ANALYSIS OF THE RETURN TO WORK PROCESS FOR FIRST RESPONDERS

IDENTIFYING PREDICTORS OF RETURN TO WORK AND UNIQUE ASPECTS OF DISABILITY MANAGEMENT IN FIRST RESPONDERS AFFECTED BY MUSCULOSKELETAL INJURIES AND MENTAL HEALTH

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Lay Abstract

First responders perform dangerous and stressful work. They are at risk of injuries and illnesses that require time off work to recover. The goal of this dissertation is to identify features of the return to work process that are specific to first responders. The studies found that first responders with injuries like sprains and strains went back to work sooner than those with mental health issues. The study also found that sooner the injury claim was started and the medical information was received, the sooner first responders could return to work. When compared to other injured workers, first responders returned to work quicker, but were more likely to only be able to do modified work rather than their typical jobs. It is important that first responders fully recovery from injuries before they can get return to responding to emergency calls.

Abstract

Background: First responders have unique and important roles. The duties performed can be dangerous, physically demanding and stressful, leading to high risks of injury and illness. Because of their unique job demands, it is important to identify aspects of the disability management process and predictors of return to work that are specific to first responders

Thesis Objectives: To analyze first responder disability management claims associated with injuries and mental health issues to determine predictors of return to work and differences in the disability management claims when comparing first responders to high and low demand occupations.

Methods: The claim data were obtained from a disability management company. In the first study, all first responder claims were included in the Cox proportional regression models and the log-rank tests to identify predictors of return to work. For the second study, the claims of high and low demand occupations were randomly age and sex-matched to the first responder claims. Differences in the duration of time off work, the duration of the claim, the injury and mental health diagnoses, and the duties performed when returning to work existed between first responders and the two occupation groups.

Results: Musculoskeletal injuries predicted an increased likelihood of returning to work in a shorter duration of time. Medical report lag and claim lag decreased the likelihood of returning to work. First responders returned to work sooner, had shorter disability claim

durations, differed in the injuries and mental health issues sustained, and were less likely to return to their pre-injury duties compared to the two occupation groups.

Conclusions: Predictors of return to work specific for first responders were identified, yet the results lack generalizability. Although first responders returned to work sooner compared to the other occupations, they were more likely relegated to modified duties.

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LIST OF ABBREVIATIONS

FR	First Responders
HD	High Physical Demand
HiREB	Hamilton Integrated Research Ethics Board
IQR	Interquartile Range
LD	Low Physical Demand
Mean diff	Adjusted Mean Difference
MSK	Musculoskeletal
OR	Odds Ratio
RTW	Return to Work
RTWF	Return to Work Full
RTWM	Return to Work Modified
sd	Standard Deviation
95% CI	95% Confidence Interval

Declaration of Academic Achievement

Shannon Killip is the primary author and contributor of this thesis. From September 2016 to September 2018, she was responsible for completing an ethics approval, data analysis, interpretation of data, drafting of the manuscripts and incorporating feedback. The thesis supervisor and funder of the project, Dr. Joy C. MacDermid, was responsible for reviewing and refining the research questions, study design and manuscripts. The remain two committee members of the supervisor committee, Dr. Kathryn Sinden and Dr. Rebecca Gewurtz, provided guidance and feedback during the committee meetings and reviewed the manuscripts. Dr. Kathryn Sinden also coordinated the meeting with the disability management company that the data were obtained from. Shannon Killip and Dr. Kathryn Sinden were responsible for meeting with employees of the disability management company, including the CEO, to discuss the availability of data and the important variables in the claim database. The data pull of all relevant disability management claim file, and the de-identification of all personal information was performed by an employee of the disability management company.

Chapter One: Introduction to First Responder Work Characteristics, Injury Profile, and Current Research in the Disability Management and Return to Work Fields

Introduction to First Responder Work Characteristics, Injury Profile, and Current Research in the Disability Management and Return to Work Fields

1.1 First Responder Job Characteristics and Work Environments

First responders include firefighters, paramedics and law enforcement officers. The bulk of specific first responder research has been performed in firefighters. Firefighters respond to the widest range of emergency call compared to the other first responders [1] as they respond to all emergencies that occur in their community [2] such as fire suppression calls, medical emergencies, natural disasters and civilian rescues [2,3]. Although responding to these potentially traumatic events can cause emotional distress in firefighters, they often do not reach for professional help or social support and instead they may turn to substance abuse to cope [4]. Firefighting is very physically demanding during emergency calls; firefighters often have to climb stairs and ladders with heavy equipment, carry heavy objects or people, and work in awkward positions [3]. Firefighters have to have aerobic and anaerobic fitness, as well as adequate muscle strength and endurance to perform their duties [5]. During fire suppression, firefighters are exposed to carcinogens, smoke, extreme temperatures, which can cause physiological harm [1]. Their work environments can be very chaotic due to the urgency of emergency situations, where loud noises and low visibility due to smoke also add to the psychologically stressful duties that firefighters perform [3].

Like firefighters, paramedics and police officers are also exposed to significant risks as they carry out their everyday job requirements. Paramedics are expected to lift and

carry people, and often work in awkward postures [1]. They respond to medical emergency calls thus they are exposed to severe injury and death, and they often feel responsible when fatalities occur [6]. Paramedics often respond to domestic violence calls and this increases their risk of assault [7]. Unfortunately there is lack of data available on paramedic health and safety as their duties often overlap firefighters [1]. Police officers can be exposed to high stress and traumatic incidences as they respond to emergency calls involving violence, shootings, hostage situations and deaths [8]. Due to the nature of the emergency calls that police officers respond to, it is very common for them to be victims of violence [1].

There are also many similarities between the job characteristics of firefighters, paramedics and police officers, which result in common risk factors that increase their chances of being injured or becoming ill. For example, first responders have high physical demands which require them to be strong and fit [1,5]. Yet a study by LaTourrette, Loughran and Seabury in 2008 found that first responders were concerned about the increased likelihood of injuring themselves during exercise [1]. They tend to work long hours [9] where lack of sleep could also affect their risk of injury [2]. First responder work days are unpredictable while they wait for emergency calls that present a new work environment, new exposures, new hazards and new tasks [9]. First responders tend to work in unpredictable and hazardous environments where they can be exposed to extreme temperature, dangerous materials [9], structural instabilities, vehicle collisions [1], and loud noises [3]. These unpredictable environments can lead to injuries from falls, contact with objects, explosions and motor vehicle accidents [9]. Lastly, all first

responders have psychologically stressful jobs as they have to cope with traumatic events such as terrorism, natural disasters and deaths [4]. Each worker will have different traumatic experiences in different quantities, and will cope in different ways which may or may not lead to mental health issues [10]. Overall, first responders seem to be exposed to significant risk factors that may put them at greater risk for physical or psychological injury [1].

1.2 Common Injuries, Mental Health Issues and other Illnesses

First responders have to cope with emotional stresses that result from the frequent emergency calls that they respond to which increases the risk of mental health issues [11]. Years of service [12] and frequency of stressful exposure can have an impact on first responder mental health and specifically post-traumatic stress disorder (PTSD) [13] . For example, first responders can respond to traumatic events, such as fires, natural disasters, fatal accidents [11], and assault [7], which can lead to PTSD, depression, anxiety, substance abuse [1,8,10] and suicide [8]. These same events can also affect their physical health and safety [9]. A study by Reichard and Jackson in 2010 [9] used a U.S National electronic hospital injury database to classify injuries sustained by first responders. They found that first responders most commonly sustained injuries in the upper extremity. This study identified overexertion as the most common way that first responders sustained strains and sprains, and these sprains most commonly occurred in the low back [9]. Although MSK injuries were most common, first responders also experienced other types of injuries such as contusions, lacerations and punctures [9]. A

strength of the study performed by Reichard and Jackson in 2010 [9] was that specific first responder job types were assessed separately, highlighting key differences in their injury patterns. This study found that paramedics were most commonly injured due to overexertion and body movements, firefighters were most commonly injured from fires or explosions, and law enforcement officers were most commonly injured due to violence [9]. Paramedics and police officers were also injured in vehicle collisions during travel when responding to emergency calls, whereas firefighters were more likely to sustain injuries during the emergency rescues due to falls, fires and explosions [9]. The limitation of the study was that only injuries that required emergency care in a hospital were assessed, leaving out any other possible injuries that may not be as severe.

A report by Karter and Molis [14] used the 2007 National Fire Protection Association firefighter injury survey data to summarize American firefighter injuries. This study found that strains, sprains and pain were most commonly sustained by firefighters especially during non-fire ground activities [14]. Although a National survey allows for a large and generalizable sample, classification bias may have been present with regards to the description of the injury because fire departments completed the survey rather than healthcare professionals. Recall bias may have also occurred as the survey also asked for a description of how the injury occurred [14].

Lastly, a review by LaTourrette, Loughran and Seabury in 2008 [1] combined data from empirical studies on the health of American public safety workers as well as U.S. National surveillance data collected for first responder injuries, illnesses and fatalities.

When looking at injuries, this report identified that MSK injuries were the most commonly sustained injury amongst first responder populations, and often involved sprains, strains, dislocations and fractures [1]. A strength of this study was that a wide range of injuries and illnesses were considered. Due to their work environments, firefighters also sustained burns, heat stroke, infection, hearing loss, respiratory disorders, cancer and complications due to smoke or toxin inhalation [1]. Firefighters and law enforcement officers were found to have a higher risk of cardiac events compared other members of the workforce, and they can lead to fatality [1]. Unique to police officers is the high rate of fatalities due to assault where a weapon is often involved [1]. A limitation of this study was that there could be classification bias with regards to the illness and injury diagnoses as the study did not discuss how that data from any of the data sources was collected or how injuries and illnesses were coded. Another limitation was the lack of detailed research or surveillance data on paramedics. The authors explained that because many paramedics also perform firefighter duties, the data for first responders and paramedics are grouped together [1].

Overall, first responders have been found to have high injury rates, although law enforcement officers and career firefighter injury rates are much higher than paramedics and volunteer firefighters [9]. Unfortunately, these studies only assessed injury and illness occurrences and did not follow up with first responders to identify RTW outcomes. It would have been important to know which first responders returned to work and which did not and how this may have related to the type of injury or illness. Durations of time off work data for each of the identified cases would have been

beneficial for determining the association between disability duration and the types of injuries and illnesses. The study by LaTourrette, Loughran and Seabury [1] did discuss permanent disability benefits and retirement in first responders in California. Although permanent disability was high among older first responders, the exact reasons could not be confirmed. No cases of first responders who actually returned to work were analysed in this study [1].

1.3 Unique Characteristics Associated with First Responders

First responders differ from the general workforce in many ways involving their work characteristics and their injury risks. All workers are exposed to physical factors, such as awkward postures and repetitive work, and psychological factors, such as high work demands and low job control that can cause stress and lead to injury [15]. But first responders have many unique job characteristics that lead to a much higher injury rates [1,2,9,16] and mental health risks [10,11] when compared to other occupations. During disaster relief, first responders have to cope with exceptionally high levels of stress caused by many factors including high demands and low job control [4]. However, even though first responders have such high injury and illness rates which occur when responding to dangerous emergency calls, they actually only spend a fraction of the day performing these physically demanding and stressful duties [1]. Injuries can also be sustained during training and exercising [1,17]. Working out and performing frequent training exercises are very important to first responders as it is crucial that they are able to perform their high physically demanding work safely and at optimal levels [1,4]. The

training process is unique for first responders as exercises must be performed repetitively to maintain skills while attempting to avoid fatigue and burnout [4].

First responders have exceptionally dangerous jobs compared to other occupations with similar physical demands [1,2]. Firefighters for example are thought to work in more dangerous and stressful situations compared to most other occupations [18]. Adding to the stress of these first responder occupations is the pressure associated with having little to no room for error while performing their duties [19]. First responders have one main duty that is very unique and that differs from the majority of occupations; they risk their lives to protect the community [4,9,19]. First responders have a high risk of fatality at work, and this is especially true for police officers who were found to have fatality rates that greatly exceeded the national rates in the USA [1].

First responders also have unique job cultures [11]. Because they work long hours [9] in close groups, social support is very important [20]. They also pride themselves on strength and resilience [11], and often come together as a group to cope after traumatic incidents [21]. Unlike most other occupations which have set schedules, job descriptions and duties to perform, every workday is different for first responders; they cannot predict the hazards they will be exposed to or when they will occur, and every emergency response is unique and complex [9]. In general, the wide range of duties performed, from fire suppression and rescues to the provision of medical care [3,9,10], are unique to first responders [4]. The closest the general population comes to experiencing the stresses, demands and work environments associated with the duties first responders perform, is

when they are victims of traumatic events [4]. However, first responders have to deal with the potential for traumatic events as part of their every day job responsibilities [4].

