment of wellbeing, capacity, and/or performance as a result of [work] activity.

We also consider the Canadian Centre for Occupational Health and Safety's definition: "Fatigue is the state of feeling very tired, weary or sleepy resulting from insufficient sleep, prolonged mental or physical work, or extended periods of stress or anxiety. Boring or repetitive tasks can intensify feelings of fatigue. Fatigue can be described as either acute or chronic."

Types of Fatigue

An integrative approach to fatigue considers the phenomena in its many forms. We broadly categorize fatigue as: (1) cognitive (includes mental, central, sleepiness), (2) physical (includes neuromuscular, peripheral, muscular, cardiovascular, exhaustion), (3) perceptual (includes visual or sensory), (4) emotional (includes compassion), and (5) burnout. These categorizations may be induced by physically or mentally demanding tasks and workplace psychosocial demands, may be related to sleep quality and duration, may be related to circadian disruptions, may be related to the individual's capacity, and related to stress arising from exposure to a traumatized individual. These categorizes have been described elsewhere: Grandjean, 1979; Saito, 1999; Barker & Nussbaum, 2011; Yung et al., 2020.

1. Cognitive fatigue involves decrements in human information processing capability due to mental workload. It is an executive failure leading to competency, productivity, and error avoidance (Techera et al., 2016). In this report, we include aspects of sleepiness, sleep quality/duration, arousal, attention, alertness, and both cognitive overload and underload theories of fatigue.

2. Physical fatigue is the inability to maintain physical performance and can be attributed to metabolic disturbances, failure of neuromuscular transmission, changes that affect the myosin-actin complex, etc. In this report, we include tiredness or exhaustion involving the cardiovascular system. Physical fatigue is associated with a reduction in strength capability, changes in motor control, and reduced proprioception (Vollestad, 1997; Gates & Dingwell, 2008; Björklund et al., 2000).

3. Perceptual fatigue includes visual fatigue that may result in a decline in visual/perceptual performance and/or an increase in visual discomfort (Megaw, 1995). Visual fatigue is a consequence of prolonged visual activity rather than mental workload.

4. Emotional fatigue includes compassion fatigue, which is the emotional, physical, and cognitive stresses resulting from exposure to a traumatized individual rather than from the exposure to the trauma itself (Figley, 1995). Caregivers, or emergency and community service workers, are susceptible to developing compassion fatigue. It is characterized by exhaustion, anger and irritability, the lack of sympathy and empathy, reduced sense of enjoyment or satisfaction with work, increased absenteeism, and the impaired ability to make decisions (Cocker & Joss, 2016). Compassion fatigue is the emotional and physical erosion when helpers are unable to refuel and regenerate.

5. Burnout is a psychological response to work stress and is defined by three dimensions: exhaustion, cynicism, and professional inefficiency (Maslach & Leiter, 2016). Burnout is cumulative stress from demands of daily life and results from prolonged high levels of stress; compassion fatigue is closely related and may be considered as a form of burnout.

Prevalence & Impact of Fatigue

When considering lost productivity to U.S. employers, fatigue is associated with an excess cost of $101 billion per year. The majority of this cost is due to reduced performance at work (i.e., due to presenteeism) rather than absenteeism (Ricci et al., 2007). Chronic fatigue syndrome (CFS) is associated with $9.1 billion in annual productivity losses in the United States (Evengård, 2007). Ricci and colleagues (2007) found a fatigue prevalence estimate of 37.9% in the U.S. workforce. In Sweden, fatigue has been a dominant symptom among individuals on sick leave or taking early retirement. The cost of sick leave and early retirement is more than $17US billion annually (Evengård, 2007). In Japan, an epidemiological study determined that 60% of working individuals experienced fatigue and more than 50% of these individuals suffered from chronic fatigue lasting at least 6 months (Kajimoto, 2007). In Canada, persistent work-related fatigue has been reported among 15% male and 20% female workers (Winwood et al., 2007).

Fatigue Among First Responder Occupations

We examine the prevalence and/or severity of fatigue among three first responder occupations: Emergency Medical Services (described in Canada as "Paramedic Services"), Firefighting, and Law Enforcement. Fatigue is differentiated and described (if available) in 5 categories: cognitive/mental fatigue (e.g., sleepiness), physical/muscular fatigue, emotional/compassion fatigue, and perceptual (e.g., sensorimotor, visual, proprioception).

EMS/Paramedics

According to the National Occupational Classification (NOC) system, workers in "Paramedical occupations" (NOC Code: 3234) are individuals who administer pre-hospital emergency care to patients with injuries or medical illnesses. These patients are transported to hospitals of other medical facilities for medical care (NOC, 2016). The Occupational Information Network (O*NET) in the United States describes "Emergency Medical Technicians and Paramedics" (SOC Code: 29-2941.00) as individuals who assesses injuries, administer emergency medical care, extricate trapped individuals, and transport patients to medical facilities (www.onetonline.org). The NOC system further describes paramedics as those employed by private ambulance services, hospitals, fire departments, government departments and agencies, manufacturing firms, mining companies, and other private sector establishments (NOC, 2016).

Cognitive Fatigue: Bentley and Levine (2016) in a US national assessment of health and safety of nationally-certified EMS professionals (Longitudinal EMT Attributes and Demographic Study – LEADS program), found that sleeping problems was one of the most prevalent negative health outcomes reported over a 10-year period. Within this 10-year period, 20% to 27% of EMS professionals reported sleeping problems in the previous year. Measuring daytime sleepiness using the Epworth Sleepiness Scale (ESS), the authors found that 19.3% to 24.9% of respondents reported excessive daytime sleepiness (score > 10). In a commentary of fatigue and safety in EMS, Patterson et

al., (2012) indicated that 10-55% of EMS professionals experienced severe mental and/or physical fatigue, which was higher than fatigue reported in the general US work population (38%). A survey of 60 Australian paramedics was conducted to investigate the impact of shift work on sleep and daytime sleepiness (Sofianopoulos et al., 2011); over two-thirds of 60 participants reported poor quality of sleep, based on the Pittsburgh Sleep Quality Index (PSQI) and one-third reported being excessively sleepy. Ten percent of participants were categorized as dangerously sleepy.

Physical Fatigue: Physical fatigue has been linked to particular paramedic tasks. For instance, manual carry of a stretcher has been associated with heavy dynamic work of the legs and static strength of the upper extremities, requiring muscular strength and endurance and cardio-respiratory capacity (Barnekow-Bergkvist et al., 2004). According to Kluth and Strasser (2006), carrying manual stretchers is a risk factor of muscular fatigue, static shoulder muscle strains were observed to be 45% of maximum force and static low back muscle strains were 30%. In that study, the holding time of these forces was approximately 1 minute.

Another strenuous paramedic activity reported in the literature is cardiopulmonary resuscitation (CPR). Fatigue may occur as early as 1 minute into compressions, which impacts prolonged CPR quality (Souchtchenko et al., 2013). Although the number of compressions was maintained over a 5-minute period, there was a significant reduction in the percentage of "correct compressions" (defined as one with a depth of 4-5 cm) from 78.8% in the first minute to 28.0% in the fifth minute (Ock et al., 2011).

vThe prevalence of paramedic burnout has been reported globally. In Germany, 20% to 40% of 1101 EMS workers showed a high degree of burnout in one of the Maslach Burnout Inventory dimensions (emotional exhaustion, depersonalization, personal ac-complishment) (Baier et al., 2018). In South Africa, the prevalence of burnout was 30% among Johannesburg-based paramedics (Stassen et al., 2013). A US study indicated that urban and rural paramedics with less than 9 years of experience were less likely to report burnout (Chng et al., 2001). A study on Canadian paramedics revealed that 74% of 87 paramedics reported at least one symptom of high burnout based on established cut-offs in the three MBI dimensions (Kukowski et al., 2016). Based on individual dimensions of burnout, 49%, 67%, and 21% of paramedics reported high levels of emotional exhaustion, depersonalization, and personal accomplishment, respectively.

Firefighters

Firefighters (NOC code: 4312) are referred to as workers who carry out firefighting and fire prevention activities, and assist in other emergencies (NOC, 2016). Firefighters are described in the US as "Municipal Firefighters" (SOC code: 33-2011.01) who control and extinguish municipal fires, protect life and property and conduct rescue efforts (www.onetonline.org). These workers may be employed by governments (municipal, provincial, or federal), and by private industrial organizations that have internal firefighting services (NOC, 2016).

Cognitive Fatigue: Firefighters may suffer from sleep disorders that exacerbate workplace fatigue. In a prospective cohort study on the impact of a sleep health program, 179 of 431 firefighters (42%) who completed a sleep disorder screening questionnaire tested positive for one or more sleep disorders (Sullivan et al., 2017). Similarly, in a study of South Korean firefighters, 320 or 657 (48.7%) had poor sleep quality, which was shown to be higher than the reported prevalence of sleep disorders in the general South Korean adult population (10 – 30%) (Lim et al., 2014).

The incidence of sleep disorders may be due to length of work shifts, work shift schedules, and other workplace conditions. For instance, Choi and colleagues (2016) indicated that firefighters often work a standard 10 to 11, 24-hr shifts per month; however, many firefighters work additional 24-hr shifts voluntarily and non-voluntarily beyond the standard schedule. Choi et al., (2016) observed among 330 US firefighters that 85.8% (n=283) reported 12 to 21, 24-hr shifts in the previous month. Within this range, 23.3% of 330 firefighters (n=77) reported 14, 24-hr shifts. Barger and colleagues (2015), in a sample of 66 fire departments (6933 participating US firefighters), found that nearly all fire departments (97.0%) employed extended duration work shifts greater than 24 hours; 19.7% of departments scheduled their firefighters to shifts greater than 48 hours.

Firefighting activities are also risk factors for cognitive fatigue. Roja et al., (2009) asserted that mental load during firefighting is related to "psycho-emotional" load rather than processes like decision-making and solution finding.

Physical Fatigue: Physical responses (i.e., fatigue) has been measured as an intermediary between mismatches of capacity and demand, and outcome. For instance, Angelini et al. (2018) examined the risk of slips, trips, and falls after the three assessment protocols and found that fatigue increased the risk of trips and falls (increase of 86% major contact errors and 56% minor contact

errors committed by the trailing foot); decrement in performance was amplified with carrying a load (e.g., hose). The impact of fatigue on hand-eye coordination and the risk of slips, trips, and falls have been corroborated by interviews of firefighters in Australia (Dawson et al., 2015).

Overexertion due to strenuous physical work has also been linked to adverse health outcomes, such as fatal cardiac events (odds ratio of 11.6) (Sen et al., 2016). Overexertion accounts for 33% of injuries claimed by firefighters, where 83% of injuries due to overexertion were strains and sprains; lifting was the cause of 49% of overexertion-related injuries (Walton et al., 2003). Overexertion-related injuries, after controlling for age and year, were 89% more costly than any other causes of injury, averaging a total cost of $319 per firefighter per year (Walton et al., 2003).

