Factors Predicting Return-to-Work Outcomes in Workers

with or without Comorbid Physical Injuries and Traumatic Psychological Injuries

by

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Abstract

Background: Physical injuries and psychological trauma frequently co-occur, and are associated with worse return-to-work outcomes. The Workers' Compensation Board of Alberta (WCB-Alberta) offers psychologically-based occupational rehabilitation programs for workers having sustained traumatic psychological injuries (TPI) in the workplace. These programs have not been formally evaluated since their inception. As a result, it is not clear how successful these programs are in facilitating return-to-work. Additionally, factors associated with return-to-work in workers with or without TPI and pain resulting from physical injuries who have been referred to psychologically-based rehabilitation services have not been identified.

Objectives: The broad aim of this study was to identify factors associated with return-to-work in workers with or without comorbid physical injuries and TPI undergoing rehabilitation for TPI through WCB-Alberta.

Methods: The current study employed a population-based, retrospective, longitudinal design. A secondary analysis of data on 488 injured workers undergoing rehabilitation for TPI between the years of 2014 and 2016 was conducted. We also examined group differences between those with or without comorbid TPI and pain resulting from physical injuries on demographic/administrative and injury-related variables, as well as psychological variables. The TPI only group consisted of 318 injured workers, and the TPI + painful physical injury group consisted of 170 injured workers. To identify factors associated with return-to-work at the time of program discharge, we used chi-squared tests of independence and independent samples *t*-tests. Logistic regression analyses were conducted to model return-to-work prediction.

Results: Return-to-work was less likely among workers with comorbid injuries, primarily physical injuries, longer average treatment durations, and among those admitted to higher

intensity interventions (i.e., multidisciplinary treatment). Return-to-work was also less likely among workers with greater levels of self-reported pain intensity, depression, and posttraumatic stress disorder (PTSD) symptoms; namely, defensive avoidance. Workers with greater levels of self-reported readiness to return-to-work were more likely to successfully return-to-work.

Conclusions: The current study provides evidence of factors associated with return-to-work in workers receiving psychologically-based rehabilitation services, which has not been extensively examined in the literature. The PTSD symptom domain of defensive avoidance was the only symptom domain significantly associated with return-to-work beyond the demographic/administrative and injury-related variables, appearing to be particularly important in relation to return-to-work outcomes. Further research with larger sample sizes is needed in order to delineate the relationships of psychological variables with return-to-work. Given power and sample size limitations, we were unable to examine whether factors associated with return-to-work differed in the TPI only and TPI + painful physical injury groups.

Preface

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

BAI	Beck Anxiety Inventory
BDI-II	Beck Depression Inventory-II
ICD-9	International Classification of Diseases 9th Edition
PDI	Pain Disability Index
PTSD	Posttraumatic Stress Disorder
SF-36	36-Item Short Form Health Survey
TPI	Traumatic Psychological Injury
TSI-2	Traumatic Symptom Inventory-2
VAS	Pain Visual Analog Scale
WCB	Workers' Compensation Board
WCB-Alberta	Workers' Compensation Board of Alberta

Chapter 1: Introduction

Traumatic psychological injuries (TPI) refer to a broad variety of psychological injuries, such as posttraumatic and acute stress disorders, adjustment disorders, and mood and somatoform disorders that may develop following exposure to work-related traumas (Gnam, 2000; Rose, 2006). An estimated 30% of workplace disability claims in Canada result from psychological injuries, posing significant societal and economic costs (Mental Health Commission of Canada, 2019). TPI is associated with worker participation restrictions (Gnam, 2000; Rose, 2006), including low job performance, impaired functioning and activity limitations, and absenteeism (Wald & Taylor, 2009). Often complicating outcomes for individuals with TPI, the co-occurrence of physical injuries and resulting pain conditions are also an important consideration (Hensel, Bender, Bacchiochi, & Dewa, 2011; Hensel, Bender, Bacchiochi, Pelletier, & Dewa, 2010; Gnam, 2000), as physical injuries are often associated with psychologically traumatic events (Duckworth & Iezzi, 2010).

Recognizing the impact of TPI on Albertan workers, the Workers' Compensation Board of Alberta (WCB-Alberta) offers TPI rehabilitation programs for injured workers who have sustained TPI in the workplace (Rose, 2006; WCB-Alberta, 2019). These programs have not been formally evaluated since their inception in 2002. As a result, evidence has not yet been established in how successful these programs are in facilitating return-to-work for workers with TPI, or what factors are associated with return-to-work. Additionally, while the co-occurrence of pain and traumatic symptoms are common in rehabilitation settings (Fishbain, Pulikal, Lewis, & Gao, 2017), the two have often been examined in isolation (Herrera-Escobar et al., 2018a). Consequently, little is known about factors predicting return-to-work outcomes in workers with

or without co-occurring TPI and pain conditions (Giummarra et al., 2017; Herrera-Escobar et al., 2018a, 2018b).

It is important to distinguish TPI from traumatic injuries, as the latter may result in TPI, but is not required in order to develop TPI (e.g., Giummarra et al., 2017, 2018; Herrera-Escobar et al., 2018a, 2018b). In the literature, the term 'traumatic injuries' most often refers to primarily physical injuries. However, the term 'TPI' has become an umbrella term representing a variety of psychological injuries that may develop following exposure to psychologically traumatic events in the workplace (Gnam, 2000; Rose, 2006). TPI may include, but are not limited to, traumatic events involving physical injuries. Posttraumatic stress disorder (PTSD) is the most common form of TPI (Gnam, 2000; Rose, 2006). However, meeting criteria for TPI does not require a diagnosis of PTSD or associated anxiety disorders, such as partial PTSD and acute stress disorders; and may reflect other psychological disorders (e.g., depression) reasonably thought to be caused by exposure to psychologically traumatic work-related events (Gnam, 2000; Rose, 2006). Being as PTSD is the most common form of TPI, the following section will draw heavily upon literature in this area. A list of these key terms and their definitions are available in *Table 1*.

1.1 Rehabilitation in Workers' Compensation Settings

The workers' compensation system in Canada is a provincially legislated system in which workers waive their right to sue their employer for work-related injuries, and in turn receive compensation and benefits over the course of their recovery. Employees and employers fund the compensation system through paying workers' compensation insurance premiums (Association of Workers' Compensation Boards of Canada [AWCBC], 2013a). Workers' compensation systems were founded on the Meredith Principles**,** which include: 1) No fault compensation,

Table 1. Key terms and definitions used in this study.

Term	Definition
Traumatic Injury	Physical injuries resulting from *physical trauma*, including traumatic injuries to the bones, nerves and spinal cord; muscles, tendons, ligaments, and joints; open wounds; surface wounds and bruises; burns; intracranial injuries; effects of environmental conditions; and other traumatic injuries and disorders resulting from physical trauma (Canadian Standards Association, 2003).
Psychological Injury	Psychological injuries resulting from a *psychological experience* (e.g., PTSD, partial PTSD, acute stress disorders, adjustment disorders, mood and somatoform disorders, etc.; Black, Sim, Collie, & Smith, 2019; Rose, 2006).
Traumatic Psychological Injury	Psychological injuries resulting from a *work-related experience involving exposure to a traumatic event.* (Rose, 2006). TPI encompass psychological injuries, but are differentiated in that they result from exposure to a traumatic event, and may include, but are not limited to, traumatic physical injuries (Gnam, 2000; Rose, 2006)

where the liability for injuries are treated equally among employees and employers; 2) collective liability, where employers collectively share the liability for injured workers; 3) guaranteed benefits, where compensation will be guaranteed for injured workers through established funds; 4) independent administration, where WCB operates independently from governments; and 5) exclusive jurisdiction, where only Workers' Compensation Boards (WCB) provide workers' compensation insurance (AWCBC, 2013a). The primary goal of WCB is not only to provide compensation for workers having sustained work-related injuries, but also to facilitate recovery and return-to-work for injured workers through providing rehabilitation planning and services (WCB-Alberta, 2019a).

1.1.1 WCB-Alberta's traumatic psychological injury rehabilitation programs.

Research suggests that multidisciplinary, graded, and tailored approaches to rehabilitation are most effective for achieving sustainable return-to-work outcomes (Cancelliere et al., 2016). Consistent with this, WCB-Alberta offers TPI rehabilitation programs for individuals having developed TPI following exposure to work-related traumas (Rose, 2006). Workers are triaged to one of three TPI program levels (TPI Level 1, TPI Level 2, or TPI Level 3) offered through WCB-Alberta, each increasing in intensity and the level of services offered in facilitating return-to-work (WCB-Alberta, 2019b). WCB-Alberta's TPI program continuum of care model has been described by Rose (2006), and can be found in *Appendix A*. TPI Level 1 programs involve one-on-one psychotherapy with a psychologist, one to two times per week. TPI Level 2 programs involve one-on-one psychotherapy with a psychologist and additional work (e.g., exposure therapy) with an occupational therapist, one to two times per week. TPI Level 3 programs are intended for workers with multiple return-to-work barriers, including physical injuries and functional limitations, and involve the provision of multidisciplinary rehabilitation

services for up to five and a half hours per day, four days a week. Services offered through WCB-Alberta's TPI rehabilitation programs may include cognitive behavioural and cognitive processing therapies, prolonged exposure therapies, group psychological sessions and psychoeducational workshops, in vitro and in vivo exposure techniques, community integration, and worksite reintegration (WCB-Alberta, 2019b). As previously mentioned, these programs have not been formally evaluated. Consequently, we do not know how effective these programs are for facilitating return-to-work in workers with varying levels of TPI, including those with or without comorbid pain conditions.

1.2 Traumatic Psychological Injury and Comorbid Pain Conditions

It is well established in the literature that pain and psychological trauma symptoms frequently co-occur (Akerblom, Perrin, Fischer, & McCracken, 2017; Andersen, Andersen, & Andersen, 2014; Fishbain et al., 2017; Giummarra et al., 2017; Siqveland, Hussain, Lindstrom, Ruud, & Hauff, 2017a; Siqveland, Ruud, & Hauff, 2017b), and that the presence of trauma symptoms in individuals with physical injuries is associated with adverse outcomes. For example, co-occurring pain and trauma symptoms are associated with greater psychological distress, functional impairments and activity limitations (Akerblom et al., 2017; Andersen et al., 2014; Ghisi et al., 2013; Giummarra et al., 2017; Langford et al., 2018), as well as worse return-to-work outcomes (Hensel et al., 2011; Herrera-Escobar et al., 2018a). As previously mentioned, most research has either examined TPI and physical injury in isolation (Herrera-Escobar et al., 2018a), or has examined TPI in individuals with primary physical injuries referred to multidisciplinary pain management programs (Akerblom et al., 2017; Andersen et al., 2014; Langford et al., 2018). As a result, the impact of comorbid pain conditions on return-to-work

outcomes for individuals receiving treatment for TPI, as opposed to pain, is also not clear (Giummarra et al., 2017; Herrera-Escobar et al., 2018a, 2018b).

The following chapter aims to provide an overview of factors predicting return-to-work in workers with or without comorbid TPI and pain conditions in order to formulate hypotheses as to what factors might predict return-to-work in a pre-existing dataset obtained from WCB-Alberta's TPI rehabilitation programs between the years 2014 and 2016. Additionally, the following chapter will identify important psychological factors associated with comorbid TPI and pain conditions in order to formulate hypotheses as to supplementary data that were extracted from WCB-Alberta's TPI rehabilitation program claim files between the years 2014 and 2016.

Chapter 2: Overview of the Literature

2.1 Theoretical Background

Understanding how comorbid pain resulting from physical injuries and TPI may become disabling for individuals is complex, as it is well known that pain-related impairments extend beyond the underlying physical pathology of the pain condition (McCracken, 2007; Sharp, 2000). Pain is better understood as a multidimensional construct involving complex interactions between cognitive, affective, and behavioural factors (McCracken, 2007; Sharp, 2000). In order to understand how comorbid TPI and pain conditions may become disabling for injured workers, brief discussion as to theoretical conceptualizations cutting across both TPI and pain conditions is warranted. These models include biopsychosocial (Gatchel, Peng, Peters, Fuchs, & Turk, 2007) and cognitive behavioural (Turk, Meichenbaum, & Genest, 1983) approaches to understanding co-occurring pain and trauma, emphasizing mechanisms of shared vulnerability (Asmundson, Coons, Taylor, & Katz, 2002), diathesis-stress (Turk, 2002), and mutual maintenance (Asmundson et al., 2002; Sharp & Harvey, 2001).