1.4 Disability Management

Injuries and illnesses in the workplace are common and can be very costly [22] especially when they result long periods of time off work [23]. Not only are the direct costs of compensation high, but the indirect costs of disability, such as the cost of hiring and training new workers, are even greater [24]. When workers get injured, many stakeholders, such as employers, co-workers and workers themselves, are affected [22]. For example, a qualitative study looking at general stakeholder interests and concerns in the RTW process was performed in 2005 by Young et al. [25]. This study involved a review of the RTW literature and discussions with other RTW researchers, and did not focus on specific occupations. Employers tended to be concerned with the decreased productivity, and the direct costs of insurance premiums and the indirect costs associated with hiring new workers. For the injured workers, financial burdens, health and changes quality of life due to the injury or illness are common concerns [25]. Lastly, co-workers may be required to perform heavier workloads [25].

Given the pervasive impact, it is very important to minimize workplace injuries. Unfortunately, it is impossible to avoid all injuries [22]. However, when workers get injured and require time off work, it is common to have disability managers coordinate and track the progress of the return to work (RTW) process [26]. Disability management is a dynamic process that requires contact between all stakeholders including the injured

worker, the employer, the disability insurer, and the union if relevant [25]. Research has been done to identify factors that lead to optimal disability management. The earlier the contact between the stakeholders, the sooner the return to work planning can begin [27]. A systematic review by Franche et al. (2005) was performed to assess the effectiveness of RTW intervention found in the literature [28]. This study found that early and ongoing contact between the disability manager, the injured worker and the employer was associated with a shorter duration of time off work, and that early contact with the health care providers also led to a shorter duration of time off work. Although this systematic review considered a wide range of studies, the disability management literature is inconsistent and there was limited evidence for many of the RTW components [28]. The availability of modified work has often been associated with faster return to work [15,23,26,28-30]. Overall, disability management is an important process that helps guide injured workers through recovery as well as the RTW process, and has been shown to lead to a shorter duration of absence [31].

1.5 Identifying Difference in the Return to Work Process for First Responders

First responders may differ from other occupations when comparing aspects of disability management and the RTW process. For example, the RTW process may be complex for firefighters because it is difficult to find suitable work accommodations [32]. First responders may struggle to recover from their injuries enough to perform their pre-injury duties because of the extreme physical demands and lack of room for error [1,26], leading to permanent disability rates that exceed the general population [1].

Unfortunately, no research comparing the disability management process of first responder to other occupations was identified in the literature. The only relevant research that has been performed involves general job characteristics that have predicted the duration of return to work which could be used to make inferences about the return to work process for different occupations. Some studies have identified job characteristics that increase the duration of work disability such as high psychological or physical demands [15,33], long work hours and high job stress [15,22]. Because first responders work long hours, and have highly demanding and stressful jobs [1,9], it is possible that the RTW process would be longer in duration for first responders compared to other occupations that are less stressful and demanding. Occupations with high demands are also more likely to return to work performing accommodated duties whereas occupations with low demands are more likely to return to work performing pre-injury duties [33]. Other studies have highlighted factors that might cause first responders to return to work sooner compared to other occupations. First responders have a strong group culture in the workplace [34] and group culture is a factor that has been shown to predict shorter duration of time off work [22,15]. Associated with group culture is the abundance of social support available for first responders from co-workers [34,35]. Social support from co-workers and supervisors is another predictive factor of early return to work [15,22,33,35].

1.6 Current Predictors of Return to Work in the Literature

There is a plethora of research that has identified predictors or RTW in general work populations with low back pain [22,35-37], mental health issues [29,38-40], MSK injuries [29,30,41-43], and general sick leave [44,45]. Some examples of common predictors of return to work outcomes are age [29,30,35,36,38,39,43,44], sex [29,30,35,43], injury severity [29,36,40], and worker expectations of recovery and return to work [29,42,43,46-51]. Systematic reviews on predictors of return to work for neck and back pain [52], low back pain [35,53] musculoskeletal injuries [42], sick-listed workers [44,45] have found inconsistent and inconclusive results for the majority of the identified predictors of return to work. A systematic review by Krause and peers in 2001 found that about 100 different predictors of return to work for work-related injuries and illnesses were identified in the literature, yet many lacked research and others had inconclusive results [15]. Although many studies on return to work after MSK injuries or mental illnesses in the general populations have been performed and many possible predictors have been identified, it is difficult to know if these studies and predictors are generalizable to first responders.

Unfortunately, no research has been performed to identify predictors of return to work in first responders. Even some of the most commonly discussed predictors, such as age, have not been explored in first responders. Age is likely to be a predictor of RTW for first responders as it has frequently been identified as a predictor in different populations [29,30,35,36,38,39,43,44]. Older age in first responders has also been

associated with more frequent recurrences of injuries [54], longer duration of injury [55], and higher rates of permanent disability and retirement after injury [1], and greater concerns for being unable to adequately perform their duties after an injury [1,32]. Two studies have been performed that have some relevance to identifying predictors of return to work in first responders. A qualitative study performed by Scheelar in 2002 involved interviewing two firefighters in order to explore common factors that influence RTW after a work-related injury. The study determined that social support from co-workers, job enjoyment, and motivation to recover and return to work were the most prominent reasons that these firefighters actually returned to work after their injuries [56]. Because the study by Scheelar in 2002 involved the qualitative interviews of two firefighters, these findings are not generalizable to the first responder population. Liao et al (2001) conducted a longitudinal study to identify predictors of the duration of injury among firefighters [55]. They found that females, married men and older firefighters were associated with a longer duration of injury, whereas more years of service resulted in a shorter injury duration [55]. However, the study may lack relevance as the data was collected more than 20 years ago and the focus was solely on firefighters. Therefore, the results cannot be generalized to current first responders. There is a need gather more data about predictors of RTW among first responders in order to better understand their support needs during the disability management process.

1.7 Issues in the Methodology of Current Disability Management Research

The research that has been identifying predictors of RTW has been performed in general injured worker samples or in samples of workers with similar injuries and illnesses instead of focusing on specific work populations that are at high risks of work injuries like first responders. The return to work process is affected by many job specific factors such as physical demands, psychosocial work characteristics, the availability of modified work, and the employer [15]. Because specific occupations are not assessed, there is most likely a lack of generalizability of the identified predictors to populations outside of the study sample. Although predictors of RTW have frequently been studied in many populations, it is unlikely that many identified predictors would be generalized to first responders as they have unique job demands and characteristics [1,9,19]. No evidence has been found in the literature that predictors of return to work have been researched in first responders. Given that first responder have very important roles in the community and are at high risk of injuries and illnesses [4], the lack of disability management and return to work research is concerning.

Another issue identified in the current RTW research is many of the studies have been using inconsistent data collection methods in order to identify potential predictors of RTW [58]. Although disability management claims are often used for RTW studies, medical information, surveys and even interviews with the injured workers are used to get additional information that is not typically found in the disability claims [58-60]. Bellis and peers (2007) explained that disability management claim data are much

different than survey data that has been collected for research; claim data is objective and relevant to real-world disability management cases whereas survey data can be biased as it relies on claimants' perceptions. Surveys are not typically administered for the purpose of disability management as they are costly and time consuming which brings about concerns as to the relevance and feasibility of current disability management research [58].

1.8 The Need for First Responder Specific Research in Disability Management

Although there is a focus on health and safety among first responders [1,19], the dangerous nature of the duties performed will always increase their risk of injury and illness [4,61]. It is crucial to specifically assess first responder disability management claims in order to identify unique aspects of the disability management and return to work processes as well as predictive factors that lead to a successful return to work. Because there is a lack of research that has assessed the disability management and RTW processes in first responders, this research hopes to guide future studies. The other goal of this research is to improve the efficiency of the disability management and RTW processes for first responders. By identifying unique aspects of disability management for first responders, disability managers will be able to focus on these factors during the RTW process if they are found to improve the RTW process. If the identified factors negatively affect the RTW process, these factors may need to be researched further in order to improve the disability management process. By identifying predictors of both longer and shorter durations of time off work, stakeholders will be able to develop

appropriate plans while the injured workers are off work. Although it is not possible to know the exact length of time that workers will be absent for [58], identifying predictors may allow disability managers to estimate the duration. Employers can use this information to organize accommodations in the workplace to keep up with demands while the injured worker is absent [19,25]. If the injured worker is expected to have a short-term absence, the decision might be to temporarily alter the scheduling and duties of the other first responders. If the injured worker is predicted to have a long-term absence, hiring and training a new first responder to replace the injured worker may be required. The injured workers can also benefit from knowing an estimate of the duration of their absence from work. Being off work for a long duration of time may result in a financial burden for the injured first responders and their families [22,58], and changes in lifestyle may be required.

Overall, identifying factors that improve the disability management process and predict a faster RTW are very important in order to have first responders return to their duties as soon and successfully as possible. This will benefit many stakeholders. The injured first responder will likely want to RTW as soon as possible because they typically enjoy the work they perform and the social support they receive from co-workers [20,56]. Employee morale is also affected when a member of the team is absent [7], thus having first responders RTW as soon as possible would hopefully avoid negative morale. Lastly, first responder compensation claims have been shown to be costly [1,61]. If first responders could RTW as soon as possible, the associated medical expenses, worker's

compensation payments, and costs of hiring and training new workers [7] could be minimized.

1.9 Composition of Dissertation Papers

This dissertation is comprised of two papers (Chapter two and Chapter three). The papers included two secondary analysis research studies that were performed as part of the requirements for the School of Rehabilitation Sciences Master's program at McMaster University. They draw on administrative data from a National Disability Management Company.

The first research paper (Chapter two) identifies predictors of return to work and disability claim closure specific to first responders. The second research paper (Chapter three) compares the disability management claims of first responders to other occupations. In this paper, differences in the duration of time off work, the duration of the disability management claim, the types of injuries and illnesses, and the duties performed at the time of return to work were assessed. Together, these papers advance the literature and our understanding of predictors of RTW among first responders by drawing on disability management data.

The final chapter provides a discussion of the overall findings and the contribution this body of work makes to rehabilitation science, disability management and first responder health and safety. In summary, the research in this dissertation attempts to address the lack of first responder specific return to work research in the

literature by identifying unique components of the return to work process for first responders.

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Chapter Two: Identifying predictors of return to work and the duration of time off work in first responders affected with musculoskeletal injuries or mental health issues

Title: Identifying predictors of return to work and the duration of time off work in first responders affected with musculoskeletal injuries or mental health issues.

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2.0 Abstract

Background: First responders have high physical and psychological demands which can lead to musculoskeletal injuries and mental health issues. Because the duties performed by first responders are crucial for community safety, first responders need to return to work as soon as possible.

Objective: To identify predictors of return to work for first responder injuries associated with a disability claim. Two secondary purposes were to determine predictors of first responder disability claim closure, and to perform descriptive statistics for the injury and return to work data.

Methods: All first responder claims collected between January 2 2012 and July 25 2017 were obtained from a National disability management company. Summary statistics were performed for the injury and return to work data. Potential predictor variables extracted from the claims database include age, sex, injury or illness diagnosis, years of service, claim lag, medical report lag, and the return to work duties. Survival analysis was performed to identify predictors of return to work and claim closure using the Cox proportional regression analysis. Log-rank tests were performed to identify predictors that affect the rate of return to work and claim closure.

Results: Sixty of the 67 identified first responder returned to work within the study period. Musculoskeletal injuries predicted an increased likelihood of returning to work and a shorter duration of time off work ($p<0.05$). Claim lag and medical report lag predicted a decrease in likelihood of return to work ($p<0.05$). Returning to work

predicted an increased likelihood of claim closure ($p<0.01$). Only 45 first responders returned to their pre-absence duties.

Limitations: The study was limited by the small sample size and the lack of generalizability.

Conclusions: Predictors of return to work were identified for first responders although more research is required to confirm. Some first responders were unable to return to their pre-absence duties and qualitative studies are needed to identify why this occurs.

2.1 Background

First responders work physically demanding jobs that are also very stressful [1-3]. They are expected to be physically fit, they work in unpredictable and dangerous environments, and at times they have to risk their safety in order to save the lives of civilians [4-6]. First responders have an increased risk of developing a musculoskeletal (MSK) injury or mental health issues compared to the general working population [1,5,7] because of the duties they perform [4,8], thus work disability and absence from work are expected. Because first responders perform important emergency response work [4], optimal management of their disability claims is important for a timely return to work (RTW). Identifying factors associated with RTW for first responders could support the disability management process.