Fatigue and cardiocirculatory strain may be hastened by working in heat (Smith, 2011); firefighters reported that exhausting fires while wearing a SCBA was the most physically demanding stressor that result in excessive fatigue (Young et al., 2014). According to Dolezal et al., (2014), US firefighters complete fire suppression activities at levels greater than 80% of their maximum heart rate.

Burnout: In a study of 109 South Korean firefighters, the mean scores between 1 (never) to 5 (every day) of emotional exhaustion, cynicism, and burnout was 2.30 (SD = 1.04), 1.76 (SD = 0.96), and 2.06 (SD = 0.95), respectively (Jo et al., 2018). Study authors indicate that the low mean burnout scores of their sample were comparable to previous studies of Korean firefighters. A study on 286 US firefighters assessed job burnout on a 1- (not at all) to 5- (very much) point Likert scale (Sattler et al., 2014). Participants reported minimal burnout (mean score of 2.43, SD = 1.18, when asked "Sometimes I feel burned out on the job").

Police Officers

This standard will be focused on "Police officers (except commissioned)" (NOC code: 4311), who protect the public, detect and prevent crime and perform other activities directed at maintaining law and order (NOC, 2016). According to US database O*NET, these workers are categorized as "Police Detectives" (SOC code: 33-3021.01), "Police Patrol Officers" (SOC code: 33-3051.01), and "Police and Sheriff's Patrol Officers" (SOC code: 33-3051.00). Police officers are workers who conduct investigations to prevent crimes or solve criminal cases, whereas Police Patrol Officers are workers who are assigned to an area to enforce laws and ordinances, regulate traffic, control crowds, prevent crime, and arrest violators (www.onetonline.org). According to O*NET, Police and Sheriff's Patrol Officers are those who are responsible for maintaining order and protecting life and property by enforcing local, tribal, State, or Federal laws or ordinances; these workers perform a combination of duties, including patrolling a specific area, directing traffic, issuing traffic summonses, investigating accidents, apprehending and arresting suspects, and serving legal processes of court (www.onetonline.org). The NOC system indicates that police officers are employed by municipal and federal governments and some provincial and regional governments (NOC, 2016).

Cognitive Fatigue: A significant risk factor of sleepiness and tiredness among police officers is work shift and length of shift. In a study of 308 US police officers from the large Buffalo Cardio-Metabolic Occupational Police Stress Study (BCOPS), there was a significant association between shift work and feeling of tiredness after stratifying by sex. The prevalence of tiredness was more than two times higher in male officers who work the afternoon shift (PR = 2.17, 95%CI: 1.33-3.56, p

= 0.0020) compared to male officers working the day shift; this relationship was found to remain significant after adjusting for covariates (PR = 1.89, 95%CI: 1.12-3.23, p = 0.0196). Male officers working the afternoon shift had a higher prevalence of tiredness compared to male officers working night shifts (adjusted PR = 1.59, 95%CI: 1.05-2.37, p = 0.0266). There were no significant trends among female officers (Violanti et al., 2018). The effect of the pattern or arrangement of shifts on fatigue have also been examined. A 2-year longitudinal study on 42 police officers from the Netherlands found that 41% of recorded workdays were extended shifts of more than 9 hours (Lammers-van der Holst et al., 2016).

The quality and duration of sleep has been investigated in law enforcement. In a US study, 43% of 379 police officers reported less than 7 hours of sleep while 11% reported less than 6 hours (Everding et al. 2016). The BCOPS cohort study revealed that the prevalence of poor sleep quality among 464 US officers was 53.9%; when stratified by shifts, the prevalence was 43.9% among officers who predominantly worked day shift, 59.8% for afternoon shift, and 69.1% for night shift (Fekedulegn et al., 2016). After adjusting for covariates, the prevalence of poor sleep quality was 72% higher among officers who worked night shift compared to day shift, and 49% higher when comparing afternoon to day shift. In Canada, 61 RCMP officers from 11 detachments enrolled into a Calgary Police Service Fatigue Training Program, reported an average of 6.3 hours of sleep per night during the work week; 14% suffered from sleep apnea, 45% suffered from insomnia, and only 21% were satisfied with their sleep (James et al., 2018). A systematic review on the sleep quality of police officers calculated a pooled prevalence of poor sleepers as 51.1%; the pooled mean score of the PSQI was 5.64 (Taylor et al., 2019).

Physical Fatigue: Sprains and strains represent 30% of all nonfatal injuries among law enforcement officers in the US; the most common nonfatal injury events between 2003 and 2011 were related to bodily reactions and exertions (15%), including overexertion from running and repetitive motion injuries (Tiesman et al., 2018). These injuries may be attributed to physically demanding tasks in police work. DiVencenzo and colleagues (2014) found that PPE increased VO2 and increased overall bodily discomfort due to the added weight of the gear but did not significant affect respiratory exchange ratio and rating of perceive exertion. A study using BCOPS data found that increasing fatigue was associated with higher prevalence of injury. That study assessed the levels of chronic fatigue (i.e., the level of tiredness or energy, irrespective of sufficient sleep) and general feelings of tiredness and lack of energy (i.e., feelings of exhaustion, lethargy, weariness, etc.). Study results indicate that 46% of officers had above average chronic fatigue scores and nearly 40% reported "feeling drained" (Fekedulegn et al., 2017).

Compassion Fatigue: Few studies have examined compassion fatigue among law enforcement officers. Turgoose et al., (2017) assessed the levels of compassion fatigue of officers who work with victims of rape and sexual assault; of 142 UK police officers, 84% compassion fatigue scores were ranked as being low, 16% were average, and none rated as high.

Burnout: Police officers may be prone to burnout, which is characterized by emotional exhaustion, depersonalization, and low personal accomplishment. In a Swedish study of 856 officers, 30% of female and 26% of male officers had high levels of emotional exhaustion while 52% of females and 60% of males had high levels of depersonalization (Backteman-Erlanson et al., 2013). Unlike other countries in the world, a study from Italy reported low burnout manifestations based on the MBI scale and concluded that the 88 police officers in their study may not be at risk for developing burnout (Setti & Argentero, 2013). A Canadian study of 410 participants (69% of which were police officers) found that psychological demand was consistently associated with burnout (Marchand & Durand, 2011); burnout tends to manifest from organizational factors rather than from critical incidents (Brady, 2017).

Objective

First responders are at high risk of suffering from decrements in neurocognitive and physical performance related to fatigue. Such performance decrements endanger not only the personal health and safety of these responders but also the health and safety of their fellow responders and the public they serve. Fatigue may also be a precursor to adverse longer-term outcomes, such as musculoskeletal disorders, cardiovascular disease, and mental health disorders. Appropriate management, policymaking, standards, guidance, and research activities can reduce the exposure to these fatigue-related risks and hazards before they pose significant problems during emergency response operations.

Emergency response providers are called into service on very short notice and at all hours of the day. As a result, they may be: deployed without sufficient sleep and rest to ensure optimal alertness and performance levels; called into service during the circadian trough of alertness and the circadian peak of sleepiness in humans; and required to perform safety-critical tasks that may be physically or mentally demanding within minutes of waking up, when the effects of sleep inertia are most potent. Once deployed, responders may participate in continuous operations requiring extended work shifts and sustained wakefulness during all hours of the day and all circadian phases of the human body. For these reasons, first responders constitute an occupational group that is particularly vulnerable to the effects of fatigue. Managing responder fatigue and mitigating its associated health and safety risks are therefore essential to protect first responder and public health and safety.

In Lerman et al., (2012), fatigue risk management was defined as a science-based, data driven process that is subject to continuous improvement, and designed to improve outcomes. When incorporated into a management system, elements are linked into a formal structure. These elements are: (1) safety management policy, (2) risk management, (3) reporting, (4) incident investigation, (5) training and education, and (6) internal and external auditing (Lerman et al., 2012); these elements can be integrated within a broader plan-do-check-act framework. One fundamental aspect of fatigue risk management is to deal with fatigue hazards based on the risk management RACE model – recognizing hazards, assessing risks, implementing controls to mitigate risk, and evaluating the effectiveness of controls.

The main objective of this project is to develop an evidence-informed national Standard on First Responder Workplace Fatigue Risk Management (the "Standard") which will be used across Canada to improve first responder health and wellness and will support the collection of consistent, national data that will inform the development of a robust and comprehensive Canadian Paramedic Information System. A goal of the project will be that first responder organizations incorporating the national Standard into their existing management systems will experience reduced worker injuries and improved health and wellness as a result of having a Workplace Fatigue Risk Management System in place. In addition, the Standard will enable further paramedic research in the area of health and wellness as well as organizational performance and productivity by contributing a common national dataset to the proposed Canadian Paramedic Information System. Canada will be the first country to have such a Standard. The project also proposes to elevate the final Standard for consideration as an international ISO standard, thus promoting Canada's leadership in the international first responder community.

The scope of this project includes: 1) conducting research related to first responder workplace fatigue risk management (including working with partners and workplaces); 2) developing a consensus-based, evidence-informed national Standard; 3) developing supporting Standard implementation tools; 4) pilot testing the standard in an organization in British Columbia; and 5) supporting the internationalization of the Standard to showcase Canada as a leader in first responder health and wellness and build capacity within international community.

This report describes the "Research and Synthesis of Evidence" phase (Figure 1), gathering evidence from three sources: 1) a scoping review of peer-reviewed literature to provide the current state-of-the-art scientific knowledge in first responder workplace fatigue risk management, 2) an environmental scan of good practices based on grey literature (e.g., reports, policy documents, best practice guidelines available on the web and elsewhere), and 3) interviews of key informants (front-line staff or management) from exemplary organizations. The scoping review will mainly inform the RACE model while the environmental scan and key informant interviews will mainly inform other aspects of the PDCA model. Collectively, the data will be synthesized, and a needs assessment will be performed to identify the issues, gaps and needs of key stakeholders.
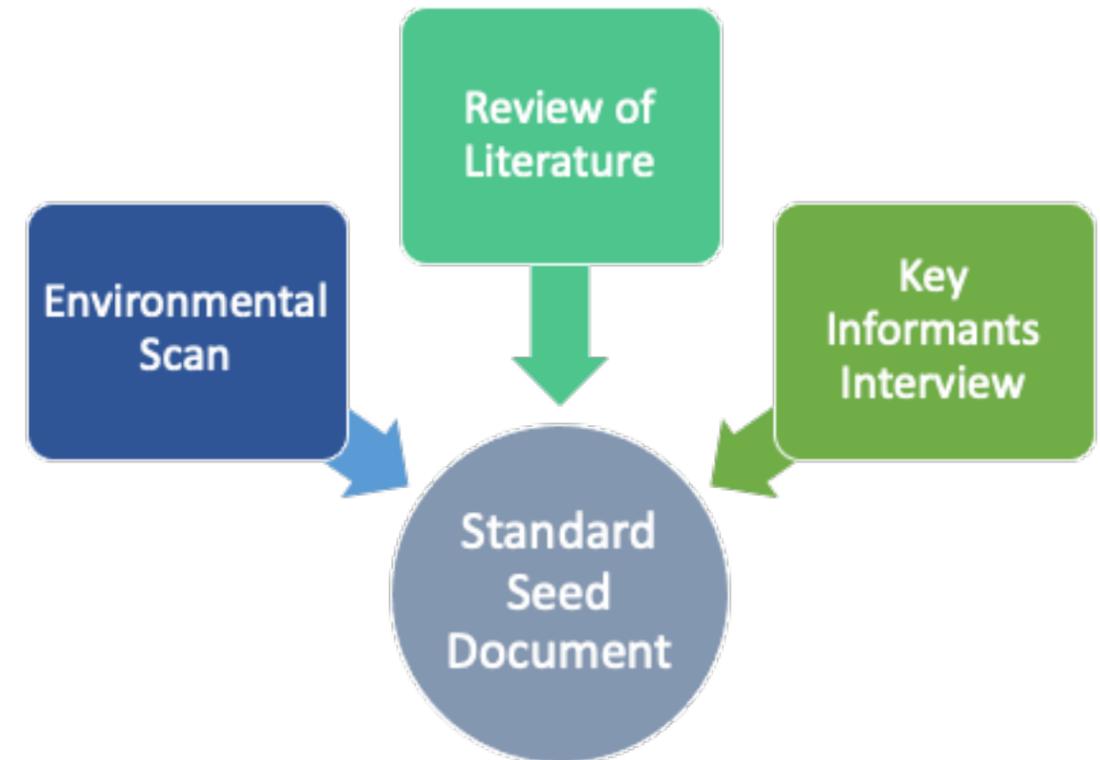

Figure 1. Three sources of information for the development of a seed document to create a workplace fatigue risk management standard.