2.1.1 Neuroscientific basis for understanding comorbid pain and trauma.

It is important to acknowledge that there is a strong neuroscientific basis for understanding the link between co-occurring pain and psychological trauma (Scioli-Salter et al., 2015); research indicates that there are shared physiological mechanisms of both (Gomez-Perez, Lopez-Martinez, Luis-Parraga, Teale-Sapach, 2015; Lerman et al., 2016; Scioli-Salter et al., 2015). For example, there are known to be multiple converging brain areas where symptoms of pain and psychological trauma potentiate one another (see *Appendix B*; Scioli-Salter et al., 2015). There are also several differences in the inflammatory responses of individuals with co-occurring pain and psychological trauma (Lerman et al., 2016). Pain transmission and amplification are

also known to be influenced by several PTSD-related neurotransmitter, neurohormone, and inflammatory system factors (Scioli-Salter et al., 2015). Fundamental to this understanding is the stress response (Bosco et al., 2013; Scioli-Salter et al., 2015), whereby following exposure to threat, signals from threat stimuli travel through the thalamus. Similarly, pain signals travel through the spinal cord to the thalamus. Following activation of the amygdala, a species-specific defense response is activated, initiating "hormonal, cardiovascular, and behavioural reactions, as well as changes in regional brain dynamics and information processing" (Scioli-Salter et al., 2015, p. 364), which enables defensive reactions (e.g., avoidance) through long-term potentiation in the amygdala. This species-specific defense response is the body's innate reaction to fearful stimuli, initiating the 'fight, flight, or freeze' reaction and promoting behavioural reactions (Allen, Myers, Beck, Pang, & Servatius, 2019; Baldwin, 2013). Defensive avoidance reactions reflect both physical and psychological responses to sources of potential threat, including the avoidance of upsetting thoughts, avoidance of feelings or reminders of psychologically traumatic events, as well as behavioural avoidance of reminders of pain (Baldwin, 2013; Cho et al., 2011). From an evolutionary perspective, defensive responses to potential sources of threat have an evolutionary advantage, ensuring biological survival (Baldwin, 2013).

2.1.2 Biopsychosocial model of chronic pain. Gatchel et al.'s (2007) biopsychosocial model of chronic pain emphasizes biological, psychological, and environmental/social factors associated with the experience of pain. These factors extend beyond the underlying physical pathology of pain conditions and symptoms to factors that may help to explain the mechanisms through which comorbid TPI and pain become disabling conditions. This model acknowledges unique personal characteristics that determine how varying individuals experience pain. Biological factors influencing the experience of pain include genetic predispositions, imbalances

in neurotransmitters and neuromodulators, neural pathways through which nociceptive input travels, nerve damage, neuroplastic responses, and hormones associated with various physical/psychological statuses. Psychological factors include negative affect (e.g., anxiety, depression) and cognitive factors (e.g., catastrophizing, distress) that contribute to further pain and pain-related impairments, as well as individuals' beliefs and appraisals of their pain that may influence adjustment and how one responds to the experience of pain. Environmental/social factors include personal and work history, socioeconomic status, environmental stressors, social support, education level, and health systems and policy issues, among others.

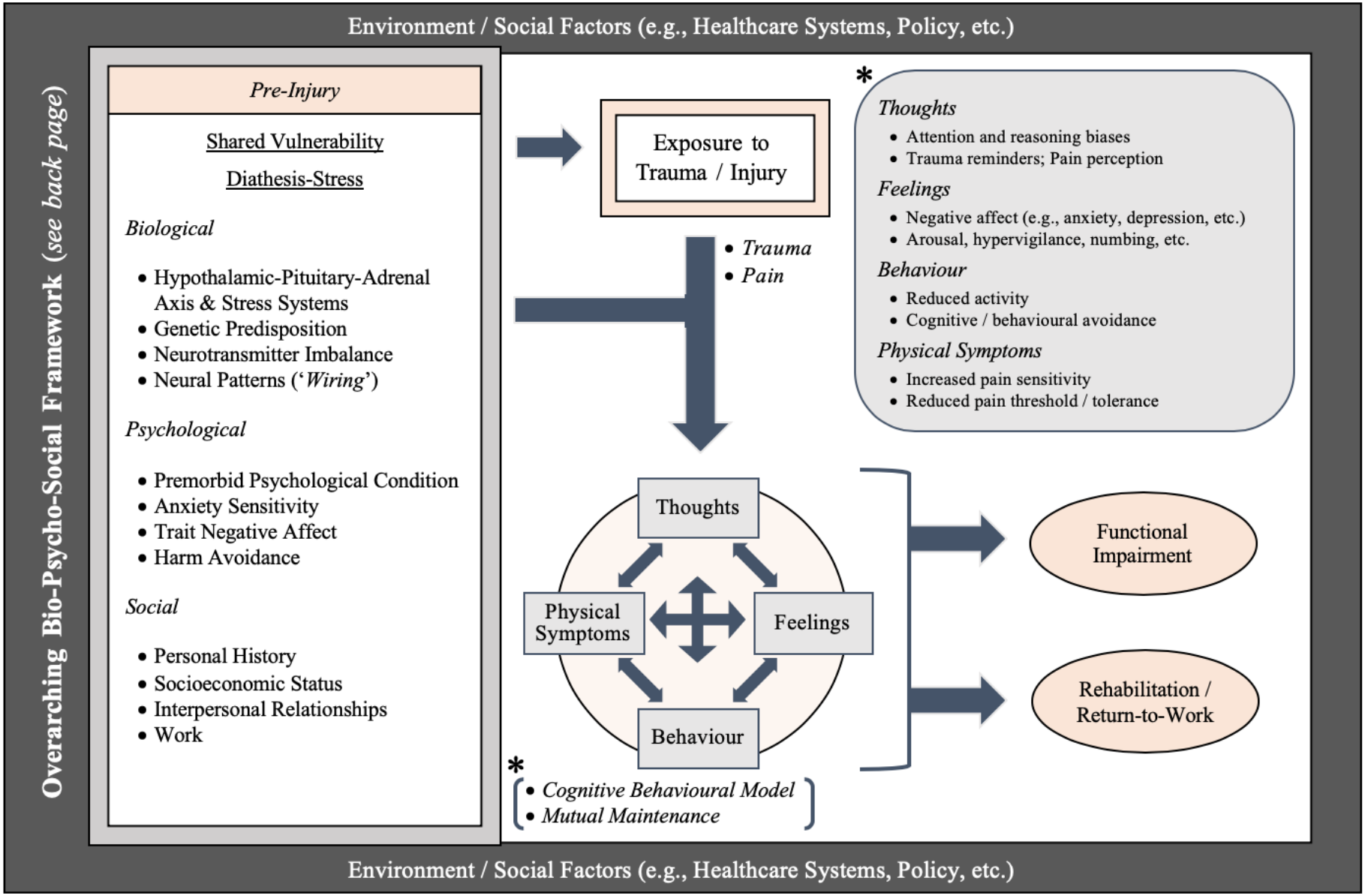
2.1.3 Cognitive behavioural model of chronic pain. According to Turk et al.'s (1983) cognitive behavioural model of pain, somatic symptoms interact with thoughts, behaviours, and emotions, which in turn interact with one another, thereby worsening the underlying pain condition. While the level of pain is a primary consideration, it interacts in a bidirectional relationship with other factors. For example, although the experience of chronic pain may influence traumatic symptoms, these symptoms may similarly influence the experience of pain. Here, cognitive re-experiencing of the traumatic event may result in avoidance behaviours (e.g., fear of movement/re-injury), which in turn results in greater functional impairments and activity limitations. Similar to Gatchel et al.'s (2007) biopsychosocial model, cognitive behavioural models posit that pain outcomes are largely determined by how an individual reacts to their pain experience. These models take into account comorbid psychological conditions that are involved in the development and maintenance of pain conditions, thereby accounting for distress and impairments that extend beyond the physical experience of pain. Cognitive behavioural perspectives augment the biopsychosocial approach by providing a more articulated perspective

as to how cognitive, emotional, and behavioural factors interact to influence the experience of pain than can be gathered from either model alone.

Key to understanding these common models of co-occurring pain and psychological trauma is that symptoms are neither purely physical nor purely psychological; rather, reflect a complex interaction between the two, influencing somatic symptoms and the experience of pain. Together, these models inform treatment through providing a basis for the implementation of various interventions. For example, targeting avoidance through cognitive behavioural interventions won't solely impact cognitive symptom domains of psychological trauma, but will also have a direct modulating effect on individuals' pain (Bosco et al., 2013; Cho, Heiby, McCracken, Moon, & Lee, 2011; Scioli-Salter et al., 2015). Further, exercise therapies—as an example—will not only have an inhibitory effect on pain transmission, but the resulting release of associated neurotransmitters, such as neuropeptide-Y, plays an important role in the stress response, influencing psychological experiences as well (Solway, Bose, Corder, Donahue, & Taylor, 2011; Sah & Geracioti, 2013; Scioli-Salter et al., 2015, 2016).

2.1.4 Conceptual framework. For the purpose of understanding how comorbid TPI and pain conditions resulting from work-related injuries may become disabling, I have adapted an integrated biopsychosocial (Gatchel et al., 2007) and cognitive behavioural (Turk et al., 1983) conceptual framework (*Figure 1*). This framework integrates biopsychosocial and cognitive behavioural approaches to understanding comorbid TPI and pain, emphasizing mechanisms of shared vulnerability, diathesis-stress, and mutual maintenance in order to provide a comprehensive account of factors involved in the development and maintenance of both conditions. The overarching biopsychosocial framework is consistent with the World Health Organization's International Classification of Functioning, Disability & Health (Cancelliere et

Figure 1. Integrated Biopsychosocial and Cognitive Behavioural Conceptual Framework of Comorbid TPI and Pain.



al., 2016; World Health Organization, 2002), integrating both medical and social models of disability.

Expanding on the role of environmental/social factors—particularly in relation to work-related disability—it is important to recognize that worker impairments and recovery are influenced by the broader socio-political context of workplace injury. Many workers perceive a lack of control in their recovery, and attribute this to a lack of their understanding of workers' compensation systems (Kilgour, Kosny, McKenzie, & Collie, 2015). Additionally, case managers often lack knowledge about complex injuries, such as co-occurring physical and psychological injuries, which negatively impacts their ability to advocate for workers and facilitate sustained return-to-work outcomes (Institute for Work & Health, 2016). Difficulties in assessing and diagnosing complex injuries may delay the provision of appropriate services, which prolongs disability-related and disability-fostering behaviours (MacEachen, Kosny, Ferrier, & Chambers, 2010; Steenstra et al., 2017). As a result, the likelihood of recovery and return-to-work diminishes (Kang et al., 2006; Park, 2012; Pransky, Gatchel, Linton, & Loisel, 2005). Workers also often experience a general mistrust by employers and compensation personnel (Kilgour et al., 2015). For example, while employers are responsible for ensuring a safe workplace, workers are often the ones who are blamed for sustaining workplace injuries (Barnetson, 2010; Barnetson & Foster, 2012; Kilgour et al., 2015). This blame, whether real or perceived, has a negative impact on workers' recovery (Kirsh, Slack, & King, 2012). Injured workers have little control over these factors related to the broader socio-political context of workplace injury.

2.2 Common Prognostic Factors of Return-to-Work

In a systematic review of systematic reviews, Cancelliere et al. (2016) synthesized evidence on return-to-work outcomes across the literature in order to identify and summarize common prognostic factors of return-to-work. Cancelliere et al.'s (2016) review included 56 systematic reviews addressing return-to-work outcomes across a variety of physical and mental health conditions, including musculoskeletal disorders (n = 29) and other physical health-related injuries such as traumatic brain injury and cardiovascular conditions (n = 18), as well as mental health-related disorders (n = 9). Common prognostic factors positively associated with return-to-work included "higher education and socioeconomic status, higher self-efficacy and optimistic expectations for recovery and return-to-work, lower severity of the injury/illness, return-to-work coordination, and multidisciplinary interventions" (Cancelliere et al., 2016, p. 19). Common prognostic factors negatively associated with return-to-work included "older age, being female, higher pain or disability, depression, higher physical work demands, previous sick leave and unemployment, and activity limitations" (Cancelliere et al., 2016, p. 19).