Disability managers often rely on information found commonly in disability claim files to determine predictors for return to work as they coordinate the RTW process [9].

Many studies looking at predictors of RTW in injured workers use surveys and other assessments that are not typically included in the disability claim files, and these studies identify predictors outside of the scope of information available to the disability managers [10]. By using relevant claim data, disability mangers may be able to identify potential difficult cases that might be long in duration [11]. Employers need this information to support their role in disability management and to better plan coverage of workplace productivity requirements [12]. Being able to predict early RTW is important for the injured worker as time off work can pose a financial burden [10,13].

There is a lack of research focused on the predictors of RTW in first responders. Studies have looked at predictors of RTW in general injured worker populations, and most often with a focus on a specific types of injuries such as low back injuries [14-16]. Also systematic reviews found the possibility of many general predictive factors of RTW, but these factors were not consistent throughout the literature and often only weak evidence exists for the identified predictors [16-18]. The only study identified in the literature with relevance to the duration of time off work for first responders was a longitudinal study by Liao et al. [19]; however the focus was only on firefighters. This study identified factors such as being married, longer tenure, and the female sex to be related in a shorter injury duration, whereas older age and being fully compensated for the injury were found to be predictors of a longer injury duration [19]. Unfortunately, this data may lack relevance to current firefighters as the data was collected from 1987 to 1998. Another study looking at firefighter injuries concluded that older firefighters had more relapses in injury but did not look into time off work [20]. In a qualitative interview

study by Scheelar in 2002, social support from co-workers, motivation and job enjoyment were reasons given by two firefighters as to why they would RTW after a serious work injury [21]. These factors cannot be considered predictors of RTW due to the lack of generalizability and statistical evidence.

Given that first responders have highly demanding jobs with high rates of both MSK injuries and mental health issues [22], it is crucial to determine predictors of their return to work. The primary purpose was to identify predictors of return to work and duration of time off work for first responders with injuries and illnesses associated with disability claims obtained from a Canadian disability management company. Two secondary purposes were: 1) to determine predictors of first responder disability management claim closure; 2) to identify common injuries and illness, frequently injured areas of the body, and the different return to work outcomes in first responder disability management claim data.

2.2 Methods

Study Design

The study involved secondary data analysis of first responder (FR) disability claim data which were collected longitudinally from January 2, 2012 to July 25, 2017 by a national disability management company who supports return to work and disability management for private and public companies across Canada. A sample of convenience was used as all FR claims in the database were included in the study. FR job types included firefighters, paramedics, emergency response or service maintainers, law

enforcement officers, and emergency and protective service workers. Contact was made with the Hamilton Integrated Research Ethics Board (HiREB), who decided an ethics review was not required since the research involved a secondary analysis of de-identified data. Consent and contract forms explaining that the data collected would be used for research had been signed at the time of the data collection by the clients and the disability managers.

Data Source and Dataset

The disability management company collects data for all referred clients. All electronic claim files are stored in a secure computer database. Typically, specific client demographic data, employment details, medical information related to the injury or illness, as well as important disability management case information such as RTW dates and claim status were included in the claims. The disability management staff and the research team met to refine the research questions, define the data to be extracted and to discuss coding issues based on the database content. Two data pulls from the electronic claims database on July 25, 2017 were performed: the first included FR (excluding law enforcement officers) and health care provider claims from January 2, 2012 to July 25, 2017, and the second included all claims from January 2, 2012 to July 25, 2017. Before the research team was given access to the data, all claims were de-identified to remove personal and medical information, and then the database was password protected in Excel. FR claims from the first data pull were combined with law enforcement officers claims from the first data pull to achieve the final sample for the study.

Outcome Variables

Data was extracted from the claims database in order to create outcome variables. The primary outcome, the duration of time until RTW, was assessed based on three RTW events: general RTW regardless of the types of duties performed (either modified or full), RTW modified (RTWM) and RTW full (RTWF) (Table 2.1). The secondary outcomes variables were classified as follows. The duration of the claim was based on the occurrence of claim closure (Table 2.1). The types of RTW were based on two time points in the disability management process: the duties performed on the first day of RTW and the type of duties performed by the end of the data collection. The two types of duties performed on the first date of return to work were modified work and pre-absence (full) duties. At the end of the claim data collection, the three categories of work performed were modified work only, full duties only, and a transition from modified to full duties. The general diagnosis was coded in the claims database as either MSK injuries or mental health claims. Specific MSK injuries diagnoses were separated into the following categories based on the diagnosis description in the claims database: surgery, dislocation or fracture, soft tissue injuries, other MSK injuries [23]. The specific mental health claims were separated into the following categories based on the diagnosis description in the claims database: depressive disorders, stress and anxiety disorders, other mental illnesses [24,25]. For the MSK injuries, the affected regions of the body were coded into four categories: upper extremity, head/back/torso, lower extremity and multiple locations.

Predictor Definitions

The following personal client data was extracted from the claim database: age and years of service were continuous variables measured in years, and sex which was a dichotomous variable (male or female). The outcome variables related to the diagnosis data and the duties performed at the time of RTW were also considered as potential predictors, and each diagnosis category and type of duty performed were coded as dichotomous variables. The following disability management data was also extracted from the database and each category was coded as dichotomous variables: the claim type (short term disability, long term disability, workers' compensation) and the reason the claim was closed (RTWM, RTWF, other reasons). Claim lag was calculated by determining the number of business days between the date of first absence and the date that the worker was referred for disability management. Medical report lag was measured by calculating the number of business days between the date of referral and the date that medical reports were obtained by the disability management company.

Data Analysis

All tests performed in STATAIC 14 were two tailed and significant at $\alpha=0.05$. Normality of the data was checked using the Shapiro-Wilk Test. Descriptive statistics were performed to determine the means, standard deviation and 95% confidence intervals (95% CI), or medians, quartiles (25% and 75%) and interquartile range (IQR) for the continuous data. Frequencies and counts were determined for the coded variables. Data were summarized based on three job type categories and the total sample. Firefighters, paramedics/firefighters and emergency response or service maintainers formed one job

category, labelled firefighters. Police officers and emergency and protective services made up the other two categories. Each category was coded dichotomously.

To perform survival analyses, the data for the three duration of time off work outcomes and the duration of time until claim closure outcome were set as survival data by setting the event of interest as the dichotomous outcome and the associated duration outcome as the time-to-event (Table 2.1). Survival analysis summary statistics were performed to identify the survival time median and quartiles for the three RTW duration outcomes and the claims duration outcome. Life tables were obtained for each outcome. Kaplan-Meier survivor function graphs were created to visually analyse the data. Pre hoc Spearman correlation analyses were performed to assess colinearity between the main outcomes (duration of time off work and duration of the claims) and the potential predictor variables. If correlations greater than 0.5 were identified, the variable was removed from the list of covariates. The Cox proportional hazard regression analysis was used to identify the hazard ratios for the significant predictors of the four outcomes. The assumptions of the Cox proportional hazard model were checked using the Schoenfeld residuals test and graphical inspection for each analysis. The robust Cox proportional regression was used if there was a larger spread of residuals identified during the graphical inspection. Stepwise regressions were performed to include all variables significant at a p-value of 0.05 in the final model. For the prediction of the three RTW outcomes, the potential predictor variables include age, sex, injury or illness diagnosis, years of service, claim lag and medical report lag. Unique to the prediction of RTWF, the return to work type (transfer from modified duties to full duties or full duties only) was

also included as a predictor variable. For the prediction of claim closure, the potential covariates included age, sex, general injury or illness diagnosis, RTW type (RTWM or RTWF by the end of the claim data collection), claim lag and medical report lag. If the general injury or illness diagnosis was significant in any of the models, another Cox regression was performed to determine the predictive effects of the specific injury and illness diagnoses. Due to the small sample size, interaction terms were not considered. In order to determine if there were differences in the survival rates between groups within each nominal predictor variable, log-rank tests were used for each of the four outcomes. For the purpose of this analysis, age was separated into three categories: under 40 years of age, 40 to 50 years of age, and over 50 years of age.

2.3 Results

Study Population

The first data pull included 453 claims which represented health care providers and FR claims in the database from January 2, 2012 to July 25, 2017 with the exception of law enforcement officers. The second data pull included 27,650 claims which represented all claims in the database from January 2, 2012 to July 25, 2017. From the first data pull, 34 FR were identified; 22 firefighters (8 firefighters, 3 paramedics/firefighters, and 11 emergency service and response maintainers), and 12 emergency and protective service workers. With the addition of the 33 law enforcement officers from the second data pull, the total number of claims for the study was 67. The FR characteristics are summarized in Table 2.2a.

Summary of Disability Management Claim Data

A total of 22 mental health claims and 45 MSK claims were identified (Table 2.2a). No recurrences of an injury or illnesses were recorded. For all FR, injuries in the lower extremity were most common as they accounted for 44% of injuries (Table 2.2a). All claims were short term disability claims, although one police officer claim for post-traumatic stress disorder (PTSD) was transferred to a workers' compensation claims after 246 business days. In general, 60 FR returned to work, 25% performing modified work and 75% performing full duties, by the end of the claims data collection (Table 2.2b). Of the 7 FR that did not RTW, 6 of the claims were still open. FR claims were typically closed due to RTW, whereas 9.5% of claims were closed for other reasons such as the claims being transferred to long term disability and retirement (Table 2.2b). FR had a median claim lag of 5 days (IQR=12), and a median medical lag of 6 days (IQR=12).

Predictors of Return to Work and the *Duration of Time off Work*

The median duration of time off work was based on the first day back to work regardless of the types of duties performed was 45 days. Based on the life table, at day 30 approximately 35% of FR had returned to work, at day 60 approximately 58% of FR had returned to work, at day 90 approximately 70% of FR had returned to work, and at day 120 approximately 85% of FR had returned to work. The log-rank test identified that there was equality in the survival functions when testing sex, age groups and type of duties performed at the time of RTW (Table 2.3). The only differences in the survival functions were detected when comparing the FR affected by MSK injuries to those

affected by mental health as the log-rank test was significant ($\chi2(1) = 6.03$, $p = 0.0141$, $\alpha = 0.05$) . This indicates that FR with MSK injury claims are more likely to RTW sooner compared to FR with mental health claims. Because one FR was left censored, meaning that RTW occurred on the same day that the injury was sustained, this worker was automatically removed from the survival analysis by the statistical software. Using the stepwise Cox proportional hazard model, FR with MSK injuries were found to be 2 times more likely than FR with mental health claims (Table 2.4). When including the specific injury or mental health diagnoses, claim lag was a significant predictor of RTW, and it was associated in a 1.7% per day of claim lag decrease in the likelihood of returning to work. FR with stress disorders or anxiety claims were identified as being 55% less likely to RTW compared to FR with other diagnoses (Table 2.4).

Predictors of Returning to Modified Duties and the Associated Duration

Of the 60 first responders that did RTW, 33 workers RTWM during the disability management process. One first responder that returned to modified work was also removed from the analysis by the statistics software due to left censoring. The sample for this analysis included the 7 workers who did not RTW and the 32 workers who returned to modified duties (n=39). Based on the life table, at day 30 approximately 33% of the FR had RTWM, at day 60 approximately 58% of the FR had RTWM, at day 90 approximately 69% of FR had RTWM, and at day 120 approximately 83% of FR had RTWM. The log-rank test identified that there was a significant difference in the survival functions of FR with MSK injuries compared to FR with mental health claims ($\chi2(1) =$

8.54, $p = 0.0035$, $\alpha = 0.05$) (Table 2.5). Only 3 FR with mental health claims returned to modified duties whereas 29 FR with MSK injuries RTWM. When using the robust Cox proportional hazard model, FR with MSK injuries were 6 times more likely to RTWM compared to FR with mental health claims. Medical report lag was also found to be a significant predictor which decreased the likelihood of RTWM work by 1.8% for every day of medical report lag. When including the specific MSK injury or mental health diagnoses, medical report lag was found to be a significant predictors with the same affects as seen in the analysis without the specific diagnoses. FR with stress and anxiety mental health claims were identified as being 86% less likely to RTWM compared to FR with other diagnoses (Table 2.4).