Methods

Semi-structured interviews with first responder personnel (frontline staff and management) were conducted to gain an understanding on current perspectives of the impact of fatigue on their health, safety, and performance of work activities. We explored how fatigue is addressed both by the individual worker and the organization; we specifically sought to understand how fatigue is detected or measured, how risks of adverse events are assessed, how fatigue is minimized, and whether the organization monitors the effectiveness of their prevention activities. Barriers for implementation or program effectiveness were identified.

All participants provided written consent to the terms and conditions of the study, including the procedures, possible risks, and audio recording authorization prior to their scheduled interview. This study was approved by the Research Ethics Board of Conestoga College (REB #309).

Study Sample

Participants were recruited by snowball sampling technique with assistance from the Canadian Standards Association Group and by reaching out to key informants who were identified as representatives of exemplary organizations, policymakers, and program providers. Key informants are individuals who may be recognized as an expert source of information (Marshal, 1996). Affiliates were identified and emails were distributed to invite potential participants.

We aimed to interview an equal representation of personnel from firefighting, police services, and paramedic services. Both frontline staff and managers (including supervisors and chiefs) were invited. Frontline staff are first responders who serve in the frontlines for public safety and represent the intended user (or targeted group) of the first responder fatigue risk management standard. These individuals have the practical experience and the opinions on how fatigue might impact their performance or wellbeing, potential risk factors that contribute to their (or their colleagues') fatigue, and potential solutions to mitigate the effects of fatigue. Frontline staff were encouraged to provide details on the mechanisms in place for communicating feedback to management and accessibility of current policies and best practices. Managers are individuals who oversee the operations of the service; their responsibilities may include strategic operating plans, policies, and risk management procedures. Managers may provide insight towards current policies and practices of fatigue risk management and barriers and facilitators of their implementation.

Recruitment and interviews were conducted between October 1, 2019 and March 3, 2020.

Interview Procedures

All interviews were conducted over the telephone. Prior to all interviews, participants were sent an information letter outlining the procedures, risks, and conditions of the study, and the interview questions to help them prepare for the type of questions that were asked during the 60-minute telephone interview (facilitator: JG). At the beginning of each interview, participants were reminded of study terms and conditions.

Interviews were semi-structured, consisting of pre-determined open-ended questions and probes, while allowing for discussion of pertinent issues for elaboration or clarity. Questions were tailored to frontline staff and managers however most of the questions were identical for each participant group (see Figure 2 for example questions). These questions were structured to give participants the opportunity to provide any general comments and ideas that should be considered for the fatigue risk management process. These questions were designed by a group of researchers with diverse research and disciplinary backgrounds and were later piloted with a senior EMS manager who provided feedback on the clarity and appropriateness of questions and to improve interview protocols. Feedback from the pilot was used to modify and finalize interview protocols.

Interviews were digitally recorded and later transcribed into text using commercially available software (Temi, San Francisco, CA, USA; www.temi.com) and checked by one of the investigators (MY). Following the interview, the transcribed data was reviewed by the participant and she/he was given an opportunity to clarify, elaborate, or add any comments, and to ensure accuracy of her/his statements. Final interviewee-reviewed transcripts were used for analysis.

Thematic Analysis

Thematic analysis was used to code and analyze data, this approach has been used to identify patterns and can be applied within a range of theoretical and epistemological perspectives (Braun & Clarke, 2006). A guide developed by Braun & Clarke (2006) was broadly followed: First, transcripts were read independently by two reviewers to familiarize themselves with the interview data. Second, two independent coders reviewed the transcripts, and coded the data to capture responses relevant to each of four topics: (1) how has fatigue been conceptualized in their service and what are potential risk factors? (2) how has fatigue been detected or measured and assessed for its risk of adverse outcomes? (3) what are the current organizational practices, policies, and programs to mitigate risk of fatigue, including roles and responsibilities or management and employees? and (4) what are the current barriers and facilitators to reducing risks of fatigue? These topics and their semi-structured interview questions (Figure 2) broadly contribute as elements of the Plan-Do-Check-Act framework and incorporate fatigue risk management elements identified by Lerman et al., (2012). Third, initial codes were sorted into potential themes and through reviewer consensus, major recurring themes across all participants were identified. Emerging themes within the PDCA framework were reviewed to ensure accurate coverage and representation of the entire data set. Excerpts from interviews were analyzed for specific examples within each theme. To maintain participant confidentiality, participants were assigned a unique participant code and any reported quotations were attributed to their job title.

Storage, organization, and thematic analysis of transcripts were completed using Microsoft Excel (Microsoft Corporation, 2020).
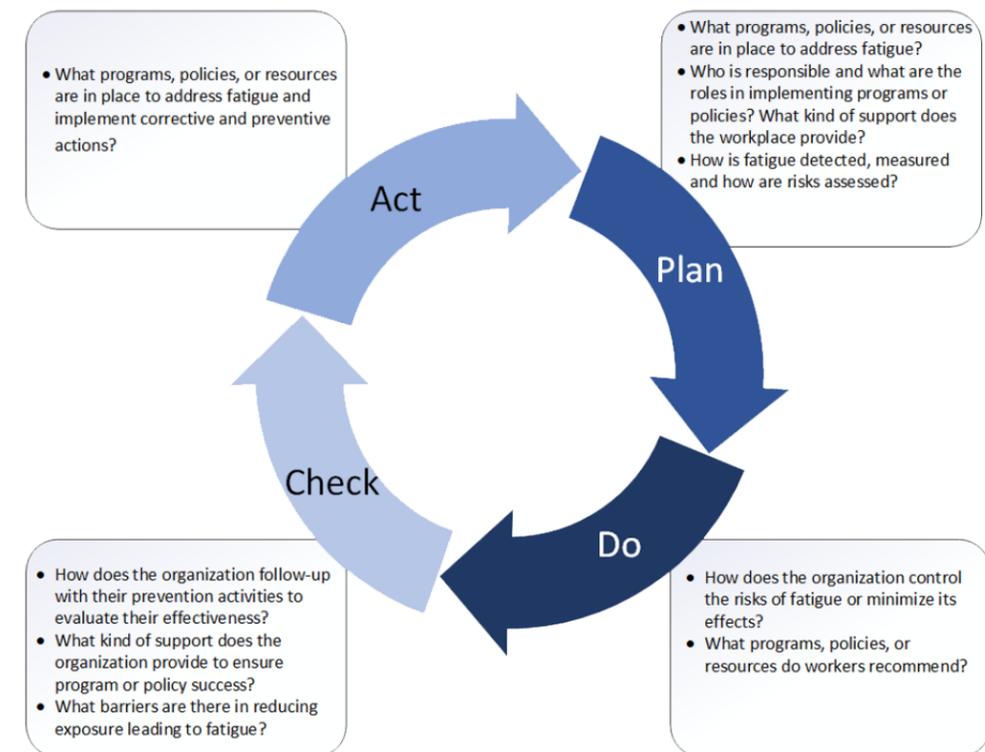

Figure 2. Examples of semi-structure interview questions broadly addressing elements of PDCA framework.

Results & Discussion: Does Fatigue Affect Work?

Key informants representing targeted first responder occupations (firefighting, emergency medical services, law enforcement) and roles (frontline staff, managers) participated in this study. Participants were recruited from various provinces across Canada. Interviews ranged between 40 and 72 minutes. Emerging themes were sorted into the PDCA framework; the PDCA framework assists an organization to integrate risk management into its overall management system and can be adapted to meet specific needs (Figure 3).

Type of Fatigue & Its Impact

Type of Fatigue

The majority of participants identified sleep and mental exhaustion as primary types of fatigue experienced in their work. Frontline staff indicated that they were often "tired", "worn out", are "unable to focus", "have trouble concentrating and gather thoughts", and cannot "perform at [their] peak". One paramedic indicated that while driving, which is a primary task in their job, they found it "really hard to focus on the road and [they] get kind of twitchy". Another paramedic defined mental fatigue as "a mental fog that accompanies that feeling of maybe not being 100% mentally… that feeling of fatigue just never goes away." A frontline firefighter associated fatigue with "decreased mental clarity" and "lower response time". An EMS manager concurred, indicating that fatigue affects cognitive abilities due to "excessive exertion without an adequate rest period or due to lack of sleep." An EMS platoon supervisor noted that being fatigued is a "constant state of life" where employees are always tired despite the amount of sleep; she/he indicated that in her/his work that their,

"body never quite knows when to sleep and when to be awake…the body clock is just disrupted and doesn't know how to operate".

A senior police officer in a management level position indicated that for shift workers, both the quality and duration of sleep are issues. Fatigue might also manifest from a shift patterns consisting of long working hours with minimal breaks; "a four on four off schedule, and for 11 hours in a role, they [officers] are done."

A platoon EMS supervisor indicated that paramedics experience general (physical) fatigue due to work, attributed to the "busyness and the amount of work that you have to put in there." The supervisor acknowledged that work fatigue combined with issues related to sleep are "compounding factors". When one paramedic hears of the word fatigue in the context of their job, they attribute fatigue to physical exhaustion from long shifts. A firefighter associated fatigue with other terms, including lower energy, decreased work capacity, elevated heart rate, reduced force production, increased hunger, inability to control mood, and decreased tolerance or pace.

A police manager discussed the possibility of burnout, indicating that police officer "tolerance for the job seems to be a lot shorter than it used to be." The manager noted that a consequence of burnout is constant switching of jobs or staff attrition:

"it seems like subconsciously that they've just had enough of this job and wanting to go to another job because that's really all they can do within our organization or they quit… to go and leave the job after you're already committed that five-year mark is quite a very difficult decision, let's put it that way."