While Cancelliere et al. (2016) found evidence supporting common prognostic factors of return-to-work across a variety of physical and mental health-related conditions, it should be noted that factors were considered common only if evidence of an association was found across more than one health condition. Many of the included systematic reviews in Cancelliere et al.'s (2016) study focused solely on musculoskeletal conditions, and were therefore deemed as "inconclusive evidence", along with systematic reviews presenting conflicting findings from one another. While the majority of research has primarily focused on factors associated with return-to-work in musculoskeletal disorders, these findings may provide an important avenue for more

broadly understanding return-to-work outcomes across a variety of physical and mental health-related conditions, such as for workers with or without comorbid TPI and physical injuries.

Additional factors positively associated with return-to-work, but excluded from data synthesis in Cancelliere et al.'s (2016) review, included higher levels of work satisfaction, workplace social support, higher locus of control, exercise, early contact with workers by employers, physical and work conditioning, lower intensity interventions, psychotherapy based workplace interventions, and vocational rehabilitation programs. Additional factors negatively associated with return-to-work but excluded from data synthesis in Cancelliere et al.'s (2016) review included lower levels of social support, higher perceived work demands, medical history/comorbidities, alcohol use problems, and receiving higher compensation. Being cautious of conclusions that can be drawn from inconclusive evidence across limited research, it is important to note that Cancelliere et al. (2016) found conflicting evidence in their association with return-to-work outcomes for levels of social support, medical history / comorbidities, alcohol use problems, locus of control, and intervention intensity.

Beyond these common prognostic factors associated with return-to-work, researchers have also found that favourable return-to-work recommendations upon treatment discharge (Dasinger, Krause, Thompson, Brand, & Rudolph, 2001; Hall, McIntosh, Melles, Holowachuk, & Wai, 1994), greater perceived energy levels (de Vries, Koeter, Nabitz, Hees, & Schene, 2012), and the provision of relaxation therapy and training (van Dixhoorn & White, 2005) are positively associated with return-to-work outcomes. Further, researchers have identified that sleep disturbances (Salo et al., 2010), and the presence of premorbid psychiatric conditions (Gould, Ponsford, Johnston, & Schönberger, 2011) are negatively associated with return-to-work outcomes, as well as with various psychological outcomes.

2.3 Traumatic Psychological Injury, Pain, and Return-to-Work

Highlighting factors more specifically associated with return-to-work in TPI and various pain conditions, a number of systematic reviews (Fishbain et al., 2017; Giummarra, Lennox, Dali, Costa, & Gabbe, 2018; Steenstra et al., 2017; Stergiopoulos, Cimo, Cheng, Bonato, & Dewa, 2011; Torchalla & Strehlau, 2017; Wynne-Jones et al., 2014) and individual research studies (Giummarra et al., 2017; Hensel et al., 2011; Herrera-Escobar et al., 2018a; Prang, Bohensky, Smith, & Collie, 2016; Siqveland et al., 2017b; Taylor, Wald, & Asmundson, 2006) have been carried out.

2.3.1 Traumatic psychological injuries. Available literature suggests that, in the absence of physical injuries, return-to-work rates for workers having developed TPI following exposure to work-related traumas range between 58% to 80% across varying follow-up periods (Torchalla & Strehlau, 2017). In the absence of physical injury, literature on return-to-work outcomes in TPI is scarce (e.g., Giummarra et al., 2018). However, it would seem reasonable to postulate that factors predicting return-to-work in TPI might be similar to those predicting return-to-work in mental health related injuries in Cancelliere et al.'s (2016) review. In one identified study examining factors associated with return-to-work in various TPI, Prang et al. (2016) found that "older age, being from a small organization, working in specific industry segments, using medications, and having a previous claim were all associated with delayed [return-to-work]" (p. 257); and—tied to the severity of symptoms—consulting a psychiatrist or psychologist. Prang et al. (2016) also found that "experiencing work pressure, assault/workplace violence or other mental stress factors, working in the public administration and safety industry and having a medical incapacity certification" (p. 257) were associated with multiple attempts at returning to work

In two systematic reviews of psychological interventions aimed towards facilitating return-to-work in workers with PTSD (Stergiopoulos et al., 2011; Torchalla & Strehlau, 2017), researchers demonstrated that workers were less likely to return-to-work if interventions did not improve PTSD symptoms. Additional research has indicated that improvements in depression, as well as specific domains of PTSD symptoms, including re-experiencing of the traumatic event and hyperarousal were associated with improvements in occupational impairment (Taylor et al., 2006).

2.3.2 Physical injuries and pain conditions. Estimates of return-to-work following physical injuries, such as musculoskeletal disorders (e.g., low back pain), range from 68% at one-month follow-up periods to 93% at six-month follow-up periods (Wynne-Jones et al., 2014). In a systematic review of prognostic factors of return-to-work in sub-acute and chronic low back pain, Steenstra et al. (2017) aimed to identify demographic, psychological, and workplace factors associated with return-to-work. Steenstra et al. (2017) identified 16 research articles addressing prognostic factors of return-to-work in sub-acute low back pain and 37 research articles addressing factors in chronic low back pain. In general, results provided a stronger quality of evidence for prognostic factors of return-to-work in chronic low back pain conditions.

Results of Steenstra et al.'s (2017) review further indicated that in sub-acute low back pain conditions, greater functional status and return-to-work expectations were positively associated with return-to-work outcomes, and that older age, greater fear avoidance beliefs, pain catastrophizing, and cognitive appraisals (e.g., fear of movement/re-injury; Truchon et al., 2010) were negatively associated with return-to-work outcomes. In chronic low back pain conditions, results indicated that higher socioeconomic status, greater functional status, and greater physical health were positively associated with return-to-work outcomes, and that older age, being male,

higher levels of pain intensity, greater fear avoidance, pain catastrophizing, and cognitive appraisals, as well as receiving workers' compensation benefits were negatively associated with return-to-work outcomes. The researchers concluded that in later stages of low back pain, psychological factors predicting return-to-work outcomes are not well understood—due to limitations in how psychological factors are measured and included in return-to-work studies.

2.3.3 Traumatic psychological injuries and comorbid pain conditions. Estimates of return-to-work in workers with comorbid pain conditions undergoing rehabilitation for TPI are not clear, as the majority of research has examined TPI in workers receiving multidisciplinary treatment for pain, as opposed to TPI (e.g., Akerblom et al., 2017; Andersen et al., 2014; Langford et al., 2018; Siqveland et al., 2017a). Researchers have identified that workers with physical injuries or permanent physical impairments who were referred to a psychological trauma treatment program were 1.94 and 2.76 times more likely to not be working at the time of assessment than workers without physical injuries, respectively (Hensel et al., 2011). Additionally, researchers have also found that up to 50% of workers with traumatic physical injuries screen positive for symptoms of PTSD (Fishbain et al., 2017), and that individuals with chronic pain who screen positive for PTSD are less likely to return-to-work (Herrera-Escobar et al., 2018a). In the absence of available literature on factors predicting return-to-work for workers with comorbid pain conditions undergoing rehabilitation for TPI, it may be useful to instead highlight factors associated with functional impairments and activity limitations in comorbid TPI and pain conditions, as these factors may be important considerations in return-to-work for these workers.

A particularly relevant study conducted by Siqveland et al. (2017b) demonstrated that PTSD may partially moderate the relationship between exposure to psychological trauma and

chronic pain. Siqveland et al. (2017b) recruited 63 individuals receiving multidisciplinary pain treatment. Individuals with or without PTSD were assessed for previous exposure to traumatic events and completed pain severity measures on treatment intake, and again within one year. Both the presence of PTSD and number of previous exposures to traumatic events were examined in their association with pain severity scores, and demonstrated a significant interaction effect where PTSD symptoms moderated the relationship between previous trauma exposure and pain severity. It is important to note that the association between PTSD and pain severity remained significant even in the presence of this interaction, indicating only a partial moderation. Nonetheless, the finding that PTSD symptoms moderated the relationship between trauma exposure and pain would suggest that the presence of PTSD symptoms early on following physical injury is an important predictor of chronicity. These results also suggest that targeting PTSD symptoms early in comorbid TPI and pain conditions may be an important consideration in facilitating return-to-work for these workers.

Researchers have also linked specific PTSD symptom domains with working status (i.e., employed vs. unemployed) at the time of assessment in previously injured workers (Ghisi et al., 2013). Ghisi et al. (2013) compared the outcomes of employed (n = 23) and unemployed (n = 15) workers six-months to seven-years following occupational injury (M = 5.2 years, SD = 1.8) on various psychological measures, including measures of depression, PTSD symptoms, state- and trait-anxiety, state- and trait-anger expression, and resiliency. The researchers did not find any significant differences between the employed and unemployed groups on any of the included outcome measures. However, they did find that the PTSD symptom domain of 're-experiencing of the traumatic event' was significantly associated with unemployment at the time of assessment. In addition, Ghisi et al. (2013) found significant positive associations between

scores of PTSD, depression, and state- and trait-anxiety/anger expression scores, as well as a significant negative association between PTSD scores and resiliency.

Expanding on the role of resiliency as a protective factor in relation to TPI and pain conditions, resiliency has been proposed as an important adaptive mechanism for adjusting to chronic pain (Alschuler, Kratz, & Ehde, 2016; Sturgeon & Zautra, 2010), and has also been shown to protect against the development of PTSD (Thompson, Fiorillo, Rothbaum, Ressler, & Michopoulos, 2018). In relation to chronic pain, resiliency is thought to promote adjustment to pain, and often includes psychological factors such as positive affect, adaptive beliefs about pain, and pain self-efficacy (Alschuler et al. 2016). Further, resiliency not only impacts adjustment, but more specifically, promotes recovery, sustainability of improvements, and psychological growth (Reich & Zautra, 2010; Sturgeon & Zautra, 2010).

Other research has found significant positive associations with PTSD symptoms and various indices of pain in individuals receiving treatment for chronic pain (Akerblom et al., 2017; Andersen et al., 2014; Giummarra et al., 2017). In a sample of 433 workers recruited 12 months following physical injury, Giummarra et al. (2017) found that the presence of PTSD symptoms were associated with greater levels of self-reported pain severity, pain-related functional impairment, anxiety, and depression. Associations between PTSD symptoms and pain-related outcomes, including pain severity, functional impairment, catastrophizing, and kinesiophobia were significant across all four domains of PTSD symptomology. These four domains include cognitive intrusions, such as cognitive re-experiencing of the traumatic event, avoidance, negative alterations in cognitions and mood, and hyperarousal (Giummarra et al., 2017).

In a study on the impact of PTSD symptoms on pain-related functioning in a sample of 463 individuals with chronic pain, Akerblom et al. (2017) found that individuals meeting criteria for a PTSD diagnosis reported significantly higher pain interference and kinesiophobia. Complementing the results of Giummarra et al.'s (2017) study, Akerblom et al. (2017) also found that individuals meeting criteria for a PTSD diagnosis reported higher levels of anxiety and depression, as well as lower levels of life control. These researchers' data were collected at one point in time, and therefore, conclusions about directionality cannot be made; however, results appear to support a bi-directional relationship between pain and PTSD.

Lastly, in a one-year longitudinal cohort study of 194 individuals referred to treatment for chronic pain, Andersen et al. (2014) found that possible PTSD was associated with poorer self-reported general health and mental health, poorer sleep quality, cognitive problems, and lower levels of social functioning in comparison to those without possible PTSD. However, an important limitation noted by the researchers is that those with possible PTSD at admission did not demonstrate lower levels of symptom reduction over the course of treatment in comparison to those without possible PTSD. The authors countered this limitation with the argument that PTSD symptoms were not measured upon discharge from the treatment program. Given this, conclusions about the interaction of pain and PTSD cannot be made; however, findings would support the idea that greater endorsement of PTSD symptoms is at least associated with worse long-term psychological outcomes in comparison to those without possible PTSD.