Predictors of Returning to Pre-Absence Duties and the Associated Duration

All 67 FR were included in the analysis, although only 45 workers RTWF. Based on the life table, at day 30 approximately 17% of FR had RTWF, at day 60 approximately 38% of FR had RTWF, at day 90 approximately 52% of FR had RTWF, at day 120 approximately 67% of FR had RTWF, and at day 150 approximately 75% of FR had RTWF. The log-rank test identified that there was a significant difference in the survival functions of FR that RTWF first without requiring modified work compared to FR that did require to RTWM first ($\chi2(1) = 18.70$, $p = 0.0035$, $\alpha = 0.05$) (Table 2.6). The robust Cox proportional hazard model identified that there was a 2.2% decrease in the likelihood of returning to work for every day of claim lag a FR had. Also FR who RTWM were less likely to return to their full duties compared to FR that RTWF (Table 2.5).

Predictors of Claim Closure and the Associated Duration of Claims

The median duration of a FR disability management claim was 54 days. The 61 claims that were closed and the 6 claims that remained open were included in the analysis. Based on the life table, at day 30 approximately 41% of the claims were closed, at day 60 approximately 58% of the claims were closed, at day 90 approximately 78% of claims were closed, and at day 120 approximately 87% of claims were closed. The log-rank test identified that there was equality in the survival functions when testing sex, age groups, return to work types, as well as MSK injuries and mental health claims. This means there was no difference in the survival functions of the subgroups within each variable, although the duration of the claim was highly correlated with the duration of time off work (R=0.72). The Cox proportional hazard model identified that FR that returned to modified or full duties at the end of the data collection were almost 3 times more likely to have their claims closed compared to those that did not RTW (Table 2.5).

2.4 Discussion

Based on the primary objective of the study, which was to identify predictors of RTW in FR, the study found that claim lag and medical report lag predicted a decreased likelihood of RTW, and FR with MSK injuries were predicted to have increased likelihood of RTW compared to FR with mental health claims. MSK injuries also predicted a shorter duration of time off work. Mental illness has previously been associated with a longer duration of time off work in sick leave patients [11]. In this study, FR with mental health claims had longer durations of time off work, and were less

likely to RTW in general as well as RTWM. It is possible that it might be more difficult to find work that would accommodate FR with mental health claims as available work could still be mentally and emotionally stressful [26]. Also, the decrease in the likelihood of RTW associated with claim lag and medical report lag is consistent with existing literature that has highlighted the importance of early contact between all stakeholders [27,28,29]. A prompt medical report gives the disability managers and the employers the medical information required to make decisions about the timing of the RTW and the types of duties that will be performed upon RTW [27, 29]. Lastly, returning to full duties at the time of RTW was associated with a higher likelihood of RTWF in a shorter period of time compared to workers who had a gradual RTW starting with modified work. Although modified work has been shown to result in a shorter duration of time off work [9], it is possible that returning to modified work first may delay workers from returning to their full duties, when they are capable of doing so.

When the potential predictors of claim closure were assessed, FR who either returned to modified or full work were more likely to have their disability claim closed compared to those who did not RTW. Both returning to modified duties and full duties had very similar hazard ratios for claim closure. It was expected that claims would be less likely to be closed if workers had only returned to modified duties because disability managers would continue care management until the worker returned to pre-absence duties. Notably, 21% of the FR claims were closed due to the worker returning to modified work. It is possible that this is a unique characteristic of disability management in first responders as it may not be possible for FR to return to their pre-absence duties

given the physical demands of their work [6]. Under these circumstances, modified work might be the only option during the disability management process and could result in permanent accommodated work that fits the specific abilities of the injured workers [9]. Also, employers may decide that they no longer required external disability management once the worker has returned to modified duties and choose to continue the process internally. More detail would have been required to make conclusions regarding termination of disability management services.

Similarly, 25% of FR returned to modified work within the data collection period. Due to physically demanding nature of the duties performed by FR, concerns exist as to whether FR are able to transition to their full duties and actually perform them adequately after an injury [6,30]. The negative aspect of modified work for FR is how limited the modified work opportunities are [30,31]. The modified duties available often involved sedentary administrative work [6] and this is often not the type of work FR want to be performing. Firefighters are often cited as 'needing to rescue', to be in control and to be needed [32,33], as well as having a 'macho mentality' [34]. These factors could make it difficult to accept modified work when FR really want to be performing their typical rescue duties.

When looking at the injury claims, FR were most commonly affected by other MSK injuries, such as arthritis, hernias or prolapsed discs. This differed from the literature as soft tissues injuries have been shown to be the most common injury type amongst FR [4,6]. The difference in results may be that these studies looked at injuries

sustained at work whereas the current study dealt with injuries that were not deemed to be work related. All 67 claims were considered to be short term disability claims, which was surprising since FR have such high risks of sustaining injuries at work [20]. It is possible that the majority of FR work-related injury and illness claims are managed internally by following disability management guidelines for public service workers [35]. It is also possible that repetitive loading and stresses on the body due to the high physical work demands of FR could make them more vulnerable to injury [9], but if the injury occurs outside of work hours, it would be difficult to see the links to all the FR occupational hazards [36]. The injury may have also occurred while exercising outside of work hours because FR are expected to stay fit [2,6]. Research on firefighters and police officers has shown that it is very common for them to sustain injuries during exercise [6,37,38]. Looking at the specific mental health claims in this study, stress and anxiety disorders made up half of all the mental health claims. Mental illnesses such as PTSD and anxiety have been shown to be common in FR as they are exposed to many stressors and traumatic incidences [1,7,8].

2.5 Strengths and Limitations

A strength of this paper was the decreased variation between subjects. RTW and disability management outcomes are affected by work characteristics [9]. By choosing a specific job type like FR, this eliminates a lot of the variability in potential risk factors for injury or illness and in the job demand [19]. Although survival analysis is meant to assess time-to-event data with censoring and was most likely the most appropriate analysis for

the data, there were still some limitations. There was some bias in the results because the FR that did not RTW by the end of the data collection were just considered to not have returned to work in general. It is possible that these FR returned to work after the end of the data collection, but this information is unknown. Furthermore, the sample size was relatively small for the number of potential predictor variables tested and interactions between variables were not tested for this reason. Because it is possible that FR receive internal disability management [36], it was not possible to get a full representation of all FR disability management claims, and thus the results lack generalizability. Also because there were few women in the sample, it was not possible to conduct a gender analysis. Due to client privacy reasons, no personal medical information was included in the claim database although it is possible that other predictors may have been identified if the medical report details were included in the claim.

2.6 Implications

The first main finding was that FR with MSK injuries were more likely to RTW and were associated with a shorter duration of time off work. Disability managers can expect longer RTW and disability management processes when working with FR with mental health claims. Employers should be prepared to make adjustments in the workplace such as hiring new workers in order to accommodate for the absent worker [13]. Lastly, it is important that future research strives to identify disability management interventions that ensure timely RTW for FR with mental health claims. Another issue for FR with mental health claims was that very few returned to modified work first. It would

be important for disability managers and employers to work with FR with mental health claims in order to find suitable accommodated work. Although it may be more complex to accommodate compared to MSK injuries, recent work on accommodating mental health in the workplace has been performed by the Canadian Mental Health Association [26] and guidelines have been created. Future research is required to identify specific guidelines for accommodating FR with mental health issues.

FR that returned to modified work first did not have a significantly shorter duration of time off work compared to those that returned to their pre-absence duties first. Returning to modified work was still beneficial for FR that were unable to return to their full duties. It is a concern that FR in this sample were unable to RTWF and more detailed research would be required to best improve the likelihood of returning to work full. The return to work process may be particularly complex for FR [30], and future research should focus on the impact of modified duties on the RTW process. This research is needed given existing policies related to early and safe RTW processes that typically encourage workers to return to modified duties [39].

2.7 Conclusion

Predictors of return to work were identified for this sample of FR affected by both MSK injuries and mental health issues. FR with MSK injuries were more likely to return to work and a shorter period of time, and claim lag and medical report lag decreased the likelihood of RTW. Modified work was found to delay the return to pre-absence duties and some FR were not even able to transition from modified work to their pre-absence

duties. Due to the lack of generalizability, more studies with larger sample sizes are required. Overall, disability management and the return to work process in FR may be very complex [30]. Future qualitative research should look at identifying the complexities of the disability management and RTW process in FR especially when assessing the benefits and difficulties of modified work.

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Table 2.1 - Definitions of the time-to-event outcomes used for survival analysis.

Table 2.1: Definitions of the time-to-event outcomes used for survival analysis.				
Outcome	**Definition**			
Primary Outcome	**Event**	**Duties Performed**	**Time to event (duration)**	**Units of Measure**
Duration of time until general RTW	RTW	Modified or pre-absence	Number of days between the date of first absence and the first date of RTW regardless of the type of duties performed	Calendar days
	No RTW	No duties performed	Number of days between the date of first absence and the last day of data collection	Calendar days
Duration of time until RTW modified*	RTW modified	Modified duties	Number of days between the date of first absence and the date of RTW modified	Calendar days
	No RTW modified	No duties performed	Number of days between the date of first absence and the last day of data collection	Calendar days
Duration of time until RTW full	RTW full	Full duties	Number of days between the date of first absence and the date of RTW full	Calendar days
	No RTW full	Full duties not performed	Number of days between the date of first absence and the last day of data collection	Calendar days
Secondary Outcome	**Event**	**Time to event (duration)**		**Units of Measure**
Duration of time until claim closure	Claim closed	Number of days between the date of referral for disability management and the date of claim closure		Business days
	Claim open	Number of days between the date of referral for disability management and the last day of data collection		Business days
*Duration of time until RTW modified excluded all first responders that returned to their pre-absence duties without performing modified duties				

Table 2.2 – Summary data extracted from the first responder disability claims

Table 2.2a: Summary of first responder demographic and medical diagnosis data obtained from the disability management claims.

	Firefighters (n=22)	**Emergency and protective services (n=12)**	**Law enforcement officers (n=33)**	**Total first responders (n=67)**
Sex	**Count (% of total n=22)**	**Count (% of total n=12)**	**Count (% of total n=33)**	**Count (% of total n=67)**
Males	20 (90.9%)	11 (91.7%)	24 (27.3%)	55 (82.1%)
Female	2 (9.09%)	1 (8.3%)	9 (27.3%)	12 (17.9%)
	Mean (sd)	**Mean (sd)**	**Mean (sd)**	**Mean (sd)**
Age (years)	45.2 (8.6)	39.2 (6.6)	44.6 (7.9)	43.8 (8.1)
Years of service (years)	14.8 (10.4)	11 (7.1)	14.2 (6.5)	13.8 (8.1)
Diagnosis	**Count (% of total n=22)**	**Count (% of total n=12)**	**Count (% of total n=33)**	**Count (% of total n=67)**
Mental Health (total)	**7 (31.8%)**	**2 (16.7%)**	**13 (39.4%)**	**22 (32.8%)**
Stress/Anxiety Disorders	3 (13.6%)	0 (0%)	8 (24.2%)	11 (16.4%)
Depressive Disorders	4 (18.2%)	1 (8.3%)	3 (9.1%)	8 (11.9%)
Other mental illness	0 (0%)	1 (8.3%)	2 (6.1%)	3 (4.5%)
MSK injury (total)	**15 (68.2%)**	**10 (83.3%)**	**20 (60.6%)**	**45 (67.2%)**
Surgery	7 (31.8%)	2 (16.7%)	3 (9.1%)	12 (17.9%)
Fracture/Dislocation	3 (13.6%)	1 (8.3%)	3 (9.1%)	7 (10.4%)
Soft tissue injury	1 (4.6%)	4 (33.3%)	7 (21.2%)	12 (17.9%)
Other MSK injuries	4 (18.2%)	3 (25%)	7 (21.2%)	14 (20.9%)
Affected Area of the Body for MSK Injuries	**Count (% of total n=15)**	**Count (% of total n=10)**	**Count (% of total n=20)**	**Count (% of total n=45)**
Upper extremity	2 (13.3%)	0 (0%)	6 (30%)	8 (17.8%)
Head, Back, Spine and Abdomen	6 (40%)	4 (40%)	6 (30%)	16 (35.6%)
Lower extremity	7 (46.7%)	6 (60%)	7 (35%)	20 (44.4%)
Multiple locations	0 (0%)	0 (0%)	1 (5%)	1 (2.2%)

Table 2.2b: Summary of return to work outcome data and claim closure data obtained from the disability management claims.