Two paramedics agreed that burnout is an issue in EMS work, and one paramedic experienced burnout as,

"being emotionally drained, and really having nothing left to give when you come [to work], when you're on your way home, when you get home to your family."

A paramedic described the potential interlinking between different fatigue types, saying that,

"fatigue feeds into mental health, which feeds into compassion fatigue and burnout, it's a big spiral, it's all connected… you have to fix one of them so you can start fixing the others."

She/he provided an example,

"If you're exhausted, you don't feel like working out and if you don't work out, you can't get to sleep at night and then your emotional health suffers."

The paramedic then summed up fatigue they experienced in their job,

"it's not just the physical aspect of fatigue, but it's a whole aspect of fatigue that walks through our door every single day."

A manager in firefighting revealed that compassion fatigue is a prevalent and significant challenge in the firefighting industry. The key informant associated compassion fatigue with the lack of sympathy and empathy when dealing with calls.

Fatigue Outcomes: Performance

Participants associated fatigue with deficits in work performance, and relating it to reduced reaction time, poor attention, and deficits in decision making. Frontline staff indicated that fatigue leads to decreased reflexes and the inability to focus, which all impact their driving performance. One paramedic stated that fatigue was most pronounced during driving and may result in "mistakes, errors, and crashes". A supervisor concurs, indicating that staff have reported driving and protocol errors, particularly during night shifts, especially when driving "between stations for standbys to cover off other areas…. just driving in the middle of the night.", on the other hand, when driving to an incident, "[fatigue] is not as bad because the adrenaline runs." Fatigue affects decision making, where one paramedic indicated,

"[fatigue] interferes with your cognitive functioning ability and the ability to do a differential diagnosis…and not looking for multiple explanations for a given problem when you should be…people start simplifying things because they're not operating at peak and they tend to take the easiest path even though that may not be the appropriate path."

Another paramedic stated that with fatigue, they would forget their standing orders, which might have serious implications in treating their patients. The same paramedic indicated that when both she/he and her/his partner acknowledged that both were fatigued, there is self-doubt and doubt in their partner's judgment, leading to a lack of confidence in making the right decision. Fatigue has led to medical-related errors. One paramedic intimated the effect of fatigue on identifying the correct drug, calculating the correct dosage, and determining the appropriate route of drug administration. In her/his story, the paramedic revealed that due to fatigue, she/he "got the drug routes mixed up" administering an IV instead of an IM, and although it affected the patient, luckily it was not a severe outcome. Although fatigue has been implicated as a factor in committing medical-related errors, a supervisor revealed that information on medical errors were collected but to her/his knowledge there have been no attempts to relate fatigue and these potential outcomes. A paramedic manager noted that fatigue may increase the risk of committing a motor vehicle accident during their commute from the base to home and may be a public safety concern:

"[after a shift] there'll be an hour of cleanup at least, and then three and a half hours to get back home. So now after this 10-hour workday, now you're going to put them in the ambulance for another seven hours with a heavy cognitive load [red transfer]. Imagine what that paramedic feels like by the time they're an hour from home driving that ambulance down the highway at highway speeds. Just absolutely wiped. Barely keeping your eyes open anymore. And you've still got a one-hour drive in the middle of the night driving a two-ton vehicle at a hundred kilometers an hour. And uh, yeah, you're meeting them on the highway."

An EMS supervisor expressed concern over the emotional toll of fatigue on her/his staff in their daily work, stating that

"…the monotony of work in terms of the repetitive nature of it… and then some of the clientele can test your patience at times. And it's much more difficult to deal with that when you're very fatigued."

A fatigued police officer was also likely to be irritable or short-tempered. The management-level police officer stated that conduct-related complaints were on the rise, 35% of the complaints from public were conduct-related, e.g., rudeness, unprofessionalism, rolling of eyes, short-tempered, not willing to engage in conversation, and could be attributed to fatigue. The police key informant shared an example:

"I know for a fact there are days that I just don't have the patience for you right now. I'm tired. There are 20 calls on the board, I have 15 reports that I have to get in. Uh, I just don't want to deal with this traffic stop right now."

A firefighting manager similarly described the emotional toll of [compassion] fatigue on her/his staff, suggesting that they have to dig deeper to deal with people in a respectful manner, manifesting into depression, anger, irritability, and lack of motivation. Simply, the firefighting manager described that fatigued staff become "morose".

Fatigue Outcomes: Health & Wellbeing

Less frequently stated but equally important is the effect and consequence of chronic fatigue on health. A paramedic manager stated that fatigue affects overall health, listing possible symptoms of fatigue due to "sleep deprivation and starvation", such as "increased sleep apnea, increased risk of cancers, and poor nutrition habits." The EMS platoon supervisor who suffers from sleep apnea, and after being denied accommodations to avoid night shift, disclosed that "shift work is leading to my early retirement… I just can't do it anymore." The law enforcement manager indicated that fatigue in combination with experiencing traumatic incidences may exacerbate ill health. She/he relayed an example,

"So you're fatigued and very tired and not having the greatest set of shifts, it's busy, and the young Constable has all of a sudden a traumatic event. Their ability to work through that traumatic event is hindered by numerous things…. [when fatigued] they already didn't have the tools in place or the rest and the calmness that's required to deal with trauma. And so now you're trying to deal with it when you're already in a broken state."

A paramedic manager agrees that fatigue and workload impact mental wellbeing, stating that

"we have a decreased access to our coping mechanisms, whether those be a puppy at home that we play with, hitting the gym, or actually seeing a psychologist just due to the hours of work and the load, we just don't have the ability to seek out those things."

She/he elaborated that after a bad call, although there are resources to seek peer support or a psychologist, if a paramedic was on a core flex shift (96 hours),

"the only way you can do it is to take sick time and take the rest of your shift off. They have to find someone to cover your whole shift now and it's unreasonable. What happens is paramedics don't go for help because they have to use sick time and admit that, 'Oh, I want to go see my psychologist'. I mean, paramedics don't like to say those words."

A frontline paramedic within the same region disclosed a story that supports the impact of current long shift schedules (core flex) on seeking/accessing support after a traumatic incident. In her/his story, the unresponsive patient was a childhood friend:

"I was already at high hours and was called to patient with no pulse, no respiration. When I got there, I realized it was a childhood friend that I'd known since I was six years old. Of course, we couldn't save him, uh, when it came back from a supervisor to try to get taken off the car for mental rest. And he told me I could have an hour to get myself back together and then it was expected to go back to work again"

A police manager noted that the effects of fatigue are cumulative and may not be apparent at the onset of exposure to risk factors; frontline personnel may not be able to connect exposure to demands or risk factors, fatigue (as an intermediary effect), and outcome. The police manager said,

"fatigue becomes very chronic over time and they start breaking down and sometimes they might not even know why."

Fatigue Outcomes: Personal and Family Life

The effects of fatigue, particularly due to work volume, may also spillover into their personal/family life. This was observed from key informants representing all three first responder occupations. A police manager described fatigue affecting "personal hygiene":

"they're sacrificing sleep, they're sacrificing time away from their personal lives with their families, especially with younger families… then you add in over-time. So now with the way the frontline is and with the work volume, overtime is great for the pocket book, but it's not great when it comes to personal hygiene. The first year or two, probably first two years, you really try to make more money than just your base salary because those options are there. But what are you giving up?"

One paramedic explained how fatigue affected their work-life balance,

"it's a source of conflict between the family and the first responder. That conflict doesn't really help you sleep situation. [My family asks] why are you going to bed at eight o'clock? I have to get up at four, and they don't get it. They say, 'go spend time with me.' I respond, 'no, I need to go to bed… so they have all these competing shift demands and competing family demands.'"

A firefighting manager described how fatigue manifests itself into home life, dealing with transitioning from a male dominated work environment while exposed to strenuous calls, to family life with its own responsibilities:

"it takes time to decompress from your world to the new world. And it's a challenge. I couldn't flip that switch overnight."

Summary

Key informants associated fatigue with disruptions in circadian rhythms, impairments in cognitive performance, physical fatigue, burnout, and compassion fatigue. The impact of fatigue includes deficiencies in work performance, leading to "mistakes, errors, and crashes", and increased irritability or short-temperedness when dealing with the public. Fatigue may have an affect on the health and wellbeing of personnel and may exacerbate ill health. Key informants expressed the impact of fatigue on their personal and family life, affecting their work-life balance.

Results & Discussion: Plan

We identified five categories of "Plan" activities from key informant interviews: issues related to organizational policies, programs, or procedures, leadership and organizational commitment, motivation (to address fatigue), and hazard identification and risk assessment. Themes emerging from identifying potential hazards were risk factors related to shifts, factors related to the task or work environment, and factors related to rest and recovery.

Written Policies

One service provided written policies specifically related to fatigue and highlighted the reporting mechanism:

> "there is a responsibility to report section in the policy, where you're supposed to report your own fatigue to your supervisor and they're supposed to deal with this."

Two other paramedics asserted that their services have no written policy or programs or other resources that specifically target "fatigue" but there are policies that deal with potential risk factors. Of the two paramedics without formal policies, one stated that their employer makes a reasonable effort to ensure adequate periods of rest between shifts and offers a variety of shift patterns to suit the paramedic's lifestyle and to minimize their fatigue, and there are policies around shift start times and length to minimize shift overruns. Similarly, in firefighting, a manager revealed that there are mandatory requirements for defusing after a critical incident, but for "fatigue", there are no policies in place.

An emerging theme was that work policies may have content deficiencies and therefore may be ineffective in preventing fatigue. One paramedic stated that policies did not reduce fatigue-related commuting accidents after long shifts; the current 8-hour recovery period between shifts was considered insufficient and does not account for long-distance commuting between the base and their residence. A supervisor acknowledged that her/his service has a written policy to allow for naps during shifts, but only for night shifts and not for other times of the day. Consistent with other key informants, the supervisor revealed that policies do not explicitly attend to "fatigue" but it "is part of the general expectations policy and there's a section on sleeping in it", specifically that "they're [frontline staff] allowed to sleep...at certain times of the day". A paramedic manager said that there are fatigue mitigation policies throughout their province but are inconsistent and "not rooted in any kind of evidence". According to this paramedic manager, in her/his province, policies written in their employment contract are different between rural and urban services. In urban services, a 30-minute "bio-break" is offered if a paramedic works continuously for 5 hours; and towards the last 30 minutes of a shift, the unit is considered "non-recommendable for any calls except for the most critical calls." As indicated by both a paramedic manager and a frontline member, rural services have a Core-Flex staffing model for full-time paramedics, which schedules personnel for extended periods of 96 hours followed by 96 hours off work (i.e., 4 days on, 4 days off shift pattern). Casual workers have the option of working 24 hours, 48 hours, 72 hours, 96 hours, or even more, consecutively. Within a 24-hour period inside the core-flex shift, paramedics are given 8-hour downtime after working "on task" 14 hours, cumulatively. The EMS manager indicated that in her/his province, fatigue policies are effective "on paper" but may not be effective "in practice". The manager indicated that for a policy indicating that paramedics can work for 14 hours during a 24-hour shift, policies are based on "time on task", where time for calls and inter-facility transfers contribute to the 14-hour work period, without consideration of the total time the paramedic remains awake. The manager expressed the following:

"The problem is if I do four hours of work at eight o'clock in the morning and then four hours of work at eight o'clock at night and then four hours of work at two o'clock in the morning and then one hour of work at six AM I've now been awake for 24 hours straight and I have not had a rest period. There's been no eight-hour break in there… I must keep working. That's the problem with the policy."