2.4 Literature Synthesis

Return-to-work outcomes appear to be better for individuals with primarily physical or mental health related injuries (e.g., Torchalla & Strehlau, 2017; Wynne-Jones et al., 2014) as opposed to those with comorbid injuries (Hensel et al., 2011; Herrera-Escobar et al., 2018a).

Since WCB-Alberta's TPI rehabilitation programs have not yet received formal evaluation, evaluating these programs is an important step towards understanding whether these services are adequately addressing the needs of injured workers. Identifying factors predicting return-to-work in workers with or without co-occurring TPI and painful physical injuries has the potential to improve rehabilitation and return-to-work services for these workers (Giummarra et al., 2017; Hensel et al., 2010, 2011; Herrera-Escobar et al., 2018a, 2018b). Additionally, psychological factors associated with return-to-work are not well understood (Steenstra et al., 2017). Considering psychological factors associated with adverse outcomes (e.g., functional impairment) in comorbid TPI and physical injuries may aid in our understanding of how we can improve return-to-work services for workers with comorbid injuries, and why services might facilitate return-to-work for some injured workers, but not others.

While researchers have identified common factors associated with return-to-work across a variety of physical and mental health related conditions independently of one another (Hensel et al., 2011; Cancelliere et al., 2016; Steenstra et al., 2017; Stergiopoulos et al., 2011; Torchalla & Strehlau, 2017; Wynne-Jones et al., 2014), evidence of factors associated with return-to-work in TPI specifically is lacking. Moreover, the impact of physical injuries and associated pain conditions on return-to-work outcomes in TPI on return-to-work is not clear. This is partly because the majority of research to date has focused on return-to-work in those receiving multidisciplinary pain rehabilitation services, as opposed to psychologically-based rehabilitation for TPI.

Researchers have identified important psychological factors associated with pain-related functional impairments in comorbid pain and psychological trauma (Akerblom et al., 2017; Duckworth & Iezzi, 2010; Fishbain et al., 2017; Gatchel et al., 2007; Ghisi et al., 2013;

Giummarra et al., 2017; Herrera-Escobar et al., 2018a, 2018b; Langford et al., 2018; Siqveland et al., 2017b; Steenstra et al., 2017), yet, these factors have not been the focus of much attention in relation to return-to-work in co-occurring TPI and pain conditions (Cancelliere et al., 2016; Steenstra et al., 2017; Stergiopoulos et al., 2011; Torchalla & Strehlau, 2017). For example, research suggests that specific PTSD symptom domains, mainly cognitive re-experiencing of the traumatic event, defensive avoidance, and hyperarousal/numbing, are highly predictive of pain-related disability in comorbid TPI and pain conditions (Cho et al., 2011; Taylor et al., 2006)—even up to twelve months following exposure to trauma (Giummarra et al., 2017). Further examining these important psychological factors in how they are associated with return-to-work outcomes in workers with or without co-occurring TPI and pain conditions may prove useful in understanding how we can improve rehabilitation and return-to-work services for these workers (Cancelliere et al., 2016; Steenstra et al., 2017; Stergiopoulos et al., 2011; Torchalla & Strehlau, 2017).

2.5 Study Objectives and Questions

We conducted a secondary analysis of a set of administrative data obtained from WCB-Alberta's TPI rehabilitation programs between the years 2014 and 2016 to answer the following four research questions:

1. What are the return-to-work rates at time of program discharge for injured workers undergoing WCB-Alberta's TPI rehabilitation programs (TPI Levels 1, 2, and 3)?;
2. What factors predict return-to-work at time of program discharge in injured workers undergoing rehabilitation for TPI?;

3. Do factors associated with return-to-work at time of program discharge differ between workers with or without co-occurring TPI and painful physical injuries?; and,
4. What can important psychological factors (e.g., trauma symptoms) add to our understanding of factors associated with return-to-work in workers with or without co-occurring TPI and painful physical injuries?

2.5.1 Hypotheses

Based on the available literature of common prognostic factors of return-to-work, preliminary predictions on the associations with select variables in the dataset obtained from WCB-Alberta's TPI rehabilitation programs and return-to-work were made, and are reported in *Table 2*. Additionally, based on the available literature specific to psychological factors associated with return-to-work or functional impairments and activity limitations in comorbid TPI and pain conditions, preliminary predictions on the associations with supplementary variables obtained from WCB-Alberta's claim files and return-to-work were made, and are reported in *Table 3*.

Table 2. Predictions based on variables within WCB-Alberta's existing dataset on TPI claims between the years 2014 and 2016.

Variable	Prediction	Notes
Age	-	Being older is associated with worse RTW.
Sex	-	Being female is associated with worse RTW.
Education	+	Higher levels of education are associated with successful RTW.
Occupation	?	Inconclusive evidence for hypotheses.
Public Safety Personnel	-	Being employed as public safety personnel is associated with poor RTW.
Comorbidity	-	Having 1 or more comorbidities is associated with worse RTW.
Length of Time Injury to Admission	-	Greater length of time between injury and referral is associated with worse RTW.
Job Attachment	+	Not being job attached is associated with worse RTW.
Modified Duties Available	+	Having modified duties available is associated with successful RTW.
Previous Claims	-	Having a previous claim is associated with worse RTW.
TPI Program Level	+	Multidisciplinary (e.g., TPI Level 3) interventions are associated with successful RTW.
Program Length	?	Insufficient evidence for hypotheses.
Short Form Health Survey	+	Higher self-rating on health outcomes is associated with successful RTW.
Pain Disability Index	-	Having greater levels of pain-related disability is associated with worse RTW.
Pain Visual Analog Scale	-	Having greater levels of pain is associated with worse RTW.

Note. + = Positive association; - = Negative association; ? = Unknown; TPI = Traumatic Psychological Injury; RTW = Return-to-Work.

Table 3. Predictions based on supplementary variables extracted through WCB-Alberta's case files on TPI claims between the years 2014 and 2016.

Variable	Prediction	Notes
Pre-Accident Psych	-	Premorbid psychological conditions are associated with worse RTW.
Non-Compensable Psych	-	Having 1 or more comorbidities is associated with worse RTW.
Previous Trauma	-	Having previous exposure to trauma is associated with worse RTW.
Psychology Log		
Pain Intensity	-	Having greater levels of pain is associated with worse RTW.
Stress/Anxiety	-	Having greater levels of stress/anxiety is associated with worse RTW.
Relaxation Skills	+	Having greater levels of relaxation skills is associated with successful RTW.
Energy	+	Having higher energy levels is associated with successful RTW.
Sleep	+	Disturbed sleep is associated with worse RTW.
Mood	+	Poor mood is associated with worse RTW.
Readiness	+	Workers' perceived readiness to RTW is associated with successful RTW.
Beck Depression Index	-	Higher depression is associated with worse RTW.
Beck Anxiety Index	?	Inconclusive evidence for hypotheses.
Trauma Symptom Inventory		
Posttraumatic Stress	-	Higher symptoms of PTSD are associated with worse RTW.
Intrusions	-	Cognitive re-experiencing is associated with worse RTW.
Avoidance	-	Defensive avoidance is associated with worse RTW.
Dissociation	-	Dissociation is associated with worse RTW.
Hyperarousal	-	Arousal and hyperreactivity are associated with worse RTW.
Self-Disturbance	?	Insufficient evidence for hypotheses.
Externalization	?	Insufficient evidence for hypotheses.
Somatization	-	Somatization is associated with worse RTW.

Note. + = Positive association; - = Negative association; ? = Unknown; PTSD = Posttraumatic Stress Disorder; RTW = Return-to-Work.

Chapter 3: Methods

3.1 Study Design

The current study employed a population-based, retrospective, longitudinal design. A secondary analysis of data contained within an existing database was conducted. This database was comprised of administrative and clinical data collected on all injured workers who underwent treatment through WCB-Alberta's various TPI rehabilitation programs between January 1st, 2014 and December 31st, 2016. This timeframe was chosen as the database was previously obtained by Dr. Douglas Gross as part of a larger study aimed at validating a Work Assessment Triage Tool for clinical decision making using these selected dates (Gross et al., 2019). Supplemental data on relevant psychological variables were extracted from WCB-Alberta TPI program screening, intake, and discharge reports on injured workers.

3.2 Participants

The full database consisted of administrative and clinical data on 488 injured workers who underwent treatment through WCB-Alberta's various TPI rehabilitation programs between the years 2014 to 2016. The full sample (n = 488) was comprised of primarily male workers (60.5%) with a mean age of 40 years (SD = 11) working in the trades industry (40.2%), who were exposed to a psychologically traumatic event in the workplace (35.5%). Differentiating those with or without comorbid TPI and painful physical injuries, we further categorized workers into two groups. Group 1 included workers with TPI only (n = 318), and Group 2 included workers diagnosed with comorbid TPI and physical injuries (n = 170). Group 1 (TPI) was comprised of primarily male workers (55.7%) with a mean age of 40 years (SD = 11). Workers in Group 1 were primarily workers in the trades industry (29.9%) having been exposed to a psychologically traumatic event in the workplace (51.3%). Group 2 (TPI + Physical Injury) was

comprised of primarily male workers (69.4%) with a mean age of 40 years (*SD* = 12). Workers in Group 2 were primarily workers in the trades industry (59.4%) having been involved in transport accidents (40.0%).

3.3 Data Collection and Measures

3.3.1 WCB-Alberta's TPI database. Variables contained within WCB-Alberta's TPI program database are listed in *Table 2* with specific hypotheses as to their association with return-to-work outcomes in workers with or without comorbid TPI and painful physical injuries. These variables included workers' age, sex, education level, occupation category, length of time from the date of injury to admission, as well as whether workers were currently working at the time of admission or were job attached (i.e., have maintained linkages with their workplace and have a job to return to), whether modified duties were available, and whether they had comorbid diagnoses or previous WCB claims. Information on the type of accident and nature of injury from the National Work Injury/Disease Statistics Program (Canadian Standards Association, 2003), primary and secondary International Classification of Diseases-9 (ICD-9) diagnoses (Centers for Disease Control and Prevention, 1996), as well as the TPI program level undertaken, length of treatment, and return-to-work outcomes were also included in the database. Additionally, the database included data on relevant patient-reported outcome measures including the Pain Disability Index (PDI; Pollard, 1984), Pain Visual Analog Scale (VAS; Scott & Huskisson, 1976), and the 36-Item Short-Form Health Survey (SF-36; Ware & Sherbourne, 1992). Tables describing the categories of the various categorical variables included in the current study can be found in *Appendix C*.

3.3.2 Data collection. As previously mentioned, the existing database was supplemented with relevant psychological variables extracted from WCB-Alberta TPI program screening,

intake, and discharge reports on injured workers. These variables are listed in *Table 3* and include scores on relevant patient-reported outcome measures obtained at both intake and discharge to WCB-Alberta's TPI programs. These measures are described below, and include the WCB-Alberta Psychology Log, Trauma Symptom Inventory-2 (TSI-2; Briere, 2011), Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996), and Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988).

3.3.3 Measures.

***Pain Disability Index* (PDI; Pollard, 1984).** The PDI is a seven-item self-report measure assessing respondents' perceived pain-related functioning. Respondents are asked to rate, on an 11-point numerical rating scale, the degree to which pain interferes with seven domains of functioning, on average. These domains include: family and home responsibilities; recreation; social activity; occupation; sexual behaviour; self-care; and, activities of daily living. Total scores on the PDI can range from 0 to 70, where higher scores indicate a greater degree of perceived impairment in pain-related functioning. Alternatively, a percentage score can be derived to account for missing data, by summing the totals of each individual item and dividing this by the total possible score. The PDI is supported as a reliable and valid measure of pain-related functioning, and has been found to possess adequate psychometric properties (Soer et al., 2013; Tait, Chibnall, & Krause, 1990). This measure has been used in workers' compensation settings, correlating strongly with measures of pain severity (e.g., Gross & Battié, 2003), and moderately with measures of functional capacity (e.g., Gross & Battié, 2003; Gross, Battié, & Asante, 2008).