	Firefighters (n=22)	**Emergency and protective services (n=12)**	**Law enforcement officers (n=33)**	**Total First Responders (n=67)**
	Count (% of total n=22)	**Count (% of total n=12)**	**Count (% of total n=33)**	**Count (% of total n=67)**
Return to work	21 (95.5%)	12 (100%)	27 (81.8%)	60 (89.6%)
No return to work	1 (4.5%)	0 (0%)	6 (18.2%)	7 (10.4%)
Type of duties performed on the first day back to work	**Count (% of total n=21)**	**Count (% of total n=12)**	**Count (% of total n=27)**	**Count (% of total n=60)**
Modified duties	12 (57.1%)	7 (58.3%)	14 (51.9%)	33 (55.0%)
Full duties	9 (42.9%)	5 (41.7%)	13 (48.1%)	27 (45.0%)
Type of duties performed at end of data collection	**Count (% of total n=21)**	**Count (% of total n=12)**	**Count (% of total n=27)**	**Count (% of total n=60)**
Modified duties only	8 (38.1%)	5 (41.7%)	2 (7.4%)	15 (25.0%)
Transfer from modified to full duties	4 (19.0%)	2 (16.7%)	12 (44.4%)	18 (30.0%)
Full duties only	9 (42.9%)	5 (41.7%)	13 (48.2%)	27 (45.0%)
	Firefighters (n=22)	**Emergency and protective services (n=12)**	**Law enforcement officers (n=33)**	**Total First Responders (n=67)**
	Count (% of total n=22)	**Count (% of total n=12)**	**Count (% of total n=33)**	**Count (% of total n=67)**
Claim closed	21 (95.5%)	12 (100%)	28 (85.0%)	61 (91.0%)
Claim not closed	1 (4.5%)	0 (0%)	5 (15.0%)	6 (9.0%)
Reason for closing the claim	**Count (% of total n=21)**	**Count (% of total n=12)**	**Count (% of total n=28)**	**Count (% of total n=61)**
Closed due to RTW modified	7 (33.3%)	5 (41.7%)	2 (7.1%)	14 (23.0%)
Closed due to RTW full	12 (57.1%)	6 (50.0%)	23 (82.1%)	41 (67.2%)
Closed for other reasons	2 (9.5%)	1 (8.3%)	3 (10.7%)	6 (9.8%)

Table 2.3 - Durations of time off work, from the first day off work to the first day back at work regardless of the type of duties performed, based on potential predictor variables.

Table 2.3: Durations of time off work, from the first day off work to the first day back at work regardless of the type of duties performed, based on potential predictor variables.			
	Median duration (days)	**25% duration (days)**	**75% duration (days)**
Duration of time off work based on the first day back to work (n=66)	45	23	110
Age categories			
Under 40	48	23	86
40 – 50 years of age	45	26	106
Over 50	40	17	123
Sex			
Males	45	22	98
Females	44	30	112
Injury type			
MSK injuries	43*	18	66
Mental health claims	80*	33	136
RTW type based on the first day back to work			
Modified duties	40	17	66
Full duties	43	23	98
*Log-rank test was significant at $\alpha < 0.05$; significant difference in the survival functions			

Table 2.4 - Predictors of the three return to work outcomes and the claim closure outcome based on the Cox proportional hazard models.

Table 2.4: Predictors of the three return to work outcomes and the claim closure outcome based on the Cox proportional hazard models.

	Hazard Ratio	**Standard Error**	**z value**	**p value (α=0.05)**	**95% CI**
Predictors of general RTW (n=66)					
MSK injuries	2.03	0.60	2.40	0.016	1.14 – 3.60
Anxiety/stress mental health claims	0.45	0.17	-2.11	0.035	0.21 – 0.95
Claim lag (days)	0.98	0.008	-1.97	0.048	0.97 – 0.99
Predictors of RTW modified (n=39)					
MSK injuries	6.00	3.30	3.26	0.001	2.04 – 17.56
Medical report lag (days)	0.98	0.009	-1.97	0.048	0.96 – 0.99
Anxiety/stress mental health claims	0.14	0.083	-3.26	0.001	0.041 – 0.45
Predictors of RTW full (n=67)					
Claim lag (days)	0.98	0.004	-4.95	<0.001	0.97 – 0.99
RTW full first without requiring modified work	5.21	1.73	4.98	<0.001	2.72 – 9.98
Predictors of claim closure (n=67)					
RTW modified	2.73	0.99	2.77	0.006	1.34 – 5.57
RTW full	2.77	1.06	2.66	0.008	1.31 – 5.86

Table 2.5 - Durations of time until first responders returned to modified work based on potential predictor variables.

Table 2.5: Durations of time until first responders returned to modified work based on potential predictor variables.			
	Median duration (days)	**25% duration (days)**	**75% duration (days)**
Duration of time until returning to modified work (n=39)	48	18	110
Age categories			
Under 40	48	18	110
40 – 50 years of age	47	30	106
Over 50	18	14	118
Sex			
Males	48	18	106
Females	44	30	136
Injury type			
MSK injuries	44**	18	66
Mental health claims	136**	33	136
**Log-rank test was significant at $\alpha < 0.005$; significant difference in the survival functions			

Table 2.6 - Durations of time until first responders returned to their full duties based on potential predictor variables.

Table 2.6: Durations of time until first responders returned to full duties based on potential predictor variables.			
	Median duration (days)	**25% duration (days)**	**75% duration (days)**
Duration of time until returning to pre-absence duties (n=67)	80	43	149
Age categories			
Under 40	80	43	119
40 – 50 years of age	80	45	136
Over 50	166	14	118
Sex			
Males	89	43	170
Females	75	49	136
Injury type			
MSK injuries	80	48	141
Mental health claims	80	33	166
RTW type			
Modified work first	136**	66	221
Full duties first	43**	23	98
**Log-rank test was significant at $\alpha < 0.005$; significant difference in the survival functions			

Chapter Three: Differences in disability management outcomes in first responders compared to high and low physical demand workers

Title: Differences in disability management outcomes in first responders compared to high and low physical demand work

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3.0 Abstract

Background: First responders have unique, high occupational demands that increase the risk of physical or psychological and complicate disability management. The extent to which disability management results in different outcomes compared to other occupations is affected by occupational demands, personal factors and other contextual factors.

Objective: To determine whether differences exists in the duration of time off work, the type of injuries or illnesses, the duties performed when returning to work, and the duration of claim in disability management claims of first responders compared to age and sex matched comparators in high or low physical demand occupations.

Methods: A retrospective analysis of disability claims collected by National Disability Management Company from January 2 2012 to July 25 2017 was performed. All relevant first responder claims were selected. The case comparators in high and low demand occupations were selected based on a job demand classification of 'heavy' or 'low/sedentary' as described in the claim database. Three equal groups, first responders, high demand occupations and low demand occupations, were formed by age and sex-matching high demand and low demand groups to the first responders. Analyses of Covariance and post-hoc comparisons tested differences in the job types for the duration of time off work and the duration of the claim. Covariate data was extracted from the claim database and included age, sex, diagnosis of injury or illness, type of duties performed upon return to work, claim and medical report lag, and reasons for claim

closure. Chi-Square assessed between group differences in the injury and mental health diagnoses, the types of duties performed at the time of return to work.

Results: Fifty-nine claims were identified per group. First responders returned to work sooner compared to high demand (mean diff=19.8,p=0.022) and low demand (mean diff=23.0,p=0.001) workers, and first responders had shorter claim durations compared to high demand (mean diff=19.1,p=0.046) and low demand workers (mean diff=27.1,p=0.02). First responders had less musculoskeletal injuries compared to high demand workers (OR:0.28,Fisher's exact=0.014, 95%CI: 0.092-0.80) but more injuries compared to low demand workers (OR=2.33,Fisher's exact=0.04,95%CI:1.04-5.28). First responders were less likely perform full duties compared to high demand (OR=0.12,Fisher's exact=0.004,95%CI:0.013-0.60) and low demand workers (OR=0.19,Fisher's exact=0.014,95%CI:0.033-0.76).

Limitations: It is unclear if the differences found were associated with injury severity as the claim files lacked medical information.

Conclusions: First responders were off work less time than other workers, and this was associated with greater use of modified work. This indicates employer support for modified work, and a need to have programs for transition from modified to full duties. A healthy worker effect may explain why despite high demands, first responders had less musculoskeletal injuries than other high demand occupations.

3.1 Background

Occupational injuries and diseases vary based on the physical and psychosocial characteristics of the work performed [1]. First responders are unique in that they have to perform duties that are very uncommon for the general working population such as responding to emergency calls involving dangerous rescues, fires, crimes, and medical emergencies in order to keep the community safe [2-4]. First responders are expected to have a high level of physical fitness and strength in order to be able to perform physically demanding tasks [6], yet the demands are unpredictable [4]. At time the work performed is sedentary or involves low demands [7] while at other times the work can be highly urgent and stressful [8]. Furthermore, first responders endure high psychological demands when they are required to risk their lives to save others [2,5], and often feel guilty when fatalities occur [9]. They also can witness traumatic events such as the death of others which can be emotionally difficult to cope with [10]. Overall, these unique physical, mental and emotional demands [2] can lead to stressors that have been shown to lead to an increased risk of developing musculoskeletal (MSK) injuries [7,11] and mental illnesses risks compared to the general work populations [2]. Studies have explained that firefighting may be one of the most stressful [8,12] and dangerous jobs [13] with much higher injury rates than the general population [4,7,11]. A systematic review of mental health in first responders by Jones in 2017 identified that the prevalence of mental illnesses such post-traumatic stress disorder (PTSD), anxiety and depression was higher than the prevalence seen in the general population [14].

When first responders or any other members of the workforce become injured or ill, it is common that a disability management company is contacted in order to manage to the return to work (RTW) process. Disability management has been shown in the literature to decrease the duration of time off work in injured workers [15,16], but the process is very complex and specific to the work performed [17] which is especially true for occupations such as firefighting [18]. The return to work process has been shown to be affected by factors such as the availability of modified work [1,16], the type of MSK injury or mental illness [17,19], as well as the physical and psychological demands of the duties performed [15,20]. Because disability management is affected by specific job characteristics, it could be useful to determine if the unique duties, stressors and health risks associated with first responders affect their return to work process compared to other types of occupations. By identifying unique aspects of first responder disability management claims, disability managers will be able customize the RTW process specifically for first responders. This could help disability managers ensure that first responders are prepared to RTW safely as soon as they can. Unfortunately, no research has been found in the literature to compare first responder disability management claims and return to work process of first responders and other types of work. Identifying similarities and differences in the disability management claims between first responders and other occupations could propel future research to determine why these potential differences may exist.

The purpose of this study was to analyse MSK injury and mental health claims from a Canada wide disability management company in order to determine if there was a

difference in (1) the duration of time off work, (2) the types of injuries and mental health claims, (3) the types of duties performed at the time of return to work, and (4) the claim duration, when comparing first responders to high physical demand (HD) and low physical demand (LD) occupations. A secondary purpose was to identify predictors of return to work and claim closure in the study sample.

3.2 Methods

Study Design

This study was a case control design where cases and controls were identified from an existing national database of disability management claims collected by a single multi-site disability management company. The data was collected in a secured database longitudinally from January 2, 2012 to July 25, 2017 in order to document client injury and illness cases. A sample size of convenience was used. Recruitment was not required as this was a secondary data analysis. Instead, inclusion and exclusion criteria were used to determine the sample of first responder (FR), HD worker and LD worker claims.

The Hamilton Integrated Ethics Board (HiREB) was contacted and ethical exemption was granted without requiring a full review because the data was de-identified prior to access. All clients and employees of the disability management company were given contracts and consent forms at the time of the data collection.

Participant Selection

FR were considered to be firefighters, paramedics, emergency response or service maintainers, law enforcement officers, and emergency and protective service

workers. In the claims database, many of the occupations were classified based on job demands (sedentary, light, medium, heavy, very heavy) by the National Disability Management Company. Occupations classified as “heavy” or “very heavy” were selected for the HD group. Occupations classified as “sedentary” or “light” were selected for the LD group. Because of the male dominated nature of most FR occupations [3,21,22], other male dominated occupations were selected for the two comparison groups. Male dominated occupations were found to include high physical demand jobs such as construction, trades work and manufacturing, and low physical demand jobs involving sciences, technology, engineering and mathematics [23]. All MSK injury and mental health claims were included; all other claims were excluded to fit the purpose of the study. Claims with no time of work (ie. first aid) were excluded. Lastly, claims without a RTW date by July 25 2017 that did not have an explanation for the delayed RTW were excluded from the study. Although selection bias is introduced, this was done in order to avoid false assumptions regarding whether the worker would actually RTW, and to avoid inaccurate estimation of the duration of time off work as it was possible that claims were opened shortly before the end of the data collection period. Only 4.5% of claims that met all other selection criteria were removed due to this last criterion, and many of the claims were opened under 3 months before the end of data collection. Claims that met the inclusion and exclusion criteria were categorized in to job types: FR, HD occupations and LD occupations. The HD and LD groups were age and sex-matched to the sample of FR claims. The random selection of HD and LD claims within a 2 year age difference was performed in STATAIC 14 using the FR group as the reference group. For the FR claims

with multiple HD and LD matches, STATAIC 14 was used to randomly select one HD and one LD claim per first responder claim (1:1:1 selection ratio) (See Appendix A).