The frontline paramedic elaborated by saying that the "clock starts to count down" after calling dispatch and notifying their supervisor for their 8-hour rest. Therefore, their 8-hour downtime rest period typically leaves five to six hours of rest after allocating time to shower, eat, and attend to other personal duties. Additionally, the 8-hour rest period may impact the quality of service provided to the community, since

"when we are shut down [during the 8-hour downtime], our ambulance is also shut down, therefore having one less ambulance for the area."

The law enforcement manager explained that fatigue management may be embedded within the "fit-for-duty" policy but not directly addressed. Programs were also available for fatigue-related issues but were not designed specifically for fatigue; a wellness program created by the police association for the organization aimed to improve mental readiness and was stated to be a "tool to gauge fatigue, anxiety, stress" to allow members to "re-evaluate, re-assess, and access resources".

A paramedic explained that there may be a limit to the reach of formal policies on mitigating fatigue:

"you can have good policies in place and still people are just not going to be able to get a good night's sleep or I only have a few employees who suffer from insomnia and they have to call in sick if they watched the whole night go by and can't fall asleep because they just feel they can't go to work that day. I think it's good that we have certain policies in place, but I think it's a hard issue to address. I don't know specifically what more you can do."

When asked to elaborate, the paramedic addressed the need for prevention strategies of fatigue that can be done outside of work:

"I've never seen or heard any resources that would address ongoing fatigue in life or outside of work. It's all just very work by the numbers stuff that's in the policy."

A second paramedic also expressed the same need for policies to help address fatigue outside of the workplace. One paramedic asserted that mitigating fatigue is a larger pervasive issue beyond workplace policies and the scope may include addressing issues with employment and seniority:

"… a lot of people take whatever for seniority. They'll take to stop being casuals and to start gaining seniority. They'll take whatever positions available. We had somebody who ended up working three hours away from their home. So, if you add on three hours, travel each way to your four shifts, that's pretty rough. That's long days. And I mean already you've just lost a bunch of your time to be able to sleep."

The police manager also expressed that there are barriers for implementing policies or programs due to the self-stigma attached to seeking professional help or care. She/he stated that,

"as police officers, we're stubborn, and the reason for that is because we're the fixers, we're trained to fix other people's problems. But when it comes to our own problems, we're very reluctant to let our guard down to get access to that help, because of some of our own self stigmas. We think that there's a problem if we let our guard down or go to psych services or try and find a sleep expert or stuff like that. We think that people are going to look differently at us or we're going to not get a promotion or we're not going to get a career advancement."

Additionally, the police manager recognized that there is stigma within specific work groups, comparing different divisions in her/his service. A firefighter also identified stigma around fatigue and the ability to perform their duties, as a barrier to fatigue risk management, stating,

"In my experience, I'm not sure I had ever come across saying somebody's having someone say I'm too fatigued to respond, that's sort of not acceptable."

An EMS manager advocated for the involvement of frontline personnel when designing policies, programs, and procedures, indicating that,

"I think it's very, very important for as many paramedics in Alberta who experienced this to have their voice heard within this research."

Fatigue Risk Management: Who is Responsible?

Participants expressed that dealing with fatigue is a shared responsibility between employer and employee; one frontline worker said that in her/his service,

"there is no specific committee responsible for issues surrounding fatigue. It always seems to be dealt with on a case by case basis with whoever is working in dispatch and the supervisor on duty… they just kind of come up with ideas I guess as they go along."

Paramedics indicated that employees are responsible for their own fatigue and are responsible to notify their employer of their status. For instance, a paramedic indicated that they are required to contact dispatch or their supervisor when they exceed their work hour policy (e.g., 14 hours cumulatively), and are held responsible if they are involved in an accident or make an error beyond this period. Another paramedic indicated that their union representation ensures that the employer complies with minimizing shift overrun, ensuring that shifts do not exceed 12 hours. The police manager concurred that it is a shared responsibility but also emphasized that senior officers have a significant responsibility to educate and mentor younger frontline staff, to "provide some input and some insight on how to get some longevity in this career." A firefighter manager concurs that employers should bare the majority of responsibility by championing fatigue risk management and by introducing and enforcing policies; she/he believes that the involvement of worker unions remains essential in delivering an effective risk management strategy. In the same vein, a frontline firefighter indicated that fatigue risk management should fall under their health and safety committee, and on a daily basis under the Platoon Chief.

A frontline worker expressed the need for more shared responsibility between employee and employer,

"I have a responsibility to make sure I'm fit for duty, but then there has to be support from the employer to say we prefer that you're not coming in because you're not fit for duty."

When asked about the level of organizational commitment, i.e., support for fatigue risk management, first responders indicated that beyond a mention in written policy, fatigue has never been addressed as its own topic. A supervisor indicated that

"… mental health is the big-ticket item right now in our business, the incident stress and cumulative stress, and it [fatigue] has been talked about as a factor in these things but fatigue itself has never been addressed as its own topic… if mental health is a big issue, I think right alongside of it is fatigue."

However, when queried about how they would like organizations to support them, a few frontline paramedics struggled to identify solutions as it was considered a personal issue:

"Like it's your own kind of choices and how you set up and how good you are at adapting to shift work. And then the casuals are a whole other issue because their shifts are so unreliable and all over and they're literally traveling for hours and hours to get to a shift sometimes. So, it's such a personal thing."

Two paramedic members offered their recommendations to improve organizational commitment and support. One manager indicated that because of the lack of "culture of support", paramedic advocacy organizations should continuously bring the seriousness of fatigue and its impact to light, and thereby encouraging the employer to address fatigue-related issues. A frontline staff member suggested that staff members should "control their own fatigue management" and attain more support from management; from their experience, reliance on supervisors to receive permission was an ineffective procedure. According to this paramedic,

"I'd like to see that when we inform the supervisors and we express fatigue, they support us and say, okay, well we'll shut you down for eight hours and get some rest or six hours or something. Instead, we really hesitate to phone because we have to justify why we think we're fatigued. Then they questioned us, well, why weren't you sleeping? And then it feels like they're trying to make us feel guilty because we're an essential service. And then if we're fatigued and we shut down, that shuts down an ambulance and potentially could harm a patient. So, I'd like more support that if, if we feel we're fatigued, take our word for it and let us rest."

In police services, support is available from both the organization and the union. Within the organization, the manager listed the wellness branch who oversees standard occupational health and safety, employee family assistance, critical incident stress management team, the reintegration program, psychological services, access to a chaplain, and a fitness and wellness unit. The police manager explained that the wellness branch, directed by an individual at the inspector-level, is managed by the human resource department, which itself is managed by a deputy chief. The police union also supports fatigue risk management, by monitoring, educating, and improving awareness of the resources available within the police service and police association.

Fatigue Worth Addressing?

All participants emphatically indicated that fatigue is worth addressing in the workplace. One front line paramedic stated that cumulative and chronic fatigue is a significant individual and organizational risk factor and should be considered as problematic as any other issue in their service. A firefighter indicated that there is "a lot of evidence" on the impact of fatigue and shift work on health but is not adequately addressed. Another paramedic further elaborated saying,

"Whether the impact is direct, like something we can actually see, like someone's yawning, grumpy, whatever, or the indirect things like the impact on family relationships, your inability to get a good night's sleep even when you don't have to work the next day. All those different things, they all add up and they add up over multiple years. And eventually they affect our physical health, but also affect our mental health. And that leads back into more problems at work, at home, and your social life. It's one big cog in that wheel and it's that one cog we have not addressed."

A supervisor concurred with these statements and indicated that organizations should manage fatigue levels better whether it's achieved by scheduling practices and other workplace programs, but ultimately

"there needs to be a lot more education on the risks associated with fatigue...[and] the consequences of failure to reduce fatigue."

A second paramedic supervisor expressed significant concern for paramedics if fatigue is not formally addressed, stating that this topic is "urgent", the consequences are "imminent", and without intervention, the service is "headed for disaster". In law enforcement, the manager indicated that although the organization might recognize fatigue as a serious problem, a focused approach on fatigue is "long overdue" and a "wholesome view" rather than "band-aid solutions" should be strongly considered. A "wholesome view" in the words of the key informant considers both work factors (e.g., specialized units, officer seniority), life factors (e.g., home responsibilities, constant connectivity to work), and personal factors (e.g., age). The motivation to address fatigue is found within firefighting, with a manager describing the potential outcomes of reducing fatigue in the workplace:

"We want our employees to be healthy and we want our employees to be productive. As an employer, I care about our people, we want them to be healthy and I want them to retire healthy. I want them to be productive. I want them to get their work done. I want them to be engaged and not disengaged from work."

Although key informants themselves believe fatigue is worth addressing, improvement in organizational commitment is highly desired. Participants believe organizations and employees will be motivated to address fatigue when there is increased recognition of the impacts or outcomes of fatigue. A paramedic supervisor indicated that frontline and management should be educated to recognize the impact of fatigue on health and performance as motivation to actively address and reduce fatigue. She/he stated that the organization should analyze whether fatigue was related to injuries, driver related performance decrements, and medical errors. A firefighting manager believed that peer-reviewed scientific evidence will help support a fatigue risk management system:

"What are the real implications of fatigue and who has done a study on the fatigue levels of first responders or of firefighters? ...we would need evidence that this is an issue for this industry. And then once we have the evidence, then how do we manage it? ..... we only have so many resources. We only have so many things we can deal with, financially, time-wise, all these other different things. We have to make sure that we're doing the right thing for our people. But if the issue of physical fatigue is 1% and mental fatigue is 37%. Where am I going to focus my efforts?"

Risk Factors: Shift Duration & Pattern

Participants explained that shift duration/pattern and shift start times were major factors in fatigue. Frontline paramedics stated that their shifts start at 6:00 AM and they woke up at 4:00 AM to get ready for work. One paramedic said,

"Nobody is going to bed at 8:00 at night. They're going to be chronically under rested if shifts start too early...You just want to avoid those really early starts."

The second paramedic in a different province concurs,

"... even if you get in bed at a decent time, it's often so early that it's hard to fall asleep at that time... you toss and turn and watch the clock count down and think how many hours you still have left to sleep."

A frontline paramedic stated that the lack of sleep may occur when employees are called into a day shift early in the morning:

"they might not have gone to sleep early because they didn't think they were working. And then all of a sudden, they have a shift."