***Pain Visual Analogue Scale* (VAS; Scott & Huskisson, 1976).** The pain VAS is a widely used single-item measure of pain intensity asking respondents to indicate the intensity of

their pain in the last 24 hours (Hawker, Mian, Kendzerska, & French, 2011). Total scores on the pain VAS range from 0 to 100, where a score of 0 indicates 'no pain' and a score of 100 indicates 'pain as bad as it could be'. The pain VAS is commonly used given its ease of administration, specificity, and sensitivity to detect clinically meaningful changes in pain (Hawker et al., 2011). Limitations of the pain VAS include its subjectivity; that is, scores will differ across individuals with varying pain conditions, and may not be comparable across individuals' experiences of pain (Ergin et al., 2015). This measure also only captures pain at one point in time, and does not necessarily capture average pain levels; and is also influenced by individual (e.g., psychological) and contextual (e.g., time of day) factors (Bodian, Freedman, Hossain, Eisenkraft, & Beilin, 2001; Hawker et al., 2011). Nonetheless, the pain VAS has demonstrated strong psychometric properties, and is considered a valid and reliable measure of pain intensity (Hawker et al., 2011). The pain VAS has also been used in workers' compensation settings, correlating moderately with measures of functional capacity (e.g., Gross & Battié, 2003).

36-Item Short Form Health Survey **(SF-36; Ware & Sherbourne, 1992).** The SF-36 is a 36-item self-report measure of health-related quality of life, assessing both physical and mental health (LoMartire, Äng, Gerdie, & Vixner, 2020). The SF-36 produces subscale scores in eight domains, including: physical functioning; role limitations due to physical health; role limitations due to emotional problems; vitality (i.e., energy/fatigue); emotional well-being; social functioning; pain; and general health (Hays, Sherbourne, & Mazel, 1993; RAND Corporation, 2020). Individual items are scored ranging from 0 to 100, where subscale scores are derived by averaging the total scores on individual items, thereby also ranging from 0 to 100 (Hays et al., 1993; RAND Corporation, 2020). The SF-36 possesses adequate psychometric properties

(Vander Zee, Sanderman, Heyink, & de Haes, 1996), with strong internal reliabilities of individual subscales (LoMartire et al., 2020; RAND Corporation, 2020; Vander Zee et al., 1996). This measure is considered valid for use in individuals with or without chronic pain conditions (LoMartire et al., 2020; Vander Zee et al., 1996), and has also been used in workers' compensation settings (Gross et al., 2008).

***Psychology Log*.** The seven-item Psychology Log is an internal measure used by WCB-Alberta to assess workers' psychosocial functioning in a variety of domains. The psychology log is comprised of 7 numerical rating scales, with values ranging from 0 to 10, and is administered at both intake and discharge to WCB-Alberta's TPI rehabilitation programs. The seven numerical rating scales ask respondents to indicate their current pain intensity, current levels of stress, feelings of self-efficacy in using relaxation skills, levels of energy, hours of sleep on average, degree to which mood is a concern, and readiness to return-to-work. This measure has not undergone any formal evaluation or validation, but is used to assess psychosocial functioning upon intake, to inform treatment goals, and to assess individuals' coping resources. This measure is also administered throughout the progression of TPI programs, and upon program discharge, to detect changes in psychosocial functioning and coping resources, as well as to determine readiness to return-to-work.

***Trauma Symptom Inventory-2* (TSI-2; Briere, 2011).** The TSI-2 is a 136-item self-report measure used to assess both acute and chronic trauma-related symptoms and behaviours, and has a recall period of six months (Briere, 2011; Godbout, Hodges, Briere, & Runtz, 2016; Psychological Assessment Resources, 2020). Individual items are rated on a 0 to 3 Likert-type scale where higher scores indicate greater levels of endorsement for various trauma-related symptoms (Godbout et al., 2016). The TSI-2 produces scores on four summary factors,

including: 1) Posttraumatic Stress; 2) Self-Disturbance; 3) Eternalization; and, 4) Somatization (Godbout et al., 2016; Psychological Assessment Resources, 2020). The measure is further divided into 12 clinical subscales comprising the scores on these general factors (Godbout et al., 2016). The TSI-2 Posttraumatic Stress factor is comprised of four subscales: Dissociation, Defensive Avoidance, Intrusive Experiences, and Anxious Arousal. The TSI-2 Self-Disturbance factor is comprised of three subscales: Depression, Insecure Attachment, and Impaired Self-Reference. The TSI-2 Externalization Factor is comprised of four subscales: Anger, Tension Reduction Behaviour, Sexual Disturbance, and Suicidality. Lastly, the TSI-2 Somatization factor is comprised of one subscale: Somatic Pre-occupation. A description of the domains measured by these factors and subscales has been adapted from Briere (2011) and are reported in *Appendix* D. Cut-off criteria for individual subscales produce categories indicating symptoms as either not clinically significant (score of 0 to 59), problematic (score of 60 to 64), or clinically elevated (score of > 64). The TSI-2 possesses strong psychometric properties, and is supported as a valid and reliable measure of trauma symptomology in both clinical and research settings (Godbout et al., 2016).

***Beck Depression Inventory-II* (BDI-II; Beck et al., 1996).** The BDI-II is a widely used 21-item self-report measure of clinical depression, with a recall period of two-weeks (Smarr & Keefer, 2011). Individual items are composed of statements rated 0 to 3, where higher scores indicate greater endorsement of depressive symptoms. Total scores on the BDI-II are derived by summing the scores on individual items, and can range from 0 to 63 (Beck et al., 1996; Smarr & Keefer, 2011). Total score ranges correspond to one of four severity categories, where a total score of 0 to 13 indicates minimal or no depression, a score of 14 to 19 indicates mild depression, a score of 20 to 28 indicates moderate depression, and a score of 29 to 63 indicates

severe depression (Beck et al., 1996). The BDI-II possesses strong psychometric properties, and is considered a valid and reliable measure of depression across a variety of populations, including non-clinical, psychiatric, and medical samples (Dozois, Dobson, & Ahnberg, 1998; Smarr & Keefer, 2011; Wang & Gorenstein, 2013). The BDI-II has also been used previously in workers' compensation settings (e.g., Lemstra, 2016; Lipszyc et al., 2017).

Beck Anxiety Inventory **(BAI; Beck et al., 1988).** The BAI is a widely used 21-item self-report measure of anxiety symptoms, with a recall period of one week (Julian, 2011). Individual items are composed of statement rated 0 to 3, where higher scores indicate greater endorsement of anxiety symptoms. Total scores on the BAI are derived by summing the scores on individual items, and can range from 0-63 (Beck et al., 1988; Julian, 2011). Total score ranges correspond to one of four severity categories, where a total score of 0 to 9 indicates minimal or no anxiety, a score of 10 to 18 indicates mild-to-moderate anxiety, a score of 19 to 29 indicates moderate-to-severe anxiety, and a score of 30 to 63 indicates severe anxiety (Beck et al., 1998). The BAI possesses strong psychometric properties, and is considered a valid and reliable measure of anxiety across a variety of populations, including student, community, and clinical populations (Julian, 2011; Lipszyc et al., 2017; Osman, Kopper, Barrios, Osman, & Wade, 1997).

Return-to-Work**.** The main outcome measure for this research was return-to-work status at time of program discharge. This was defined was whether the worker was confirmed as returning to work at pre-accident levels (yes/no). Return to something other than pre-accident work (not ready to return, return to modified work levels) both indicate that the injured worker has ongoing difficulties with work ability related to the compensable condition.

3.4 Procedures

The current project received ethical approval from the University of Alberta's Health Research Ethics Board (Pro00085765). This approval included the supplemental data extraction of relevant variables from WCB-Alberta's TPI rehabilitation program claim files between January 1st, 2014 and December 31st, 2016. Supplemental data extraction from WCB-Alberta's TPI program claim files took place at Millard Health, a WCB-Alberta rehabilitation facility. Consistent with literature published on data verification and auditing processes in clinical trials (Califf, Karnash, & Woodlief, 1997; Houston, Probst, & Martin, 2018), a minimum of 10% of data extracted on individual workers underwent a double entry data verification process in the current study. Claim files were randomly selected and assigned to one of two WCB-Alberta research partners for double data entry.

3.5 Statistical Analysis

Prior to statistical analyses, data were screened for both accuracy and any missing values. For continuous variables, skewness and kurtosis were also examined in order to determine whether assumptions for statistical testing were met. Data cleaning procedures and guidelines are further outlined in Tabachnik and Fidell's (2013) book, *Using Multivariate Statistics*.

Descriptive statistics for sample characteristics were calculated and analyzed for both the full sample ($N = 488$) as well as Groups 1 ($n = 318$) and 2 ($n = 170$) independently, and were described as *n* (%) or mean (*SD*). For continuous data violating assumptions of normality, descriptive statistics were described as median (IQR). Additionally, the *n* (%) or mean (*SD*) of the various patient-reported outcome measures utilized in the current study (i.e., PDI, VAS, SF-36, Psychology Log, TSI-2, BDI-II, and BAI) were analyzed. Prior to statistical testing, means, standard deviations, skewness, and kurtosis of continuous variables were examined to determine

whether assumptions for statistical testing were met. Additionally, collinearity of included variables was assessed; bivariate correlations of ≥ 0.70 at a significance level of less than 0.05 were considered for determining collinearity among variables (Tabachnik & Fidell, 2013). Significant differences between Groups 1 and 2 on sample characteristics and scores of patient-reported outcome measures were tested using independent sample *t*-tests for continuous variables and chi-squared tests of independence for categorical variables. For all analyses where greater than 20% of the cells in the cross-tabulations for categorical variables had an expected frequency of less than five, Fisher's exact test and corresponding *p*-values were reported rather than chi-squared test results (Daniel & Cross, 2013; Tabachnik & Fidell, 2013). In the case of small *n* or where assumptions of normality for continuous variables were not met, Mann-Whitney U tests were utilized for testing significant differences between conditions. Statistical procedures that were used in examining each of the specific research questions are outlined below. For all analyses, $p < 0.05$ was considered for statistical significance. IBM's Statistical Package for the Social Sciences Version 26.0 (SPSS 26; IBM Corporation, 2019) was used for data analyses.

3.5.1 Research Question 1

What are the return-to-work outcomes at time of program discharge for injured workers undergoing of WCB-Alberta's TPI rehabilitation programs (TPI Levels 1, 2, and 3)? To describe the return-to-work outcomes of WCB-Alberta's TPI rehabilitation programs, frequencies of return-to-work outcomes (i.e., not returning to work versus successful return-to-work) for workers who underwent treatment in either TPI Levels 1 or 2, or TPI Level 3 were tabulated. Chi-squared tests of independence were conducted to determine whether return-to-work rates significantly differed for workers between the TPI program levels, where TPI Levels 1 and 2 were merged due to small cell sizes of TPI Level 1 programs.

3.5.2 Research Question 2

What factors predict return-to-work at time of program discharge in injured workers undergoing rehabilitation for TPI? Chi-squared tests of independence and independent samples *t*-tests were conducted comparing those who had successfully returned to work to those who had not returned to work at the time of program discharge in order to examine factors associated with return-to-work in the full sample. Based on these associations, combinations of statistically significant variables were then selected for statistical modelling using multiple logistic regression techniques (Daniel & Cross, 2013). Logistic regression is appropriate for data analyses where the dependent variable is not continuous (Daniel & Cross, 2013; Tabachnik & Fidell, 2013), allowing researchers to identify combinations of independent variables predictive of binary outcomes (i.e., not returning to work versus successful return-to-work). Logistic regression techniques allow for predictor variables to be a mix of either continuous, discrete, or dichotomous variables, such as in the current study. Logistic regression analyses were used to identify those variables most strongly associated with return-to-work. Variables were selected and retained based on their statistical significance ($p < 0.05$), or where judged to be clinically important. Prior to modelling, logistic regression assumptions were tested, and collinearity of variables were assessed using bivariate correlations (see *Appendix E,* Tables 1 and 2).

3.5.3 Research Question 3

Do factors associated with return-to-work at time of program discharge differ between workers with or without co-occurring TPI and painful physical injuries? Chi-squared tests of independence and independent samples *t*-tests were conducted to identify significant differences between Groups 1 and 2 on demographic/administrative and injury-related variables, as well as the various patient-reported outcome measures. Based on the available literature, we expected

that return-to-work outcomes and factors associated with return-to-work would differ for workers with or without co-occurring TPI and pain conditions. To test this, we tabulated the frequencies of return-to-work outcomes for both Groups 1 and 2 independently. Chi-squared tests of independence were conducted to determine whether return-to-work rates significantly differed between these groups.