Dataset Details

Disability management claim data was collected by a disability manager for every client throughout the duration of the RTW process from the date of referral until the date of claim closure or until July 25 2017 which was the date of the data pull performed by an employee of the disability management company. The data was not originally collected for research purposes; instead the data was collected to facilitate claims and disability management processes. Included in the database were worker characteristic (demographics and employment details), injury or illness classifications, claim status and RTW outcomes. The data pull was performed by an employee of the disability management company and included all claim data collected from January 2 2012 to July 25 2017. Once the data pull was performed, the data were entered into a password protected Excel file and all personal information was removed by an employee of the disability management company.

Outcome Variables

Outcome variables were based on data extracted from the disability claims and were described in Table 3.1. The first outcome, the duration of time off work, was a continuous variable calculated in calendar days from the first day that the worker was absent from work to the day the worker returned to work. The second outcome looked at assessing the medical reasons for the claim. This meant looking generically at the

classification of MSK injuries and mental health claims, as well as the specific diagnoses which were extracted from the claim data. Three mental health categories were also created: depressive disorders, stress and anxiety disorders, other mental health issues [24,25]. Four MSK injury categories were created to encapsulate all possible diagnoses: surgery received (ie. meniscectomy), dislocation or fracture, soft tissue injury, other MSK injuries (ie. arthritis) [26]. The region of the body affected by MSK injuries was also assessed: upper extremity, lower extremity, and head, back or torso, multiple locations. The third outcome assessed the duties performed at the time of RTW and the duties performed by the end of the claim (Table 3.1). Each category identified for outcomes two and three were coded dichotomously. The fourth outcome, claim duration, was a continuous variable calculated from the referral date to the date that the claim was closed. Because it is possible that disability management claims remain open even after a worker returns to work, these claims did not have a date of claim closure, and thus there was no associated duration of the claim. These claims were removed from this analysis in order to avoid estimation bias.

Covariate Definitions

All potential covariates for the comparison analyses were extracted from the claim database. The following covariates broken down into categories and were coded as dichotomous variables: sex (male and female), claim type (short term disability, long term disability, workers' compensation), and reasons for the claim closure (RTW and other reasons). The specific injury and the mental health categories as well as the

categories for the RTW duties performed (as described in the outcome description section) were also considered as potential covariates. Age and years of service were extracted from the claim data and were considered to be continuous variables measured in years. The dates relevant to claim lag and medical report lag were extracted from the claims database and were used to calculate these continuous covariates in business days. Calculating the duration between the date of referral to the disability management company and the date that the medical report was received by the company determined the medical report lag. Calculating the duration between the first day of absence and the date of referral to the disability management company determined the claim lag. These covariates will also be considered the potential predictors of RTW and claim duration for the secondary purpose of this study.

Data Analysis

The data analysis was performed in STATAIC 14. All tests were two tailed and significant at $\alpha=0.05$. The Shapiro-Wilk Test was used to determine the normality of the outcome variables and the covariates. Descriptive statistics were performed to summarize all the variables of interest for each of the three occupation groups. All dichotomous variables were presented in frequencies and counts. The continuous covariates were summarized by the medians, first quartile (25%) and third quartile (75%).

All assumptions for the analysis of covariance (ANCOVA) were inspected both statistically and visually. Natural log transformations were performed on the duration of time off work and the duration of the claim in order to normalize skewed data. The means, standard deviation and 95% confidence intervals (95% CI) were determined for

the natural log values of the duration of time off work and the duration of the claim. These values were then back transformed for natural log day units to regular day units to allow for easier interpretation. To perform ANCOVA, an additive model was assumed. Interaction terms were not considered due to the small sample size as well as the lack of evidence of possible interactions in the literature. For the analysis of the duration of time off work, the potential covariates considered were age, sex, MSK injury or mental health claim types, RTW types based on the first day back to work (RTW modified or RTW full), claim lag and medical report lag. For analysis of the duration of the claim, the potential covariates considered were MSK injury or mental health claim types, RTW types based on the last day of data collection (RTW modified only, RTW full only or transferring from modified work to full duties), reasons for claim closure, claim lag and medical report lag. Two separate analyses of covariance were performed to test if differences existed between the FR, HD workers and LD workers when assessing the duration of time off work and the duration of the disability management claim. If ANCOVA detected a difference, post-hoc Sidak corrected multiple comparisons were performed to compare FR to the HD group and FR to the LD group. The adjusted mean days off work and the adjusted mean duration of the claim were calculated for each of the three job type groups based on the effects of the significant covariates in the ANCOVA models. The adjusted mean duration values were back-transformed from natural log day units to days. These back-transformed values were used to calculate the mean differences in day units. Regression analyses were performed for the significant ANCOVA models to identify predictors of RTW and claim duration in the total sample.

The following comparisons were made between FR and HD workers, and FR and LD workers using the Chi Squared Tests of Homogeneity. The Fisher's exact test for significance was used due to the small sample size. Odds ratios were calculated for the significant comparisons. The first two comparisons considered the number of workers with MSK injuries and the number of workers with mental health claims. The mental health claim categories, the MSK injury diagnosis categories, and the three affected regions of the body for workers with MSK injuries were assessed. The last two comparisons involved the duties performed at the first day back to work and the duties performed by the end of the data collection.

3.3 Results

Study Population

The second data pull from the claims database which included 27,650 claims was used to determine the sample for this study. A total of 59 FR disability management claims were identified to meet the inclusion and exclusion criteria. Before age and sex matching the data, 443 HD occupation claims and 504 LD occupation claims were found to meet the inclusion and exclusion criteria. Once the age and sex matching was performed using the first responder sample as the reference group, three even groups of 59 claims were identified for a total sample of 177 claims. The HD group included machine operators, forestry workers, splicers, plant labourers and production line workers. The LD group included air traffic control and flight services workers, engineers,

information technology workers, accountants and financial analysts. The three groups were made up of 17% females and 83% males (Table 3.2).

Summary of the Disability Management Data

Disability claim data, including the unadjusted mean duration of time off work, the type of duties performed at the time of RTW and the unadjusted mean duration of the claim were summarized in Table 3.3. Injury and mental health diagnoses were summarized in Table 3.4. Only 2 recurrences of injuries occurred in this sample during the disability management process, and both occurred in HD workers with MSK injuries.

Difference in the Duration of Time off Work

The ANCOVA model detected that a difference existed (R^2=0.22,$F_{2,170}$=6.56, p=0.002, α=0.05) and FR were found to RTW significantly sooner when compared to the HD group and the LD group (Table 3.5). The adjusted mean number of days off work for each occupation group were 33.6 (95% CI: 26.3-42.8) for FR, 52.7 (95% CI: 40.9-68.0) for the HD group, and 60.7 (95% CI: 47.5-77.6) for the LD group.

Differences in the MSK Injury and Mental Health Diagnoses

When comparing the number of workers with MSK injuries and mental health claims between occupation groups, FR had significantly more mental health claims (OR=3.53, Fisher's exact=0.014, 95%CI: 1.25-10.83) and less MSK injuries (OR=0.28, Fisher's exact=0.014, 95%CI: 0.092-0.80) compared to HD workers. FR also had significantly less mental health claims (OR=0.43, Fisher's exact=0.04, 95%CI: 0.19-0.97)

and more MSK injuries (OR=2.33, Fisher's exact=0.04, 95%CI: 1.04-5.28) compared to LD workers. When looking at the specific MSK injury and mental health diagnoses (Table 3.4), FR were found to have significantly less soft tissue injuries compared to the HD workers (OR=0.18, Fisher's exact=0.001, 95%CI: 0.07 - 0.46). FR had significantly less depressive disorders than the LD workers (OR=0.33, Fisher's exact=0.04, 95%CI: 0.11 - 0.95). Little difference existed in the number of MSK injuries sustained per region of the body when comparing the three occupations. FR had significantly fewer back, torso and head injuries compared to the HD workers (OR=0.42, Fisher's exact=0.05, 95%CI: 0.18 - 0.99).

Differences in the Duties Performed when Returning to Work

No significant differences in the duties performed upon RTW were found between FR and HD or LD workers. When looking at the types of duties performed by the end of the data collection period (Table 3.3), significant differences were found. FR RTW on modified duties only by the end of the data collection more frequently than the HD group (OR=8.05, Fisher's exact=0.004, 95%CI: 1.67 - 75.93) and the LD group (OR=5.28, Fisher's exact=0.014, 95%CI: 1.32 - 30.19). FR were less likely to RTWF by the end of the data collection when compared to HD workers (OR=0.12, Fisher's exact=0.004, 95%CI: 0.013 - 0.60) and LD workers (OR=0.19, Fisher's exact=0.014, 95%CI: 0.033 - 0.76). FR were also found to have significantly less transfers from modified work to full work when compared to HD workers (OR=0.35, Fisher's exact=0.009, 95%CI: 0.15 -0.79).

Differences in the Duration of the Claims

At the end of the data collection, 58 first responder claims, 58 HD worker claims and 56 LD worker claims were closed (Table 3.3). When looking at whether a difference exists in the duration of the claim between occupation groups, the ANCOVA model detected that a difference existed (R^2=0.32,$F_{2,167}$=4.01, p=0.02, α=0.05). FR claims were closed significantly sooner than both the HD and LD worker claims (Table 3.6). The adjusted mean duration of the claim for each occupation group were 42.0 (95% CI: 33.2-53.0) for FR, 61.8 (95% CI: 49.0-78.1) for the HD group, and 65.0 (95% CI: 51.4-82.1) for the LD group.

Predictors of Return to Work and Claim Durations

Claim lag, medical report lag and older age predicted an increase in the duration of time off work. Soft tissue injury claims were associated with a shorter duration of time off worker compared to all other injuries or mental health claims (Table 3.5).

Workers who returned to work had shorter claim durations. Also associated with increased claim durations were the claims that were closed for reasons other than the workers returning to work (Table 3.6).

3.4 Discussion

When comparing the duration of time off work between job types, FR returned to work significantly sooner than HD and LD workers. However, this was associated with a larger return to modified work. When comparing the frequencies of injuries illnesses between job types, FR were found to have significantly less MSK injuries but more

mental health issues compared to HD workers, and they were also found to have more MSK injuries but less mental health issues when compared to LD workers. When comparing the types of duties performed by the end of the data collection period, FR were found to only return to modified more frequently than both job types and they were also less likely to transition from modified work to full duties when compared to HD workers. Lastly, when comparing the duration of the claim, FR claims were significantly shorter. Unfortunately, due to the small sample of FR, these finding are most likely specific to this sample and may have limited generalizability. Due to the lack of medical data, such as severity, and the nature of the retrospective study, the causes of these differences seen in FR disability management claims cannot be confirmed. Because of these limitations, interpretations of the results should be made with caution.

Although there was no significant differences between the frequencies of workers that RTW modified on their first days back to work when comparing FR to the other occupations, FR still returned to modified work at a high rate. It is possible that the FR employers have implemented successful modified work policies. The availability of modified work has been linked to a quicker [1] and more successful [18] RTW process. Drawing on findings from past research, social support from co-workers and supervisors has generally been linked to improving RTW outcomes [1,20,27]. Because FR work in team environments, social support might be more available [28]. Past research has found that firefighters often lack support outside of work [29]. For example, in a qualitative study on returning to work after a traumatic injury in firefighters, social support from co-workers, along with job enjoyment and motivation, were given as the main reasons for

actually returning to work [30]. Thus, a possible explanation for shorter time off work among FR may be that they lack support outside of work. Generally, FR have been shown to be passionate about the rescue work they perform as they enjoy the feeling of being considered heroes [31,32]. Similarly, the disability management literature has also highlighted job motivation [17,27] and personal expectations [15,17,20] as being important predictors of RTW. It is also common that supervisors expect injured or traumatized firefighters to get back to work immediately [12]. Alternatively, the 'macho mentality' often associated with FR [12], where that injuries and illnesses are seen as weaknesses, could cause workers to feel pressure to RTW sooner.