Shift patterns and durations were also of concern; a frontline paramedic found difficulty of a 2-day, 2-night, and four-off shift pattern. A platoon supervisor also found difficulty bouncing between day and night shifts,

"... there's definitely lack of sleep and their lack of ability to sleep during the days after a night shift. The proper rest is disrupted."

One paramedic indicated that night shifts become challenging with increasing age, particularly for those who may not have the seniority to select their preferred shift:

"they're physically unable to do nights... there's people in this profession that they may be in that age bracket where they're having a really hard time with nights, but due to a lot of different circumstances, whether it's seniority or whatever, they're still working that and they're not coping."

A paramedic manager revealed that shift durations exceeding 96 hours (Core Flex schedules), occur in rural services in her/his province, and remain a significant factor in frontline staff fatigue. This has been substantiated by a frontline service member who associates the current 96-hour schedule with their fatigue and its consequences.

Risk Factors: Task and Work Environment

Task and work environment factors were identified as potential causes of fatigue. Boredom during firefighting operations may lead to overcompensation of activities by filling inactive work periods with training and other duties. A paramedic cited boredom as an issue, particularly during driving:

"when you're just up there driving and you're all by yourself cause your partner's in the back so there's no one to distract you or try and keep you awake."

A paramedic supervisor cited emergency or alarm tones as contributory factors particularly if employees are given the opportunity to nap during work hours,

"it's never the same kind of sleep because their body is always prepared for the emergency tones to go off and send them out on another call."

A second paramedic supervisor and a frontline paramedic acknowledged that adequate nap and rest at an ambulance station may be hindered by station noise such as emergency radios. In their service, there are "dorms in ambulance stations" containing bunk beds:

"If I'm sleeping on a bunk bed and the guy on top of me is still on duty, and not out of service, his radio could be six feet from my head and go off during my eight hours of sleep. We're out of service, they're not going to dispatch us, but certainly our rest can be interfered with."

The frontline paramedic further elaborated that when one crew is trying to rest, besides radio noises, a second crew at the station may be making noise when "using the kitchen, washer and dryer" and other appliances. Ultimately, "the people who are trying to rest aren't getting proper rest within the station". Station noises and alarms, as well as the anticipation of calls, are contributing factors to fatigue in firefighting. A firefighter indicated that in her/his service, a position of rest can occur between 22:00 and 06:30 (within a 24-hour shift, starting at 07:00); however, the opportunity of rest is "sporadic, hit and miss, and unpredictable" if an emergency call occurs within this position of rest period.

Participants noted issues with recovery and rest as contributing factors to fatigue. Both EMS supervisors indicated call volume/intensity and the lack of downtime between calls, compounded by the lack of sleep, as significant factors to work fatigue. Within a shift, individual strenuous calls may have a significant cognitive impact; when combined with poor weather conditions, the amount of cognitive effort further increases. As an example, an EMS service member recounted,

"If I'm doing a drive on a nice warm summer day with a very uncomplicated patient, I can go for hours and hours and hours, but you put us on an icy road, with a critical patient, one hour can feel like I've worked all day."

Increasingly problematic are back-to-back calls (i.e., call stacking) that lead to no downtime:

It's like call after call after call after call. So, when you go home, you just collapse on the coach.

A firefighter suggested that demanding calls and the lack of downtime are not only mentally draining but also physically demanding, affecting their performance on all subsequent calls.

A frontline paramedic stated that there's inadequate rest between shifts and inadequate turnover time between day and night shifts; for instance, "you have to finish seven day shifts without a transitional period into night shifts." The participant recommended that wording of the employment standards act should be written clearly to avoid split shifts and "bizarre shift patterns." Another paramedic expressed concerns for casual employed paramedics (who work on a contract, i.e., working on a relief, call-in, or casually scheduled basis, to gain full employment), who require sleep but may not have had the opportunity when scheduled for an unexpected shift. A manager within law enforcement identified constant connectivity to work as a factor in insufficient quality rest and recovery:

"Basically, you have access to work 24/7…I have 2 work phones right now. And some of the specialized areas, some of them will have two to three phones…. So, sleeping with a phone beside your bed, 24/7 which I do for my job, has changed a little bit because you're subconsciously thinking that phone is always there, and it could ring."

A manager in firefighting expressed the impact of dealing with high stressful environments and the potential for dealing with the lack of "positive outcomes" and having calls "at the same locations attending to the same people", all of which contribute to frontline personnel experiences of compassion fatigue.

"If I'm doing a drive on a nice warm summer day with a very uncomplicated patient, I can go for hours and hours and hours, but you put us on an icy road, with a critical patient, one hour can feel like I've worked all day."

Risk Factors: Staff Levels

A root cause for many of these issues may be related to staffing levels and budget planning. The paramedic supervisor asserted that staffing levels may not meet the volume of work, with challenges in forecasting staffing needs and the required budget to meet these needs. The supervisor recommends improvements to current practices to ensure a balance between work volume and personnel resources. Two paramedics from another service expressed concern for rural members who experience a Core-Flex schedule of 96 hours. Both argued that the current hesitation in removing Core-Flex scheduling may be due to the anticipated cost of hiring additional frontline personnel and the Core-Flex may be viewed as a strategy to save money. Challenges with staff levels are also apparent in law enforcement and is recognized by employees (with the volume of work as the biggest complaint) and senior administration. The police manager detailed that

"resources have not increased at a rate of the population increase. So, what we're seeing is that police are responsible for more, thus the pressures are building. You've got less mentors out on the streets and less senior officers that play a part in whether [younger officers] are properly trained and led through difficult times."

Work volume issues are further complicated by work scheduling priorities, such as achieving "minimum manpower requirements". The police manager relayed an example of an officer who may have worked all night and attended court in the next morning and afternoon and who would request additional recovery time before their next shift. Their supervisor may refuse the request and order the officer to start their regular shift, despite an exhausted officer, to meet minimum manpower requirements. The police manager stated that resultingly, officers will

"not call in [for more recovery] or they're just going to call in sick…so now sick time rates are up… people could share that they are not fit for duty, but minimum manpower requirements take a front seat."

In firefighting, staff levels and minimum manpower requirements have contributed to feelings of fatigue:

"I would say human resource management at a fire scene that can be attributed to many things like a lack of shortage of staffing or multiple calls at the same time. We have a minimum staffing in the city at any given time... our human resources are exhausted pretty quickly without the opportunity to recover prior to engaging in work again."

Risk Assessment Tools

Tools for risk assessment were often informal, composed of self- assessments and partner- observations. Both paramedic frontline personnel indicated that there was no defined process in detecting fatigue in the workplace nor there was any training to identify fatigue. One paramedic said,

"because you're out on the road, and you're only at base for a little bit, management doesn't see you, so often it is just you and your partner."

Informal self-assessments and partner- observations were often based on identifying signs and symptoms. In paramedics and law enforcement, key informants acknowledged that fatigued personnel were more prone to committing errors. In EMS, both frontline staff and manager attribute errors in the execution of daily tasks and driving performance to fatigue. One paramedic stated that fatigue affects their attention and memory. Another paramedic claimed that fatigue led her/him to "forget little things that she/he would normally remember", for instance,

"during a long shift, I came back to base and I forgot a [door] code that I used a bunch of times every day."

The same paramedic also indicated that when fatigued, they become fidgety during driving and would often "nod off". She/he would also observe that their colleagues would "space out" during calls. Another paramedic told her/his story of the impact of fatigue while commuting back home after a long shift. She/he relayed their story:

"I noticed that after a night shift.... where you pull up to a red light in your own car, I just looked both ways and drive through it because you're so stuck in that habit from being at work.... you're still operating on a work mentality.... The other thing is I've noticed, I'm not even remembering how I got home.... You're just zoned right out, and you appear at home and you're like, I don't even remember how I got here."

A paramedic noted signs and symptoms of their partner during the shift:

"they're yawning, and when you ask them a question, they don't give you the right answer. They're just not themselves. They're not 100%."

Self-assessments may also occur prior to shifts, when frontline personnel may experience exhaustion and are not prepared for work:

"we kind of do a self-check...[we self-reflect at] four o'clock in the morning. Nope. I'm still in a brain fog. I shouldn't be going into work."

Self-assessments and partner-observations rely on effective reporting mechanisms in order to implement risk mitigation controls. In one service, paramedics are required to

"self-report and report fellow employees who they think are fatigued.... the policy is for dispatch to contact the supervisor on duty right away... who [decide on appropriate controls] on a case by case basis." Barriers exist for reporting as *"people just don't want to tattle on their partner."*

From the manager perspective in EMS, the platoon supervisor concedes that there was no formal method to detect fatigue, and self-identified fatigue was most realistic. In one rural service, supervisors and managers may be located at a different station in a different city, requiring self-assessments and partner-observations to detect frontline personnel fatigue. Although EMS managers may not have direct access to frontline staff to detect their fatigue, supervisors, however, should be able to detect fatigue among their staff, by

"just knowing who your staff is and how they would normally act, and seeing when something's a little different than what you would expect."

They may also notice a decrease in work quality among their personnel,

"I can read somebody's ambulance call report and I can see that it's not as thorough as it might've been."

Another paramedic supervisor acknowledged that self-identified and partner-observations are common, based on signs of yawning, micro sleep, lack of concentration, and irritability, but admitted that these are imprecise strategies. She/he exclaimed that fatigue was difficult to measure, especially while paramedics are working. Instead, the supervisor recommended organizations to evaluate the level of fatigue based on the,

"sheer number of hours worked and most importantly when the last rest period was... they can always look at dispatch information, how busy the car has been."

A firefighting manager referred to a validated fatigue survey (Epworth Sleepiness Scale) that is used by the medical professional during an annual medical exam. The key informant detailed that such fatigue surveys allow patient-doctor discussion of their issues with sleep quality or duration and the potential risk factors. However, a firefighter in a different service indicated that there were no methods in their service to detect fatigue, nor were frontline personnel provided informal methods to detect fatigue by management. Instead, the firefighter relied on personal signs and symptoms, namely dehydration, lack of mental clarity, and decreased energy; and among their colleagues, visible signs of sleepiness. The firefighter recommended that in an "ideal world" the firefighting service will monitor fatigue, based on measures of "heart rate variability or some sort of tracking device".

When errors are committed and are substantial, the organization may pursue a formal incident investigation. Both managers in EMS and law enforcement detailed tools in their service. The paramedic manager referred to an event investigation tool that reviews system design errors (e.g., equipment, training, procedures, processes) and human behaviours (e.g., sleep duration, sleep quality). The manager described this event investigation tool as a,

"framework for identifying system problems as opposed to solely human behaviour problems that would help mitigate risk as a result of fatigue."