3.5.4 Research Question 4

What can important psychological factors (e.g., trauma symptoms) add to our understanding of factors associated with return-to-work in workers with or without co-occurring TPI and painful physical injuries? This research question was examined through exploring the associations of psychological variables with return-to-work outcomes based on the results of logistic regression analyses outlined above (*Section 3.5.2*). These analyses were further supplemented by examining whether psychological variables might be interacting with, or confounding the relationship between, other included predictor variables and their association with return-to-work outcomes (e.g., Tabachnik & Fidell, 2013). For example, examining whether including or excluding the TSI-2 trauma factor from modelling influences the association between pain-related variables and return-to-work.

3.6 Power and Sample Size Considerations

Prior to statistical testing, a-priori power analyses for determining the appropriate sample size needed in order to detect meaningful statistically significant effects were conducted. Power analyses were conducted using G*Power, a freely available software for conducting power and sample size calculations. For all analyses, the desired level of statistical significance was set to 0.05, and the desired level of power was set to 0.80.

Based on the available literature, the association with working status of injured workers with or without comorbid TPI and physical injuries has an odds ratio of 2.55, where workers with comorbid TPI and physical injuries are significantly less likely to be working at the time of assessment (Hensel et al., 2011). Based on this data, the appropriate sample size needed for detecting meaningful statistically significant differences on return-to-work outcomes would be 59. However, other outcomes of interest in the current study include measures of pain and traumatic stress. Previous literature provides odds ratios for the associations of these variables with return-to-work as follows: pain intensity (0.98; 95% CI [0.98-0.99]; Kendrick et al., 2017), and traumatic stress (0.94; 95% CI [0.88-0.99]; Laisné, Lecomte, & Corbière, 2013), where those with greater levels of pain and psychological trauma are less likely to return-to-work. Based on these estimates, the appropriate sample size needed for detecting meaningful statistically significant differences on return-to-work outcomes would be 74,956 and 8,225, respectively. Based on a-priori power analyses, statistical power is expected to be a limitation of our analyses; however, these limitations are likely to become more prominent as the odds ratios for included variables approach 1.00, which may explain the large sample size estimates indicated above.

Given power and sample size limitations of the current study, logistic regression analyses were only conducted in the full sample, and not independently in relation to Groups 1 and 2. Additionally, given the large number of statistical tests conducted, a more stringent alpha level of 0.05 for selection of variables associated with return-to-work to be included in modelling procedures was used, as issues associated with multiple testing are known to underestimate *p*-values (Heinze, Wallisch, & Dunkler, 2018). Given the small sample sizes and accompanying power limitations due to incomplete data for the various patient-reported outcome measures, these scores were not examined together in the full, final model (i.e., Model 6, *Table 6;* Heinze et

al., 2018). Rather, independent associations of these variables with return-to-work within the final model were examined to delineate the relationship of these variables with return-to-work beyond the inclusion of other established predictors with complete data (see *Table 6*). Lastly, the Pain VAS, PDI, and SF-36 measures were excluded from analyses given small *n*. These measures were only administered to a minority of workers in Group 2 (TPI + Physical Injury), and therefore, not representative of the broader sample of workers undergoing rehabilitation for TPI.

4.0 Results

4.1 Data Cleaning

4.1.1 Categorical Variables

Several data collection issues arose throughout the data collection process; for many of the variables containing continuous data, including the BDI-II, BAI, and TSI-2, workers' scores on these measures were reported inconsistently across rehabilitation facilities. For example, in some facilities, workers' scores on these measures were reported according to their diagnostic cut-off scores (Minimal, Mild, Moderate, Severe (BDI and BAI); Nonsignificant, Problematic, Clinically Elevated (TSI-2), while in other facilities, workers' scores were reported as a numerical value. In order to facilitate having complete and consistent data on these measures, measures for all workers were categorized into their respective cut-off categories, which were comparable to categorical data obtained. Additionally, given the small number of workers falling into 'moderate' or 'problematic' categories on various patient-reported outcome measures, data were further collapsed as follows: BDI-II and BAI ([1] Minimal-to-Mild; [2] Moderate-to-Severe; Beck et al., 1986, 1988), TSI-2 ([1] Nonsignificant, [2] Elevated; Briere et al., 2011). Demographic and administrative variables, including: education, occupation, type of accident, and TPI program levels were also collapsed due to small sizes in certain categories, and a category of 'other' was created where applicable (see *Appendix C,* Table 1). Sample sizes for the included categorical variables ranged from 194 (TSI-2) to 460 (BDI-II).

4.1.2 Continuous Variables

Of the included variables, duration of injury (i.e., number of days from the time of injury to admission), number of previous compensation claims, length of TPI programs from admission to discharge (in days), SF-36 role limitations due to physical injury subscale scores, PDI scores,

and Psychology Log sleep scores (i.e., self-reported average hours of sleep per night), were found to violate assumptions of normality. For these variables, median (IQR) are reported rather than mean (*SD*), and non-parametric Mann-Whitney U tests were substituted for independent samples *t*-tests for testing significant differences between groups. Sample sizes for the included continuous variables ranged from 47 (Pain VAS) to 242 (Psychology Log).

4.2 Sample Characteristics

4.2.1 Full Sample

Sample characteristics for the full sample (n = 488), as well as Groups 1 (n = 318) and 2 (n = 170) are reported in *Table 4*. The full sample (n = 488) was comprised of primarily male workers (60.5%) with a mean age of 40 years, working in the trades industry (40.2%), and having been exposed to a psychologically traumatic event in the workplace (35.5%). The majority of workers did not have education levels specified (70.1%), did not have a comorbid injury (82.8%), were job attached at the time of admission (86.5%), and did not have modified duties available (57.8%). On average, the number of days from the date of injury to admission was 63, the number of previous compensation claims was 2, and the average program length from the time of admission to discharge was 80 days. Additionally, the majority of workers were admitted to TPI Level 1 or 2 programs (51.6%), and had not returned to work at the time of program discharge (59.4%). Most workers had experienced a primarily psychological injury according to the National Work Injury/Disease Statistics categorization (45.9%), had a primarily psychological diagnosis according to the ICD-9 (68.9%), and did not have a secondary ICD-9 diagnosis (81.6%). In the full sample, TPI Levels 1 and 2 combined had a 60.3% return-to-work rate, while TPI Level 3 had a 19.5% return-to-work rate. Descriptive statistics of the various patient-reported outcome measures for the full sample are reported in *Table 4.*

Table 4. Demographic/Administrative, Injury-Related, and Clinical Characteristics of Injured Workers Admitted to WCB-Alberta's TPI Programs between the Years 2014-2016 by Group and Subgroups.

Variable	Full Sample Mean ± SD *or* n (%)	Physical Injury Mean ± SD *or* n (%)	TPI Only Mean ± SD *or* n (%)	Difference (Physical Injury vs. TPI) *t or* χ^2
Demographic/Administrative Variables[a]				
Group	(*n* = 488)	(*n* = 170)	(*n* = 318)	
Age (in years)	40.2 ± 11.3	40.1 ± 12.3	40.3 ± 10.8	-0.17, $p = 0.868$
Sex				8.76, $p = 0.003$**
Male	295 (60.5)	118 (69.4)	177 (55.7)	
Female	193 (39.5)	52 (30.6)	141 (44.3)	
Education[a]				21.13, $p < 0.001$***
Partial/Complete Highschool or Less	44 (9.0)	34 (20.0)	10 (3.1)	
Partial/Complete Technical School	60 (12.3)	19 (11.2)	41 (12.9)	
Partial/Complete University	42 (8.6)	21 (12.4)	21 (6.6)	
Not Specified	342 (70.1)	96 (56.5)	246 (77.4)	
Occupational Category				56.21, $p < 0.001$***
Business, Finance, & Management Occupations	41 (8.4)	14 (8.2)	27 (8.5)	
Health Occupations	100 (20.5)	10 (5.9)	90 (28.3)	
Education, Law, Social & Community Government Services	88 (18.0)	21 (12.4)	67 (21.1)	
Trades	196 (40.2)	101 (59.4)	95 (29.9)	
Other	63 (12.9)	24 (14.1)	39 (12.3)	
Public Safety Personnel				56.94, $p < 0.001$***
Yes	131 (26.8)	11 (6.5)	120 (37.7)	
Police	22 (17.5)	4 (36.3)	18 (15.0)	
Firefighter	16 (14.0)	2 (18.2)	14 (11.7)	
Ambulance Worker	76 (66.7)	3 (27.3)	73 (60.8)	
Corrections	17 (1.8)	2 (18.2)	15 (12.5)	
No	357 (73.2)	159 (93.5)	198 (62.3)	

Table 4. (*cont'd*).

Variable	Full Sample Mean ± SD *or* n (%)	Physical Injury Mean ± SD *or* n (%)	TPI Only Mean ± SD *or* n (%)	Difference (Physical Injury vs. TPI) *t or* χ^2
Comorbid Injury				67.89, $p < 0.001$***
Yes	84 (17.2)	62 (36.5)	22 (6.9)	
No	404 (82.8)	108 (63.5)	296 (93.1)	
Duration (days since injury)[1]	62.5 (30.0, 148.8)†	78.5 (40.0, 163.0)†	54 (28.0, 141.5)†	-2.69, $p = 0.007$**
Job Attached at Admission				1.94, $p = 0.164$
Yes	422 (86.5)	142 (83.5)	280 (88.1)	
No	66 (13.5)	28 (16.5)	38 (11.9)	
Modified Duties Available				6.28, $p = 0.099$
Yes – Full-time	171 (35.0)	65 (38.2)	106 (33.3)	
Yes – Part-time	15 (3.1)	9 (5.3)	6 (1.9)	
No	282 (57.8)	89 (52.4)	193 (60.7)	
Unknown	20 (4.1)	7 (4.1)	13 (4.1)	
# Previous Compensation Claims[2]	2.0 (0, 5)†	2.0 (0, 4)†	2.5 (1, 6)†	2.28, $p = 0.023$*
Type of Rehabilitation Program (First Admission)[3]				82.55, $p < 0.001$***
TPI Program Levels 1 & 2	252 (51.6)	40 (23.5)	212 (66.7)	
TPI Program Level 3	236 (48.4)	130 (76.5)	106 (33.3)	
Program Length (in days)[4]	80 (55.0, 120.5)†	60.5 (53.0, 108.3)†	84.0 (55.0, 135.0)†	-2.74, $p = 0.006$**
RTW Outcome				33.64, $p < 0.001$***
RTW = Yes	198 (40.6)	39 (22.9)	159 (50.0)	
RTW = No	290 (59.4)	131 (77.1)	159 (50.0)	
Injury-Related Variables				
Type of Accident				168.62, $p < 0.001$***
Contact with Objects/Equipment	52 (10.7)	40 (23.5)	12 (3.8)	
Falls	16 (3.3)	11 (6.5)	5 (1.6)	
Exposure to Harm	173 (35.5)	10 (5.9)	163 (51.3)	
Transport Accidents	103 (21.1)	68 (40.0)	35 (11.0)	
Assault and Violence	102 (20.9)	35 (20.6)	67 (21.1)	

Table 4. (*cont'd*).

Variable	Full Sample Mean ± SD *or* n (%)	Physical Injury Mean ± SD *or* n (%)	TPI Only Mean ± SD *or* n (%)	Difference (Physical Injury vs. TPI) *t or* χ^2
Other	40 (8.2)	4 (2.4)	36 (11.3)	
Missing	2 (0.4)	2 (1.2)	0 (0.0)	
Nature of Injury				169.62, $p < 0.001$***
Traumatic/Physical Injury	166 (34.0)	112 (65.9)	54 (17.0)	
Psychological	224 (45.9)	12 (7.1)	212 (66.7)	
Missing	98 (20.1)	46 (27.1)	52 (16.4)	
Primary ICD-9 Diagnosis				412.96, $p < 0.001$***
Mental Health Condition	336 (68.9)	18 (10.6)	318 (100.0)	
Musculoskeletal Injury	152 (31.1)	152 (89.4)	0 (0)	
Secondary ICD-9 Diagnosis				48.21, $p < 0.001$***
Mental Health Condition	40 (8.2)	13 (7.6)	27 (8.5)	
Musculoskeletal Injury	50 (10.2)	50 (29.4)	0 (0)	
None	398 (81.6)	107 (62.9)	291 (91.5)	
Patient-Reported Outcomes Measures				
SF-36[5] ($n = 48$)	[b]	[b]	[b]	[c]
Physical Function	-	35.6 ± 26.2	-	-
Role Physical	-	18.8 (0.0, 25.0)†	-	-
Bodily Pain	-	28.0 ± 24.5	-	-
General Health	-	58.5 ± 21.0	-	-
Vitality	-	34.0 ± 19.5	-	-
Social Function	-	29.3 ± 21.8	-	-
Role Emotional	-	32.5 ± 28.9	-	-
Mental Health	-	43.2 ± 19.8	-	-
PDI[6] ($n = 54$)	[d]	65.7 (45.0, 83.6)†	[d]	[e]
Pain VAS[7] ($n = 47$)	[f]	61.3 ± 24.3	[f]	[g]

Table 4. (*cont'd*).