FR were also found to have significantly less MSK injury claims and specifically less soft tissue injuries than the HD workers in this study. When comparing first responders to the HD occupations, both groups had similar requirements for aptitude and physical demands, and worked in similar hazardous environments [33]. The difference could be that first FR have periods of sedentary activity before performing high demand work [7,34], whereas manufacturing and trades work has commonly been associated with repetitive physical strain throughout a shift [35].

FR reported fewer mental health claims compared to the LD group. Specifically, LD workers had significantly more depressive disorder claims. When comparing the different occupations using the National Occupational Classification (2016), the LD demand occupations were found to have higher cognitive aptitude requirements than the first responders [33]. Although FR have mental stressors, they are inconsistent as they are not always responding to emergency calls [34], whereas the LD workers, such as air

traffic controllers, are exposed to mental stresses much more frequently in a day [36]. FR may have more time to recover between stressful exposures. Also, FR commonly underreport mental health issues due to associated stigmas [2,12] or because they do not perceive the need for professional assistance [10,12].

By then end of the data collection period, both the HD and LD groups returned to their full duties more frequently than the FR. FR were more likely to just perform their modified duties. The inability to transition to full duties could be a unique characteristic of the disability management process for FR and may be attributed to their high physical demands [7]. FR can lose the physical fitness and strength required to perform their pre-injury duties [37] as they can become deconditioned when they are absent from work [17]. FR that are unable to fully recover and regain adequate abilities to perform their pre-absence duties could be required to perform permanent accommodated work [7]. A study found that FR over 50 years of age were unable to recover enough from their injuries to sufficiently perform their duties and were more likely than the general population to claim permanent disability [7]. It is less likely that HD and LD workers require an overall level of strength and fitness to perform their work and thus it might be easier to return to their full duties. There is also more of a risk when FR are not fully capable to perform their duties since mistakes can lead to serious injuries or fatalities [38].

When comparing the duration of the claims between FR and the two other occupation groups, FR were found to have a significantly shorter mean claim duration.

This is most likely because FR also had the shortest duration of time off work and the majority of claims in the sample were closed due to RTW.

Because ANCOVA is a type of regression analysis, some predictors of RTW were identified. Many studies in the literature have identified older age as a predictor of longer durations of time off work [19,39,40]. Claim lag and medical report lag were both associated with a longer duration of time off work. Early contact between all stakeholders has been shown in the literature to lead to a successful return to work process [41]. Lastly, workers with soft tissue injuries were found to return to work sooner than workers with any other MSK injury or mental health claim. This is most likely related to the severity of MSK injuries although this data was not available in the claims; the more severe the injury, the longer the worker is off work [17,40,42]. Also, mental health claims have been associated with a longer duration of time off work [19]. Returning to work was associated with a decreased duration of the claim whereas the claims that were closed for reasons other than RTW were associated with longer claim duration. This was expected as it is the goal of all involved stakeholders to have workers RTW [43].

3.5 Implications

The main finding of the study was that FR RTW sooner than other occupations. The other major finding was that FR returned to modified duties frequently, and were less likely to RTW full by the end of the data collection compared to both of the other occupation groups. This may be a unique characteristic of the RTW process for FR. More research is required to explain why some FR are unable to transition from modified work

to full duties. The current guidelines and interventions for transitioning FR from modified work to full duties need to be explored to identify they are unsuccessful at times. Given that potential reasons for this include deconditioning [17] and not recovering enough to be able to perform full duties adequately [7,18], health care providers, specifically rehabilitation professionals, have a very important role. Rehabilitation professionals should consider the uniquely high demands of FR work [4,7] before ending the provision of rehabilitation services even if RTW modified has occurred. Moreover, disability managers should continue to provide guidance during the RTW process until FR have returned to their pre-absence duties rather than closing claims after the FR return to modified work. In this sample, it was found that FR claim files were being closed even though they had only returned to modified work. This was unique for FR as very few claims were closed due to RTW modified in the other two occupation groups. Qualitative interviews with disability managers should be performed to determine why claims are closed before workers return to their pre-absence duties.

3.6 Strengths and Limitations

An important aspect of this study design was to attempt to decrease the variation between claims for analysis. By age and sex matching the three occupation groups, this removed the effects of age or sex differences on the return to work process. The selection of male dominated occupations for the HD and LD groups was performed to eliminate some differences in work environments. Male dominated work environments have been associated with factors such as harassment, stereotyping and discrimination [44]. It was thought that these factors may pressure workers to RTW sooner due to stigmas associated

with injuries and mental health, as seen in male dominated occupations like firefighting [2,12,31].

The study sample selection was also a major limitation. The sample was biased as selecting male dominated occupations resulted in a LD group where most of the occupation required high cognitive aptitudes that were rated as being in the top third of all occupations [37]. These occupations are likely much more stressful than most occupation which could be the reason for such high numbers of mental health claims and longer duration of time off work. The study also excluded all claims that did not have a RTW date in order to remove added complexities of censored data to avoid making incorrect assumptions about the duration of the absence and whether the RTW occurred. This may have simply excluded claims that were added to the dataset late in the data collection process, or it may have introduced sampling bias by excluding the claims longest in duration.

The overall sample was also small which limited the data analysis and the significant results. Underreporting of injuries and mental illness due to stigma is common in FR [2,31]. Often identified in firefighters is their job enjoyment [30], and their association with a strong and heroic identity may cause them not to report injuries [12,31]. It is possible that FR receive internal disability management. For example, after a traumatic event, critical incidence debriefing is performed for firefighters to avoid mental health issues [32]. Lastly, the data was obtained from a single disability management company and this company does not manage all the first responder claims across Canada. For these reasons the sample is not representative and thus the results are

difficult to generalize to FR more broadly. Another limitation of the study was the lack of medical information, such as severity. Severity of an injury has been linked to predicting the duration of time off work [17,20]. The current study was unable to identify the reason why FR RTW sooner compared to other occupations, and it is possible that first responder injuries were less severe resulting in a shorter duration of time off work.

3.7 Conclusion

The purpose of this study was to compare aspects of the disability management process in first responders and other types of occupations. FR were found to RTW sooner and have a shorter disability claim duration when compared to other occupations, although they were less likely to return to their full duties by the end of the disability management process.

Overall, FR have a unique set of job demands, both physically and mentally [4], and these unique characteristic may also be reflected in the disability management and RTW processes. Qualitative research is needed to explore the disability management process for FR further in hopes of identifying why first responders RTW sooner than other workers, and why so many FR are unable to perform pre-absence duties after an injury or illness. More research with the same objectives in larger samples is required to confirm and further explain the results of the study. Including severity of the injury as a covariate in future research is recommended as it may help clarify results when assessing the duration of time off work in injured workers.

3.8 References

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Table 3.1: Definitions of the disability management outcomes for comparisons between the three occupation groups.

Table 3.1: Definitions of the disability management outcomes for comparisons between the three occupation groups.		
Outcome	**Definition**	**Units of measure**
1. Duration of time until RTW	Duration between the date of first absence and the date of RTW, regardless if the worker performs modified work or full work. The day of RTW was not included in the count.	Number of calendar days
2. Classification of injuries and mental health issues	Mental health claim categories: depressive disorders, stress and anxiety disorders, other mental health issues	N/A
	MSK injury categories: surgery received, dislocation or fracture, soft tissue injury, other MSK injuries	N/A
	Affected region of the body categories: upper extremity, lower extremity, head/back/ torso, multiple locations	N/A
3. Return to work outcomes – duties performed	Based on the first day back at work: RTW modified or RTW full	N/A
	Based on duties performed by the end of data collection: RTW modified only, transition from modified to full duties, RTW full only	N/A
4. Duration of claim	Duration between the date of referral for disability management and the date of claim closure. The day the claim was closed was not included in the count.	Number of business days

Table 3.2 – Worker characteristics based on each occupation group.

Table 3.2: Worker characteristics based on each occupation group.									
	First responders (n=59)			**High physical demand work (n=59)**			**Low physical demand work (n=59)**		
Sex	**Count (% of total n=59)**			**Count (% of total n=59)**			**Count (% of total n=59)**		
Males	49 (83.0%)			49 (83.0%)			49 (83.0%)		
Females	10 (17.0%)			10 (17.0%)			10 (17.0%)		
Age	**Median**	**25%**	**75%**	**Median**	**25%**	**75%**	**Median**	**25%**	**75%**
Males	43.0	37.0	49.0	43.0	36.0	50.0	45.0	37.0	49.0
Females	45.5	44.0	47.0	45.0	43.0	48.0	44.5	43.0	49.0
Years of service	**Median**	**25%**	**75%**	**Median**	**25%**	**75%**	**Median**	**25%**	**75%**
Males	11.0	7.0	19.0	13.5	6.0	16.0	11.0	6.0	16.0
Females	19.5	11.0	23.0	9.5	4.0	18.0	10.0	6.0	13.0

Tables 3.3 – Summary of the disability management data extract from the claims.

Table 3.3: Summary of the disability management data from the claims database.

	First responders (n=59)			High physical demand work (n=59)			Low physical demand work (n=59)		
Claim type when initially filled	**Count (% of total n=59)**			**Count (% of total n=59)**			**Count (% of total n=59)**		
Short term disability	59 (100%)			40 (67.8%)			58 (98.3%)		
Long term disability	0 (0%)			1 (1.7%)			0 (0%)		
Worker's compensation	0 (0%)			18 (30.5%)			1 (1.7%)		
	Median	**25%**	**75%**	**Median**	**25%**	**75%**	**Median**	**25%**	**75%**
Claim lag	7	1	13	4	1	9	4	1	9
Medical report lag	7	0	13	3	0	9	9	5	16
Type of duties performed at the date of RTW	**Count (% of total n=59)**			**Count (% of total n=59)**			**Count (% of total n=59)**		
Modified duties	32 (54.2%)			35 (59.3%)			23 (39.0%)		
Full duties	27 (45.8%)			24 (40.7%)			36 (61.0%)		
Type of duties performed at the end of data collection	**Count (% of total n=59)**			**Count (% of total n=59)**			**Count (% of total n=59)**		
Modified duties	13 (22.0%)			2 (3.4%)			3 (5.1%)		
Transfer from modified to full duties	19 (32.2%)			34 (56.6%)			20 (33.9%)		
Full duties	27 (45.76%)			23 (38.98%)			36 (61.02%)		
Reason for closing the claim	**Count (% of total n=59)**			**Count (% of total n=59)**			**Count (% of total n=59)**		
Closed due to RTW full	41 (69.5%)			45 (76.3%)			40 (67.8%)		
Closed due to RTW modified	13 (22.0%)			1 (1.7%)			1 (1.7%)		
Transfer from one type of claim to another	3 (5.1%)			5 (8.5%)			11 (18.6%)		
Retirement, termination or resignation	1 (1.7%)			2 (3.4%)			4 (6.8%)		
Reason not given	0 (0%)			5 (8.5%)			0 (0%)		
Claims not closed	1 (1.7%)			1 (1.7%)			3 (5.1%)		
	Mean (n=59)	**95% CI**		**Mean (n=59)**	**95% CI**		**Mean (n=59)**	**95% CI**	
Number of days off work*	36.7	28.1 – 47.9		44.0	33.5 – 57.7		66.6	51.6 – 86.0	
	Mean (n=58)	**95% CI**		**Mean (n=58)**	**95% CI**		**Mean (n=56)**	**95% CI**	
Claim Duration*	34.6	27.0 – 44.4		71.3	53.7 – 94.7		68.4	52.4 – 89.2	

*Unadjusted means; back-transformed values from natural log units to original units

Table 3.4 – Musculoskeletal injury and mental health diagnoses obtained from the disability management claims databases.