A frontline EMS member identified a communication program to report their near misses and incidences, where information is relayed to management and labour relations. The police manager described a review process that is completed by a specialized unit (e.g., major collisions investigation unit) or by supervisors who review all use of force. However, the manager divulged that personnel may be hesitant to provide information on sleep quality, duration, or any factor that presumes personal fault. Reporting systems are in place for workplace injuries, documenting the shift and shift time. However, a paramedic manager cannot recall the service utilizing or analyzing these data. A paramedic indicated that when an incident investigation is pursued after a fatigue-related error or accident, often the root cause (i.e., fatigue) is not addressed. For instance, if a paramedic got into a vehicle accident due to "falling asleep", the driver is provided driver training rather than strategies to reduce fatigue. A firefighter indicated that although the time of day is recorded when reporting an injury, it remains an assumption that the injury is attributed to firefighter fatigue, and that "90% of people wouldn't make that assumption."

Summary

Specific and comprehensive workplace written policies often do not exist; written policies on fatigue as part of a larger general work policy often focus on shift schedules and work hours. Key informants expressed the need for fatigue-specific policies. For services that have limited policies surrounding fatigue, there are both content and implementation deficiencies to effectively address fatigue in their workplace. Fatigue policies should consider an integrative approach consisting of education on risks, potential consequences, and recommendation of controls beyond work hours and shift schedules.

Participants indicated that fatigue is a shared responsibility between employer and employee but there is no specific committee that is responsible for issues surrounding fatigue. All participants strongly recommended that fatigue should be worth addressing in the workplace, on the contrary, often there is a lack of organizational commitment dedicated to mitigating fatigue. Key informants suggested that more investigations on the outcomes of fatigue may help motivate the organization (and frontline personnel) to be committed to support all facets of fatigue risk management.

Risk factors identified by first responders include shift duration/pattern and start times, task and work environment factors, and a lack of rest and recovery within and between shifts. Many of these issues may be related to high work volume due to reduced staffing levels. Risk assessment tools were primarily informal, specifically self-assessments and partner-observations. Self-assessments and partner-observations were based on signs and symptoms of fatigue, such as being more error prone. Frontline personnel are responsible to report their (or their partner's) fatigue to the on-duty supervisor but are often reluctant if it is perceived to be "tattling". From a manager's perspective, a decrease in work quality of their frontline staff is a potential indicator of their fatigue, but there are no formal methods of detecting fatigue in their service. On the other hand, in firefighting, one manager indicated that a validated fatigue survey (Epworth Sleepiness Scale) has been used as part of an annual medical examination. Formal incident investigations and associated tools are used when errors are substantial, but personnel may be hesitant to provide information on factors related to fatigue if it presumes personal fault.

Results & Discussion: Do

We categorized activities attributed to "Do" in the PDCA model as risk controls and interventions.

Fatigue Controls and Interventions

Key informants described risk mitigation controls that were categorized as administrative, personal, employee recruitment/training. There were no engineered solutions. Common administrative controls were napping, shift schedules, and support programs.

Napping

A firefighter reported the availability of dorm facilities at their station but policies limit naps between 22:00 and 06:30, if call permits. During standard working hours (07:00 to 22:00), naps are not permitted. In EMS, both frontline paramedics and managers reported that their services allowed personnel to nap. A paramedic stated that they were allowed to pull over to the side of the road and nap during downtime or if given permission by the supervisor on duty. A manager from another paramedic service has a personal "midnight policy", when she/he does not conduct any supervisor business with staff during night shifts, allowing staff to nap during downtime. In two paramedic services, their bases provide places to sleep. In one service, the base houses bedrooms. In another service, there are no beds, but the service provided couches and La-Z-Boy chairs. In rural bases of a provincial service, there are sleeping quarters of staff lounges that facilitate napping during downtime. However, in another paramedic service, napping facilities are not provided given the limited physical space.

Although bases provide resources for naps during work hours, there are several barriers in adoption. First, one paramedic said that beds were not often utilized since paramedics were busy or on the road. Second, if given the opportunity to nap at the base, the quality of sleep is compromised due to noise from radios and alarms. Third, there is hesitancy of personnel to nap as there is personal belief that "if I sleep on a night shift, I won't be able to sleep when I get home." Despite these limitations, workplace provisions for napping may be helpful for members who live further from the base to reduce the risk of fatigue-related accidents while commuting to home or for extensive shift durations.
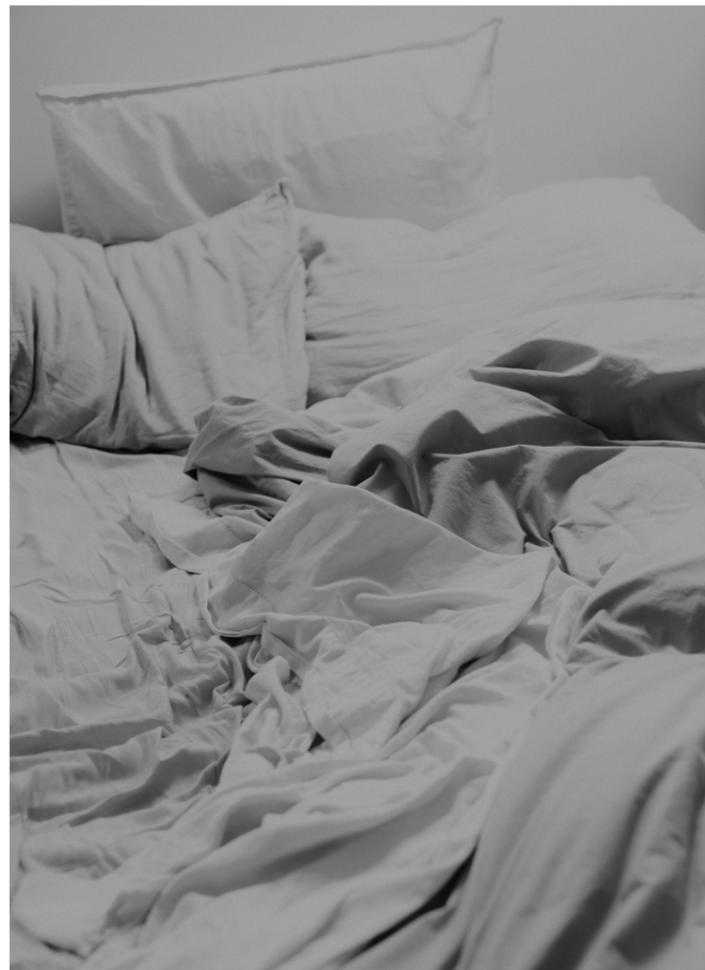
Shift Lengths and Shift Patterns

A second common intervention currently in practice are restrictions in shift lengths and options for shift patterns. In one paramedic service, there is a restriction in the number of hours (108 hrs) that paramedics can work over a two-week period and paramedics cannot work more than six consecutive days. Additionally, in that service, there must be a complete 24 hours break during the two-week period and must satisfy a "10-hour rule", where ten hours must separate shifts. However, the paramedic noted that there are barriers to the effectiveness of the 10-hour rule:

> "If somebody gets off late, but if they're a casual and they're working a couple of hours away, they have to get home and that cuts into their 10 hours and then maybe they're going to a whole opposite base on the other side of the province the next day. So, they may have 10 hours between their shifts but actually, when you take account the driving time, it's not even close to 10 hours."

Therefore, for casually employed paramedics who are working at multiple services to gain full employment, the 10-hour rule may be insufficient. The key informant recommended a system to allow paramedics to communicate with one another to trade shifts, to avoid paramedics "crossing over each other" to work at bases across the province. Paramedics who obtain shifts at bases far from their home may lose addition recovery time due to long commutes. In two other EMS services, the organization offered multiple shift patterns. One key informant said,

> "the one that seems most sought offers people extended periods of time…. it means that you're quite compressed in a workweek. So, in seven days you're working 72 hours."

However, the key informant expressed the desire for a more thorough investigation in schedule patterns. Another paramedic recounted that the workplace provided a variety of shift patterns, which "alleviated a lot of the stress for people because they can try and pick according to what works for them." The paramedic indicated that scheduling options and flexibility were beneficial, however, this option was reserved for senior members, leaving other members to fulfill remaining schedule openings. This can be particularly problematic given the other fatigue-related stressors associated with casual paramedic work, contributing to the risk of experiencing adverse outcomes. Frontline staff provided recommendations to reduce shift lengths or change shift patterns. One paramedic who works within a Core-Flex schedule prefers a fixed 12-hour shift. Another paramedic recommended restricting early morning start times and to encourage short rest periods at work. This emerged as a recommendation to the early start times for day shifts that was identified as a causal factor of fatigue.

In firefighting, the manager supported the shift schedule implemented within her/his province, allowing personnel to work two, 10-hour days and two, 14-hour nights, compared to standard 24-hour shifts found in other jurisdictions. The same manager expressed the desire to rotate firefighters between fire stations to minimize the effects of "challenging shifts" towards a select group of personnel. The manager stated:

> "you have certain halls that deal with maybe 30, 40% of the call volume for the entire city out of one or two fire stations and we have started talking about, okay, we need to make sure that we have a rotation system to take those people that have been working in the busy fire stations because the tempo is mentally and physically more challenging because you are always on. So, we're looking how can we rotate people out on an annual basis or a biannual basis and moving them through the system. So, you spent two years at a very busy hall. Well, guess what? Now you go to a hall, it's not too busy."

A frontline firefighter recommended a policy to allow "out of service time" to temporarily recover after a strenuous call. An increase in staffing levels, in an "ideal world", may help mitigate potential barriers to recovery time.

> "After a strenuous call, we could have a policy that would allow that person out of service time to recover temporarily, to give them an opportunity to refuel and to rest. I guess for that to happen, it would require a certain staffing level. And I'm not sure we currently have a staffing level that would support that, but I mean that would be an ideal world to have something like that…. we just don't have anything that would support physical readiness or fatigue management along those same lines."

Support Programs

Support programs were identified to help mitigate the effects of fatigue within a police service. The police manager indicated that although current wellness programs have some direction on sleep deprivation, police officers may not access and utilize these services. She/he explained,

"If they're fatigued and they're already tired on their days off, the last thing they want to think about is going back to the organization and looking for programs. So, the cycle keeps continuing."

Fitness and wellness support programs are also offered within the firefighter manager's service. The support program promotes physical fitness of frontline staff, and the employer provides a gym within the fire station. The manager suggests, "the fitter you are, the less your recovery time." Wellness programs for mental health are also supported within the firefighter's organization. Recently, with partnership between a mental health association and the firefighting association, the "Resilience Minds Program" was introduced to deliver education on compassion fatigue.

A frontline firefighter also valued physical fitness to improve first responder capacity but urged organizations to further prioritize training and conditioning:

"I think first responder capacity and conditioning, et cetera, needs to be taken a little more seriously rather than just recommended. There's no accountability for that currently. I mean we can sort of correlate critical conditioning to fatigue resistance, I would say as a fair assumption. Currently there is no way of ensuring a first responder has the capacity for the job."

Personal Strategies

Key informants also described their own personal strategies both at home and at work to reduce their own fatigue. Common themes include regimented sleeping habits, personal strategies to improve sleep quality at home, limit caffeine intake after a certain hour, proper nutrition, and short-term solutions while at work.