Variable	Full Sample Mean ± SD *or* n (%)	Physical Injury Mean ± SD *or* n (%)	TPI Only Mean ± SD *or* n (%)	Difference (Physical Injury vs. TPI) *t or* χ^2
Psychology Log[8]	(*n* = 242)	(*n* = 98)	(*n* = 144)	
Pain Intensity	2.9 ± 3.1	5.1 ± 2.7	1.8 ± 2.6	10.06, $p < 0.001$***
Stress	7.1 ± 2.2	7.2 ± 2.1	7.1 ± 2.2	0.16, $p = 0.874$
Relaxation Skills	4.1 ± 2.1	4.2 ± 2.3	4.0 ± 2.0	0.56, $p = 0.578$
Energy Levels	3.7 ± 2.0	3.8 ± 2.1	3.7 ± 2.0	0.21, $p = 0.837$
Sleep (hours/night)	5.0 (4.0, 6.0)†	4.5 (4.0, 6.0)†	5.0 (4.0, 6.0)†	0.95 $p = 0.340$
Mood	3.9 ± 1.8	4.0 ± 2.0	3.8 ± 1.8	1.03, $p = 0.306$
Readiness to RTW	25.9 ± 25.6	27.9 ± 24.9	24.7 ± 26.0	1.20, $p = 0.230$
BDI-II[9]	(*n* = 460)	(*n* = 158)	(*n* = 302)	0.07, $p = 0.785$
Minimal-to-Mild	120 (24.6)	40 (23.5)	80 (25.2)	
Moderate-to- Severe	340 (69.7)	118 (69.4)	222 (69.8)	
Missing	28 (5.7)	12 (7.1)	16 (5.0)	
BAI[10]	(*n* = 260)	(*n* = 90)	(*n* = 170)	0.93, $p = 0.335$
Minimal-to-Mild	58 (11.9)	17 (10.0)	41 (12.9)	
Moderate-to-Severe	202 (41.4)	73 (42.9)	129 (40.6)	
Missing	228 (46.7)	80 (47.1)	148 (46.5)	
TSI-2 Factor Scores				
Trauma (TR)	(*n* = 223)	(*n* = 76)	(*n* = 147)	095, $p = 0.330$
Not Significant	68 (13.9)	20 (11.8)	48 (15.1)	
Clinically Elevated	155 (31.8)	56 (32.9)	99 (31.1)	
Missing	265 (54.3)	94 (55.3)	171 (53.8)	
Self-Disturbance (SE)	(*n* = 201)	(*n* = 66)	(*n* = 135)	0.10, $p = 0.756$
Not Significant	131 (26.8)	44 (25.9)	87 (27.4)	
Clinically Elevated	70 (14.3)	22 (12.9)	48 (15.1)	
Missing	287 (58.8)	104 (61.2)	183 (57.5)	

Table 4. (*cont'd*).

Variable	Full Sample Mean ± SD *or* n (%)	Physical Injury Mean ± SD *or* n (%)	TPI Only Mean ± SD *or* n (%)	Difference (Physical Injury vs. TPI) *t or* χ^2
Externalization (EX)	(*n* = 201)	(*n* = 66)	(*n* = 135)	0.10, *p* = 0.751
Not Significant	140 (28.7)	45 (26.5)	95 (29.9)	
Clinically Elevated	61 (12.5)	21 (12.4)	40 (12.6)	
Missing	287 (58.8)	104 (61.2)	183 (57.5)	
Somatization (SO)	(*n* = 201)	(*n* = 66)	(*n* = 135)	15.29, *p* < 0.001***
Not Significant	140 (28.7)	34 (20.0)	106 (33.3)	
Clinically Elevated	61 (12.5)	32 (18.8)	29 (9.1)	
Missing	287 (58.8)	104 (61.2)	183 (57.5)	
TSI-2 Subscale Scores				
TR – Dissociation	(*n* = 214)	(*n* = 74)	(*n* = 140)	1.61, *p* = 0.205
Not Significant	131 (26.8)	41 (24.1)	90 (28.3)	
Clinically Elevated	83 (17.0)	33 (19.4)	50 (15.7)	
Missing	274 (56.1)	96 (56.5)	178 (56.0)	
TR – Avoidance	(*n* = 216)	(*n* = 74)	(*n* = 140)	1.18, *p* = 0.278
Not Significant	74 (15.2)	22 (12.9)	52 (16.4)	
Clinically Elevated	140 (28.7)	52 (30.6)	88 (27.7)	
Missing	274 (56.1)	96 (56.5)	178 (56.0)	
TR – Intrusions	(*n* = 214)	(*n* = 74)	(*n* = 140)	0.06, *p* = 0.809
Not Significant	50 (10.2)	18 (10.9)	32 (10.1)	
Clinically Elevated	164 (33.6)	56 (32.9)	108 (34.0)	
Missing	274 (56.1)	96 (56.5)	178 (56.0)	
TR – Hyperarousal	(*n* = 214)	(*n* = 74)	(*n* = 140)	1.19, *p* = 0.276
Not Significant	62 (12.7)	18 (10.6)	44 (13.8)	
Clinically Elevated	152 (31.1)	56 (32.9)	96 (30.2)	
Missing	274 (56.1)	96 (56.5)	178 (56.0)	

Table 4. (*cont'd*).

Variable	Full Sample Mean ± SD *or* n (%)	Physical Injury Mean ± SD *or* n (%)	TPI Only Mean ± SD *or* n (%)	Difference (Physical Injury vs. TPI) *t or* χ^2
SE – Depression	(*n* = 202)	(*n* = 68)	(*n* = 134)	0.79, *p* = 0.373
Not Significant	98 (20.1)	30 (17.6)	68 (21.4)	
Clinically Elevated	104 (21.3)	38 (22.4)	66 (20.8)	
Missing	286 (58.6)	102 (60.0)	184 (57.9)	
SE – Insecurity	(*n* = 192)	(*n* = 65)	(*n* = 127)	0.21, *p* = 0.650
Not Significant	134 (27.5)	44 (25.9)	90 (28.3)	
Clinically Elevated	58 (11.9)	21 (12.4)	37 (11.6)	
Missing	296 (60.7)	105 (61.8)	191 (60.1)	
SE – Self-Reference	(*n* = 192)	(*n* = 65)	(*n* = 127)	0.90, *p* = 0.342
Not Significant	124 (25.4)	39 (22.9)	85 (26.7)	
Clinically Elevated	68 (13.9)	26 (15.3)	42 (13.2)	
Missing	296 (60.7)	105 (61.8)	191 (60.1)	
EX – Anger	(*n* = 201)	(*n* = 68)	(*n* = 133)	0.78, *p* = 0.377
Not Significant	118 (24.2)	37 (21.8)	81 (25.5)	
Clinically Elevated	83 (17.0)	31 (18.2)	52 (16.4)	
Missing	287(58.8)	102 (60.0)	185 (58.2)	
EX – Tension Reduction	(*n* = 194)	(*n* = 66)	(*n* = 128)	0.66, *p* = 0.415
Not Significant	128 (26.2)	41 (24.1)	87 (27.4)	
Clinically Elevated	66 (13.5)	25 (14.7)	41 (12.9)	
Missing	294 (60.2)	104 (61.2)	190 (59.7)	
EX – Sex Disturbance	(*n* = 192)	(*n* = 65)	(*n* = 127)	4.83, *p* = 0.028*
Not Significant	153 (31.4)	46 (27.1)	107 (33.6)	
Clinically Elevated	39 (8.0)	19 (11.2)	20 (6.3)	
Missing	296 (60.7)	105 (61.8)	191 (60.1)	

Table 4. (*cont'd*).

Variable	Full Sample Mean ± SD *or* n (%)	Physical Injury Mean ± SD *or* n (%)	TPI Only Mean ± SD *or* n (%)	Difference (Physical Injury vs. TPI) *t or* χ^2
EX – Suicidality	(*n* = 194)	(*n* = 66)	(*n* = 128)	1.04, *p* = 0.307
Not Significant	138 (28.3)	50 (29.4)	88 (27.7)	
Clinically Elevated	56 (11.5)	16 (9.4)	40 (12.6)	
Missing	294 (60.2)	104 (61.2)	190 (59.7)	
SO - Somatization	(*n* = 201)	(*n* = 66)	(*n* = 135)	15.29, *p* < 0.001***
Not Significant	140 (28.7)	37 (21.8)	109 (34.3)	
Clinically Elevated	61 (12.5)	32 (18.8)	29 (9.1)	
Missing	287 (58.8)	104 (61.2)	190 (59.7)	

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. TPI = Traumatic psychological injury; RTW = Return-to-work; ICD-9 = International Classification of Diseases – 9; SF-36 = 36 Item Short-Form Health Survey; PDI = Pain Disability Index; Pain VAS = Pain Visual Analog Scale; BDI-II = Beck Depression Inventory - II; BAI = ; TSI-2 = Trauma Symptom Inventory-2; TR = TSI-2 Posttraumatic Stress Factor Scale; SE = TSI-2 Self-Disturbance Factor Scale; EX = TSI-2 Externalization Factor Scale; SO = TSI-2 Somatization Factor Scale.

[1] Number of days from the accepted injury on file to the time of admission to WCB-Alberta.

[2] Cumulative number of previous compensation claims accepted by WCB-Alberta on file.

[3] Level of TPI programming worker was first admitted to between the years of 2014 – 2016.

[4] Length of TPI programming from the date of first admission to date of final discharge, regardless of TPI Program Level.

[5] SF-36 subscale scores range from 0 to 100.

[6] Pain Disability Index scores are expressed as a percentage ranging between 0 and 100.

[7] Pain Visual Analog Scale scores are expressed as a percentage ranging between 0 and 100.

[8] Psychology Log subscale scores are expressed as an integer ranging between 0 and 10, with the exception of 'Sleep', in which workers indicate their average hours of sleep per night, and 'Readiness to RTW', in which workers indicate their readiness to RTW expressed as a percentage ranging between 0 and 100.

[9] BDI-II total scores fall into one of two categories: Minimal-to-Mild, Moderate-to-Severe.

[10] BAI total scores fall into one of two categories: Minimal-to-Mild, Moderate-to-Severe.

[11] TSI-2 Factor and Subscale total scores fall into one of two categories: Not Significant, Elevated.

[a] All demographic/administrative and injury-related variables, with the exception of education (*n* = 148), had complete data (*n* = 488).

[b] SF-36 outcome scores are only reported the physical injury subgroup, as this measure was unique to this group.

[c] Tests of significance for differences on SF-36 scores between the Physical Injury and TPI only subgroups were not calculated, as this information was only available for the Physical Injury subgroup.

[d] PDI outcome scores are only reported the physical injury subgroup, as this measure was unique to this group.

[e] Tests of significance for differences on PDI scores between the Physical Injury and TPI only subgroups were not calculated, as this information was only available for the Physical Injury + TPI subgroup.

[f] Pain VAS outcome scores are only reported the Physical Injury + TPI subgroup, as this measure was unique to this group.
[g] Tests of significance for differences on Pain VAS scores between the Physical Injury + TPI and TPI only subgroups were not calculated, as this information was only available for the Physical Injury + TPI subgroup.
[†] Variables violated assumptions of normality (skewness, kurtosis); Median (IQR) are reported rather than Mean (SD).