Table 3.4: Musculoskeletal injury and mental health diagnoses obtained from the disability management claims databases.			
	First responders (n=59)	**High physical demand work (n=59)**	**Low physical demand work (n=59)**
Diagnosis description	**Count (% of total n=59)**	**Count (% of total n=59)**	**Count (% of total n=59)**
Mental Health (total)	**19 (32.2%)**	**7 (11.9%)**	**31 (52.5%)**
Stress/Anxiety Disorders	9 (15.2%)	5 (8.5%)	12 (20.3%)
Depressive Disorders	7 (11.9%)	2 (3.4%)	17 (28.8%)
Other mental illness	3 (5.1%)	0 (0%)	2 (3.4%)
MSK (total)	**40 (67.8%)**	**52 (88.1%)**	**28 (47.5%)**
Off for surgery	11 (18.6%)	4 (6.8%)	3 (5.1%)
Fracture/Dislocation	6 (10.2%)	7 (11.9%)	8 (13.6%)
Soft tissue injury	10 (17.0%)	32 (54.2%)	9 (15.2%)
Other MSK injuries	13 (22.0%)	9 (15.2%)	8 (13.6%)
MSK injury location	**Count (% of total n=40)**	**Count (% of total n=52)**	**Count (% of total n=28)**
Upper extremity	8 (20.0%)	10 (19.2%)	4 (14.3%)
Back/Torso/Head	14 (35.0%)	25 (48.1%)	13 (46.4%)
Lower extremity	18 (45.0%)	17 (32.7%)	11 (39.3%)

Table 3.5 – Results of the comparisons of the mean duration of time off work between first responders and the two other occupation groups.

Table 3.5: Results of the comparisons of the mean duration of time off work between first responders and the two other occupation groups.

Covariates in the significant ANCOVA model for the duration of time off work (R^2=0.22,$F_{2,170}$=6.56, p=0.002, α=0.05)

	ANCOVA results		**Effects of the covariates in the regression analysis**			
	$F_{(1,170)}$	**p (α=0.05)**	**Beta Coefficient**	**$t_{(176)}$**	**p (α=0.05)**	**95% Confidence Interval**
Age	5.20	0.023	0.018	2.28	0.024	0.0027 – 0.037
Soft tissue injuries	18.61	<0.001	-0.74	-4.31	<0.001	-1.07 - -0.40
Claim lag	6.00	0.015	0.0046	2.45	0.015	0.00089 – 0.0083
Medical report lag	6.30	0.013	0.007	2.51	0.013	0.0017 – 0.014

Results of the post-hoc multiple comparison analysis for the duration of time off work

	Mean Difference (original day units*)	**Mean Difference (in natural log units)**	**$t_{(175)}$**	**p (α = 0.05)**	**95% Confidence Interval**
First responders vs. HD workers	19.8	0.47	2.57	0.022	0.058 – 0.89
First responders vs. LD workers	23.0	0.59	3.45	0.001	0.21 – 0.98

*Mean difference of back-transformed adjusted mean values; back-transformed from natural log units to original calendar day units

Table 3.6 – Results of the comparisons of the mean duration of the disability management claims between first responders and the two other occupation groups.

Table 3.6: Results of the comparisons of the mean duration of the disability management claims between first responders and the two other occupation groups.

Covariates in the significant ANCOVA model for the duration of the claim (R^2=0.32,$F_{2,167}$=4.01, p=0.02, α=0.05)

	ANCOVA results		Effects of the covariates in the regression analysis			
	$F_{(1,167)}$	p (α=0.05)	Beta Coefficient	$t_{(171)}$	p (α=0.05)	95% Confidence Interval
Returning to work	21.69	<0.001	0.66	2.28	<0.001	0.38 - 0.94
Claim was closed for reasons other than RTW	42.61	<0.001	1.18	6.53	<0.001	0.82 - 1.54

Results of the multiple comparison analysis for the duration of the claim

	Mean Difference (original day units*)	Mean Difference (in natural log units)	$t_{(170)}$	p (α = 0.05)	95% Confidence Interval
First responders vs. HD workers	19.1	0.39	2.29	0.046	0.005 – 0.77
First responders vs. LD workers	27.1	0.44	2.60	0.020	0.057 – 0.82

*Mean difference of back-transformed adjusted mean values; back-transformed from natural log units to original business day units

Chapter Four: Future Direction and Concluding Remarks

Future Directions and Concluding Remarks

4.1 Summary

This thesis focused on identifying aspects of the disability management process that were unique to first responders with musculoskeletal injuries and mental health issues in the hopes of determining predictors of return to work specifically tested in first responders. It established many predictors of return to work as well as factors that affect the duration of time off work. First responders with musculoskeletal injuries were more likely to return to work and more likely to have a shorter duration of time off work when compared to workers with mental health injuries. Specifically, first responders with stress and anxiety disorders were associated with being the least likely to return to work compared to those with any other injury or illness diagnoses. Claim lag and medical report lag decreased the likelihood of return to work; for every day of associated lag present, the first responder had approximately a 2% decrease in the likelihood of returning to work. Lastly, first responders that returned to modified work first were predicted to have a longer duration until returning to pre-absence duties and were less likely to return to their pre-absence duties in general. In the second study, first responders were found to return to their pre-absence duties significantly less than both high physical demand workers and low physical demand workers. First responders were also found to return to work significantly sooner and have shorter disability management claim duration compared to the high and low demand occupation groups. In this sample, first responders were found to have less musculoskeletal injuries compared to the high

demand occupations whereas they had more musculoskeletal injuries compared to the low demand occupations.

4.2 Study Strengths and Limitations

Disability management has been shown to be a predictor of return to work [1]. The research presented here drew on administrative files from one disability management company, thereby, minimizing variation within the return to work process. This is a strength as it allowed us to focus on predictors of RTW when other criteria are held fairly constant. However, it does limit the scope of the research and prevent us from learning about how different aspect of the RTW process can impact outcomes. Return to work can also be affected by work characteristics such as physical demands [2]. For this reason, variability was also minimized by selecting a specific occupation group like first responders, and by forming two comparison groups based on their physical demands for the second study. This study also matched the two comparison groups to the first responder sample based on age and sex. This removed any effects of differences on age and sex on the disability management outcomes of the study as both age and sex have previously been identified as predictors of return to work [3-6].

The study only assessed disability management claims with no addition information. This was thought to be important as the results of these studies are practical to disability managers and other stakeholder, and the results may actually be applied in disability management settings for first responders. Lastly, given the challenges associated with the heavily skewed duration of time off work data, where some workers

did not return to work by the end of the data collection period, the most appropriate analysis methods were selected. Survival analysis is able to deal with skewed and censored duration data. Unfortunately, survival analysis assumes that censored data mean that the workers did not return to work. In reality, the worker may have returned to work after the data collection ended and this could introduce bias in the results of the first study. Sampling bias was present in second study. By trying to limit bias in the results with many inclusion and exclusion criteria, sampling bias was created. The low demand occupation group was found to be comprised of very cognitively demanding and stressful jobs which may have impacted the results of the study. Claims without RTW dates were also excluded. This may have been beneficial by removing claims that were opened close to the end of the data collection as it avoids bias in estimating a shorter duration of time off work. Conversely, this may have biased the results by removing claims that were long in duration.

Both studies were limited in many ways due to the small sample sizes. Even though first responders have a high injury rate [8], their disability management claims represented a very small percentage of total claims in the database. It is possible that first responders receive internal disability management or other companies may also manage first responder injury claims, and underreporting of injuries and mental illness is also common in first responders [8,9]. Because the sample was not representative of the first responder population, the results may not be generalizable to first responders outside of the sample. The significance of the findings and the number of predictors of return to work may have also been limited. The lack of females in the sample made it impossible

to perform sex specific analyses to explore if any sex differences existed. The database lacked medical information such as severity and comorbidities which both have been shown to affect the return to work process [3]. Lastly, the inability to determine the exact causes of the results found was a major limitation of the studies. Conversely, these studies identified possibilities for future research which is the most important strength of this thesis.

4.3 Future Directions

The main finding of the first study was that first responders with mental health claims had longer durations of time off work compared to workers with musculoskeletal injury claims. It is important that all stakeholders are prepared for a longer duration of time off work for first responders with mental health claims. Since claim duration was associated with the duration of time off work, disability managers should expect a longer disability management process for first responders with mental health claims. There is a need for an updated plan of action or new strategies for helping first responders with mental health issues return to work sooner.

In this study, very few first responders with mental health claims returned to modified work. It may be beneficial for disability managers, in collaboration with employers, first responders and researchers, to identify guidelines for returning first responders to suitable modified work. Future research is required to identify intervention that can assist first responders in returning to work sooner when they have mental health issues.

Employers will need to be prepared to make adjustments in the current scheduling of first responders in order to keep up with demands, especially while employees are off work for mental health reasons. Employers also need to focus not only on physical health and safety at work, but also mental health and safety because of the longer duration of time off and the potential complexities for the disability management process associated with mental health claims. Qualitative work should be performed with disability managers to identify any complexities associated with mental health claims, and how the return to work process differs for these claims. Lastly, the first responders with the mental health claims should be made aware of the potential lengthy duration of time off work associated with their mental health issues. Because first responders can be reluctant to seek for care when related to mental health issues [10], they should also be pushed to obtain the profession help they need in order to return to work as quickly as possible.

Possibly the most interesting finding of this thesis was that first responders were much less likely to return to their pre-injury duties compared to other occupations. It is concerning that many first responders were unable to return to their pre-absence duties and instead just performed modified work; future research would be required to understand the reasoning for this. Future qualitative research should be performed to determine if first responders are satisfied with the modified duties they are performing. Past research in firefighters has highlighted the high level of job enjoyment that they have [11], and they may not be content with their modified duties. For the first responders that were unable to perform their pre-absence duties within the study period, returning to modified duties was beneficial because they were able to perform some type of work

rather than no work at all. Employers should continue to make modified work available for first responders, but the focus should be to only have them performing modified duties short-term with the ultimate goal of having all first responders return to their pre-absence duties. Many of the claims were closed after first responders returned to modified duties. Although the reason for this is unknown, it is important that the disability management process is continued even after first responders return to modified work. Future qualitative research should attempt to determine why these disability management claims are frequently closed before first responders return to their pre-absence duties. Furthermore, first responders may have recovered enough that health care professionals believe their services are no longer required, especially if they have returned to work. Even though first responders return to work, they often are performing modified duties because they may have not recovered adequately from their injuries. Health care providers need to remember that first responders are expected to have high levels of strength and fitness, and they must be healthy and fully recovered from injuries before they can perform their highly demanding jobs safely and adequately [7]. It is important that health care professionals continue providing care and rehabilitation services to these first responders until they have regained their pre-injury abilities. It should also be the injured workers' duties to maintain their strength and fitness if possible in order to avoid deconditioning [12]. Because first responders have such high physical demands and it is very important that they perform their duties optimally [7], first responders have to be fully recovered from their injuries and have to be physically capable of performing their duties.

Another main finding was that both claim lag and medical report lag decreased the likelihood of first responders returning to work. All stakeholders involved in the RTW process for first responders should ensure that the disability management process is initiated immediately after the occurrence of injuries or mental health issues. It is also important that early contact occurs between disability managers and health care professionals to ensure that all medical information required for the planning of the return to work process be sent to the disability management company [13,14].

Overall, it is important to understand that disability management and the return to work processes in first responders are very complex [12,15]. It is crucial that all stakeholders participate in order to return first responders to work as soon as possible. Future research should look at identifying the complexities of the disability management and return to work processes in first responders especially when assessing the benefits and difficulties of modified work. Also more studies with larger sample sizes would be required to confirm the results of these studies and to identify other potential predictors of return to work or unique aspects of the disability management process in first responders. Qualitative research in disability management may be more effective in identifying factors that make first responder claims unique, complex and possibly more difficult to manage.

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Appendix A - Codes for random age and sex matching performed in STATAIC 14.

```
*High Demand Worker Selection
gen id=_n
preserve
keep if jobtype == 2
tempfile controls
save `controls'
restore
keep if jobtype == 1
//    NOW JOIN ON AGE AND SEX
//    ALLOW WINDOW FROM 2 YEARS BELOW TO 2 YEARS ABOVE
rangejoin age -2 2 using `controls', by(sex)
//    RANDOMLY SELECT ONE MATCH IF THERE ARE MORE
set seed 1234
gen double shuffle = runiform()
by id_U (shuffle), sort: keep if _n == 1
drop shuffle

*Low demand job matches
gen id=_n
preserve
keep if jobtype == 3
tempfile controls
save `controls'
restore
```

```
keep if jobtype == 1
//    NOW JOIN ON AGE AND SEX
//    ALLOW WINDOW FROM 2 YEARS BELOW TO 2 YEARS ABOVE
rangejoin age -2 2 using `controls', by(sex)
//    RANDOMLY SELECT ONE MATCH IF THERE ARE MORE
set seed 1234 // OR WHATEVER RANDOM NUMBER SEED YOU LIKE
gen double shuffle = runiform()
by id_U (shuffle), sort: keep if _n == 1
drop shuffle
```