Frontline paramedics revealed that they try to get to bed at a "decent" hour in preparation for an early shift. However, two paramedics find that sleeping early (e.g., 9pm) was very difficult. A third paramedic provided personal strategies to improve both sleep quality and duration at home, stating that,

"we've got blackout blinds, our walls are painted blue. I finally got earplugs…and having a consistent routine that you follow and knowing what works for you."

The same paramedic insisted that "protecting" their time between shifts improved their recovery. This includes avoidance of scheduling appointments immediately before or after shifts and scheduling of recreational activities that may impact their sleep quality (i.e., immediately before bedtime).

Short-term solutions have been used to reduce the effects of fatigue particularly while operating an ambulance. Two frontline paramedics list their personal strategies: consuming caffeine, chewing gum, listening to music, increased activity (stretching), and reducing ambient temperature (i.e., rolling down the window). However, both paramedics note that these strategies are temporary masking solutions and do not address the root cause of the problem. Two other paramedics identified rotating roles (driving and attending to the patient) as personal strategies to reduce fatigue during long transfers but may not be effective if the patient requires advanced care (and only one paramedic of the unit is an ACP), or if the ambulance cannot stop due to the critical need of the patient.

Employee Recruitment and Training

A police manager described education and training programs that have been provided to new recruits to engage them in their own health and fitness. The police manager indicates,

"[a] resilience piece was taught to the recruits. It was a four-step program that's occurred in various weeks throughout their training. There was a piece in there that they would actually present back to their class on a resilience type lecture and some of the neat innovative ways that they could teach people about resilience and how it's effective or it's a crucial tool for frontline policing."

Similarly, a paramedic stated that early education (i.e., college) is essential and fatigue-specific training should be accessible to all paramedics. This paramedic recommended training on best practices beyond shift hours that are both relevant and practical, as shift changes alone may "not be an option". She/he also expressed the need for training for families of paramedics to better support the frontline personnel. These statements were supported by another EMS manager who said that fatigue was not addressed in entry to practice education; additionally, a supervisor or manager would not be educated in this area and therefore would not have the intrinsic knowledge to support frontline staff.

The police manager recommended that trainers should be credible (i.e., with similar lived experience), knowledgeable, and trustworthy to effectively deliver training to recruits. She/he said,

"we see a lot of gaps in training and education. We have a civilian component that are brilliant people but yet you still have a police officer [who is] reluctant to go to those people because they're not cops… So, I would have no hesitation to go and talk to our fitness and lifestyle unit because they're the top notch in their fields. They know what they're talking about. But the argument is 'Yeah, but they don't know the police culture.'"

A paramedic agreed that trainers should not only be credible but should be frontline staff or peers,

"if it comes from the top down, they're like, well you haven't been on the road in 15 years. Why are you telling me this is going to help me with my sleep? You haven't had to work a night shift in 15 years, so it may want to come from peers that are in that same position. They have credibility."

The need for credible trainers may help "break down the stigma" attached to fatigue. A firefighter indicated that a chief officer, with similar lived experience, who is open with her/his challenges sends a "powerful" message that fatigue is not a unique, solitary experience.

A police manager recommended improved training to supervisors to handle fatigue of the frontline staff. From her/his experience, training should be provided to supervisors to be more empathetic, learn how to identify fatigue quickly, and develop more effective risk mitigation strategies.

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Summary

Risk mitigation controls include administrative, personal strategies, and employee recruitment or training (Figure 3). Napping, shift schedules, and support programs emerged as common administrative controls. However, there are several barriers to their adoption and there is desire for more targeted research in devising shift schedules. Personal strategies have been used but often temporarily mask rather than reduce fatigue. Employee training may help build resilience, but trainers should be credible (i.e., have the same lived experience), supervisors should be trained to better deal with fatigued frontline staff, and supervisors should be more empathetic.

Results & Discussion: Check and Act

Check

Key informants described whether risk mitigation controls were reinforced and whether there was any organizational follow-up (i.e., tracking and review) of prevention activities. Key informants expressed their thoughts mainly on individual-level follow-up (monitoring and review) rather than organizational-level follow-up. In terms of reinforcement, if a frontline service member did not abide to their on-duty supervisor, responsibilities were shifted towards the frontline staff. For instance, a frontline paramedic said,

"I guess the warning always was that if they specifically say that you should pull over and sleep somewhere, even if it's just on the side of the road, and you say no, any collisions would be kind of more your fault, the company wouldn't take on the responsibility as much."

When asked whether the organization follows-up with any prevention activity, key informants from all first responder occupations stated that no such procedure or practice existed. A frontline paramedic said that they never experienced any follow-up after a control has been implemented; a second paramedic suggested that although there may be some way of tracking prevention activities implemented at the individual-level, "no one's ever asked that"; a third paramedic exclaimed, "No. That I can say unequivocally." A manager-level paramedic explained that a supervisor might acknowledge fatigue after evaluating an injury but there is no official follow-up procedure. A paramedic strongly stated that after reporting their fatigue using an incident investigation tool, there is no follow-up, and "they [management and labour relations] just kind of ignore us." A second EMS manager confidently stated that there were no follow-up procedures and that,

"if they were doing quality assurance, they would be seeing that what they're doing isn't working and then try something else."

In police services, follow-up practices might occur if an officer utilizes a care program (e.g., short-term disability type plan) and is in the process of return-to-work. If an officer was seeking guidance and receives strategies to reduce their fatigue, there is no formal follow-up procedure. The police manager stated that when it comes to follow-up, "we need to improve on that" and recommended that follow-up practices should be the responsibility of supervisors; however, the manager expressed apprehension of supervisors dealing with risk management due to confidentiality issues if fatigue was viewed strictly as a performance issue.

A frontline firefighter took the position that there were no follow-up activities in their service since "we not collect any data regarding fatigue at all, so there wouldn't be any metrics to follow-up with other than self-report." A manager in firefighting concurs that confidentially might prevent effective follow-up procedures of implemented controls for specific individuals. In her/his service, unless the firefighter is prevented from coming to work, a "not fit for duty" report is issued. In these reports, individual data and information is "sanitized", where personal identity descriptors are removed when personnel are assessed (during annual medical exams when a fatigue assessment is conducted). The manager indicated,

"how do we make that follow-up? We have to use a broad-brush based on trends, and hope it follows down through the masses."

A paramedic suggested that pre- and post- surveys may be helpful and could be integrated into their peer support program to evaluate the effectiveness of an intervention or as a mechanism to report on risk.

In terms of organizational-level follow-up, a firefighter manager indicated a process that involves the organization reviewing organizational-level data (e.g., rates) to evaluate implemented controls. She/he stated:

"The only way we can ensure that the system is working would be to evaluate. You know, look at the information that we get from a sanitize point of view. Look at it the next year and see if there's a change…"

Act

With the lack of formal (and informal) follow-up practices, not surprisingly, there were minimal themes related to policies, programs, or practices of corrective and preventative activities after implementing a risk management plan. However, the firefighter manager who revealed a process involving organizational-level data to evaluate risk controls, continued:

"…If we've implemented any type of controls we would look at the data the next year and go, 'Hey, you know what, uh, our symptoms of fatigue are down by 22%. What we're doing is working, let's carry on.'"

There was no other feedback on how information was shared or should be shared among relevant personnel within an organization.

Summary

First responders reported minimal formal follow-up procedures, including tracking, monitoring, and review, of prevention activities or a fatigue risk management system. A re-occurring challenge is maintaining confidentiality of individuals when following-up on implemented controls at the individual-level. However, a process reviewing organizational-level performance (e.g., rates) data can be implemented, as means to decide whether improvements should be made on the risk management framework, policy, or plan.
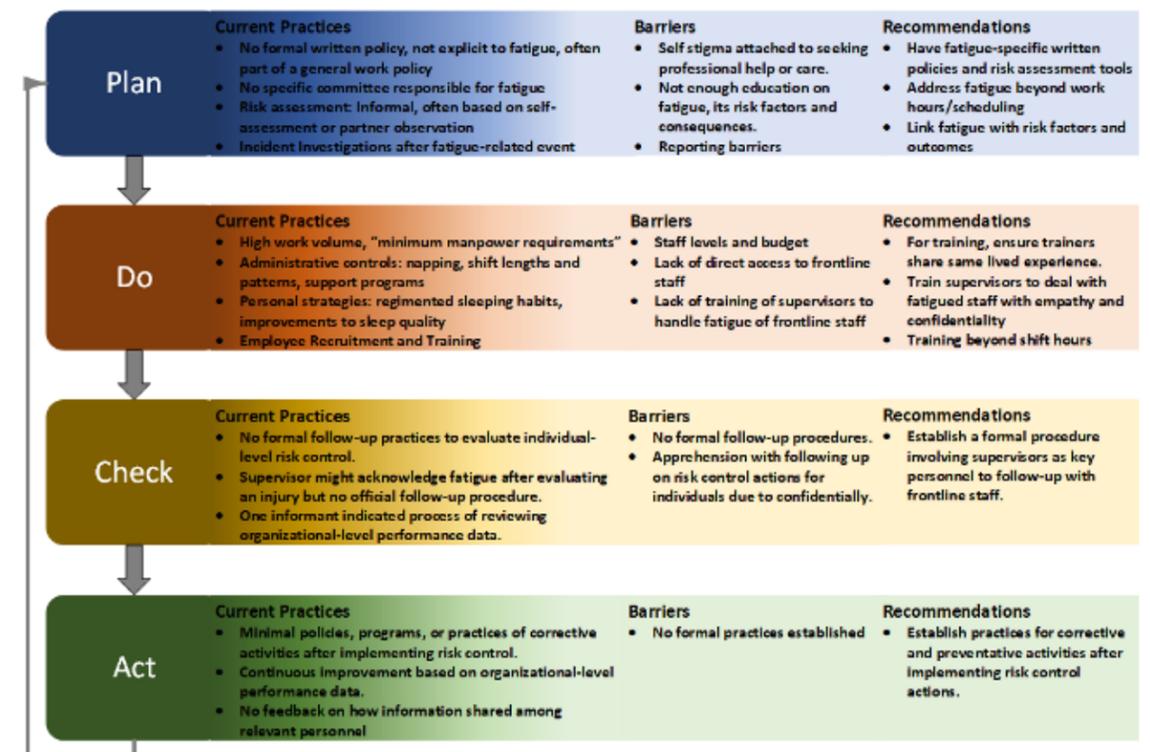

Figure 3. Emerging themes identified from key informant interviews based on the PDCA framework and categorized under current practices, barriers, and recommendations.

Conclusion

The lived experience of key informants provided insight towards the extent, impact, and management of fatigue. Although participants understood the potential consequences of fatigue and expressed the desire to reduce its effects, current workplace strategies for fatigue risk management are reactionary, risk assessment tools are informal, and control strategies are much to be desired. Identifying and educating management and frontline personnel on the potential impact and outcomes of fatigue are essential to motivate and support a fatigue risk management system. Recommendations ranged from providing space within a base to facilitate restful sleep, offering a range of shift patterns to match an individual's chronotype, and improved training for personnel during early education, support throughout employment, and training for managers. Participants recommended that training should be delivered by individuals who are credible (with similar lived experience) and knowledgeable.

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