Further exploring the differences between injured workers in TPI Level 1 and 2, and TPI Level 3 programs, those in TPI Level 3 programs had elevated scores in a number of psychological domains. Workers in TPI Level 3 programs were more likely to score within the Moderate-to-Severe range on the BDI-II (χ^2 = 6.69, p = 0.010), as well as in the elevated range on TSI-2 Posttraumatic Stress (χ^2 = 21.29, p < 0.001), Self-Disturbance (χ^2 = 15.13, p < 0.001), and Somatization factor scores (χ^2 = 5.62, p = 0.023). Workers in TPI Level 3 programs were more likely to fall in the elevated score ranges on all of the TSI-2 Posttraumatic Stress factor subscales, including: Dissociation (χ^2 = 5.88, p = 0.015), Defensive Avoidance (χ^2 = 14.87, p < 0.001), Cognitive Intrusions (χ^2 = 7.23, p = 0.007), and Hyperarousal (χ^2 = 7.94, p = 0.005). Similarly, workers in TPI Level 3 programs scored higher on Psychology Log pain intensity (t (297) = -6.44, p < 0.001), and lower on Psychology Log relaxation (t (200.43) = 2.07, p = 0.040), average hours of sleep (χ^2 (289) = -3.04, p = 0.002), and mood scores (t (254) = 2.01, p = 0.045).

4.2.2 TPI + Painful Physical Injury and TPI Only Subgroups

Both the TPI only (Group 1; n = 318) and TPI + Physical Injury (Group 2; n = 170) groups were comprised of primarily male workers (55.7% and 69.4%, respectively) with a mean age of 40 years. Workers in Group 1 were primarily workers in the trades industry (29.9%) having been exposed to a psychologically traumatic event in the workplace (51.3%), while workers in Group 2 were primarily workers in the trades industry (59.4%) having been involved in a transport accident (40.0%). The majority of workers in both Groups 1 and 2 did not have an education level specified (77.4% and 56.5, respectively), did not have a comorbid injury (93.1% and 63.5%, respectively), were job attached at admission (88.1% and 83.5%, respectively), and did not have modified duties available (60.7% and 52.4%, respectively).

On average, the number of days from the date of injury to admission was 54 in Group 1 and 79 in Group 2, the number of previous compensation claims was 2.5 in Group 1, and 2 in Group 2, and the average program length from the time of admission to discharge was 84 and 61, respectively. The majority of workers in Group 1 were admitted to TPI Level 1 or 2 programs (66.7%). The return-to-work rate in Group 1 was 50.0%, indicating that equal levels of workers in Group 1 had returned to work at the time of program discharge in comparison to those not having returned to work. In comparison, the majority of workers in Group 2 were admitted to TPI Level 3 programs (76.5%), and had not returned to work at the time of program discharge (77.1%).

Most workers in Group 1 had experienced a primarily psychological injury based on National Work Injury/Disease Statistics categorizations (66.7%), had a primarily psychological diagnosis according the ICD-9 (100.0%), and did not have a secondary ICD-9 diagnosis (91.5%). In contrast, most workers in Group 2 had experienced a primarily physical injury (65.9%), had a primarily physical diagnosis (89.4%), and did not have a secondary diagnosis (62.9%). In Group 1, TPI Levels 1 and 2 combined had a 67.9% return-to-work rate, while TPI Level 3 had a 14.2% return-to-work rate. In Group 2, TPI Levels 1 and 2 combined had a 20.0% return-to-work rate, while TPI Level 3 had a 23.8% return-to-work rate. Descriptive statistics of the various patient-reported outcome measures in both Groups 1 and 2 are reported in *Table 4*.

4.2.3 Chi-squared Tests of Independence and Independent Samples *t*-tests for Differences between Subgroups

Workers in Group 2 had a greater proportion of males in comparison to Group 1 (see *Table 4*). Group 2 had greater proportions of workers in the partial/complete high school or less ($\chi^2 = 38.37$, $p < 0.001$), and partial/complete university ($\chi^2 = 4.66$, $p = 0.031$) education

categories, but did not significantly differ from Group 1 in terms of the partial/complete technical school ($\chi^2 = 0.30$, $p = 0.582$) education category. There were a greater proportion of workers in health occupations, as well as education, law, social and community or government services in Group 1 in comparison to Group 2 ($\chi^2 = 34.18$, $p < 0.001$, $\chi^2 = 5.69$, $p = 0.017$, respectively), and a greater proportion of those in trades occupations in Group 2 ($\chi^2 = 40.22$, $p < 0.001$). Groups 1 and 2 did not significantly differ in their proportions of workers in business and management occupations ($\chi^2 = 0.01$, $p = 0.923$), or other occupations ($\chi^2 = 0.34$, $p = 0.561$). There were also a greater proportion of workers employed as public safety personnel in Group 1 in comparison to Group 2 (see *Table 4*). Group 2 had a greater proportion of workers with comorbid injuries, a greater average number of days from the time of injury to admission in comparison to Group 2, and a greater proportion of workers admitted into TPI Level 3 programs. However, workers in Group 1 had a greater average number of previous compensation claims, and a greater average length of TPI programming. Lastly, Group 1 had a greater proportion of workers who had successfully returned to work at the time of discharge in comparison to Group 2.

In terms of injury-related variables, Group 2 had a greater proportion of workers having experienced object- and equipment-related injuries ($\chi^2 = 46.19$, $p < 0.001$), falls ($\chi^2 = 8.55$, $p = 0.003$), or transport accidents ($\chi^2 = 57.16$, $p < 0.001$) in comparison to Group 1. Group 1 had a greater of proportion of workers having been exposed to psychological trauma or harm in the workplace ($\chi^2 = 98.42$, $p < 0.001$) or experiencing 'other' injuries ($\chi^2 = 11.63$, $p = 0.001$), but Groups 1 and 2 did not significantly differ in terms of having experienced assault or violence in the workplace ($\chi^2 = 0.004$, $p = 0.952$). Accordingly, Group 1 had a greater proportion of workers having experienced a primarily psychological injury, and having been diagnosed with a

primary psychological ICD-9 diagnosis, while Group 2 had a significantly greater proportion of workers having experienced a primarily physical injury and having been diagnosed with a primary physical ICD-9 diagnosis (see *Table 4*). Lastly, workers in Group 2 endorsed greater levels of self-reported pain intensity and had a greater proportion of workers endorsing elevated TSI-2 Somatization factor and subscale scores.

4.3 Associations of Variables with Return-to-Work

4.3.1 Full Sample

Successful return-to-work at pre-accident levels in the full sample was more likely among workers without comorbid injuries, those admitted to TPI Level 1 or 2 programs, and those with primarily psychological injuries and diagnoses (see *Table 5*). Workers having been exposed to psychological trauma or harm in the workplace were more likely to successfully return-to-work in comparison to those with other injuries ($\chi^2 = 8.95$, $p = 0.003$). Additionally, workers having experienced object- or equipment- related injuries or falls were less likely to return-to-work in comparison to workers with other injuries ($\chi^2 = 5.98$, $p = 0.015$, $\chi^2 = 5.47$, $p = 0.019$, respectively). No significant differences were detected in the return-to-work rates among workers having been involved in transport accidents ($\chi^2 = 0.06$, $p = 0.815$), having experienced assault or violence in the workplace ($\chi^2 = 1.59$, $p = 0.208$), or grouped within 'other' injuries ($\chi^2 = 0.33$, $p = 0.567$). Less time from the date of injury to admission, and shorter average lengths of program duration were also associated with greater odds of successful return-to-work at the time of program discharge (see *Table 5*). In terms of patient-reported outcome measures, successful return-to-work was associated with lower self-reported pain intensity, greater energy levels, greater mood levels, and readiness to return-to-work on the Psychology Log (see *Table 5*). Greater self-reported levels of depression on the BDI-II, as well

Table 5. Chi-2 Tests Examining Associations of Demographic/Administrative, Injury-Related, and Clinical Factors with RTW in Full Sample of Injured Workers Admitted to WCB-Alberta's TPI Programs between the Years 2014-2016.

Full Sample	Return-to-Work at Pre-accident Levels		
	Yes	No	t or χ^2
Variable	Mean ± SD or *n* (%)	Mean ± SD or *n* (%)	
Demographic/Administrative Variables[a]			
Age (in years)[b]	40.48 ± 11.12	39.99 ± 11.50	-0.46, $p = 0.643$
Sex			0.49, $p = 0.486$
Male	116 (39.3)	179 (60.7)	
Female	82 (42.5)	111 (57.5)	
Education[a]			2.47, $p = 0.291$
Partial/Complete Highschool or Less	6 (13.6)	38 (86.4)	
Partial/Complete Technical School	10 (16.7)	50 (83.3)	
Partial/Complete University	11 (26.2)	31 (73.8)	
Occupational Category			2.73, $p = 0.604$
Business, Finance, & Management Occupations	18 (43.9)	23 (56.1)	
Health Occupations	47 (47.0)	53 (53.0)	
Education, Law, Social & Community Government Services	35 (39.8)	53 (60.2)	
Trades	74 (37.8)	122 (62.2)	
Other			
Public Safety Personnel			0.55, $p = 0.457$
Yes	57 (28.6)	74 (25.6)	
Police	7 (31.8)	15 (68.2)	
Firefighter	8 (50.0)	8 (50.0)	
Ambulance Worker	37 (48.7)	39 (51.3)	
Corrections	5 (29.4)	12 (79.6)	
No	142 (71.4)	215 (74.4)	
Comorbid Injury			11.83, $p = 0.001$**
Yes	20 (23.8)	64 (76.2)	
No	178 (44.1)	226 (55.9)	
Duration[1, b] (days since injury)	38.5 (20.75, 109.5)†	83.5 (39, 180)†	-5.94, $p < 0.001$***

Table 5. (*cont'd*).

Full Sample Variable	Return-to-Work at Pre-accident Levels Yes Mean ± SD or *n* (%)	 No Mean ± SD or *n* (%)	*t* or χ^2
Job Attached at Admission			< 0.01, $p = 0.952$
Yes	171 (40.5)	251 (59.5)	
No	27 (40.9)	39 (59.1)	
Modified Duties Available			3.10, $p = 0.212$
Yes – Full-time	62 (36.3)	109 (63.7)	
Yes – Part-time	4 (26.7)	11 (73.3)	
No	121 (42.9)	161 (57.1)	
# Previous Compensation Claims[2, b]	2.0 (1.0, 5.0)†	2 (0.0, 5.0)†	0.54, $p = 0.587$
Type of Rehabilitation Program[3] (First Admission)			82.25, $p < 0.001$***
TPI Program Levels 1 & 2	152 (60.3)	100 (39.7)	
TPI Program Level 3	46 (19.5)	190 (80.5)	
Program Length[4, b] (in days)	61 (49.0, 100.5)†	92.5 (56.0, 145.3)†	5.99, $p < 0.001$***
Injury-Related Variables			
Type of Accident			17.99, $p = 0.003$**
Contact with Objects/Equipment	13 (25.0)	39 (75.0)	
Falls	2 (12.5)	14 (87.5)	
Exposure to Harm	86 (49.7)	87 (50.3)	
Transport Accidents	43 (41.7)	60 (58.3)	
Assault & Violence	36 (35.3)	66 (64.7)	
Other	18 (45.0)	22 (55.0)	
Nature of Injury			4.50, $p = 0.034$*
Traumatic Injury + Phys	60 (36.1)	105 (63.9)	
Other Diseases or Illnesses	105 (46.9)	119 (53.1)	
Primary ICD-9 Diagnosis			24.12, $p < 0.001$***
Mental Health Condition	161 (47.9)	175 (52.1)	
Musculoskeletal Injury	37 (24.3)	115 (75.7)	

Table 5. (*cont'd*).

Full Sample Variable	Return-to-Work at Pre-accident Levels Yes Mean ± SD or *n* (%)	 No Mean ± SD or *n* (%)	*t* or χ^2
Secondary ICD-9 Diagnosis			1.37, $p = 0.242$
Mental Health Condition	7 (17.5)	33 (82.5)	
Musculoskeletal Injury	14 (28.0)	36 (72.0)	
None			
Patient-Reported Outcomes Measures			
SF-36[5] (*n* = 48)	[b]	[b]	[b]
PDI[6] (*n* = 54)	[b]	[b]	[b]
Pain VAS[7] (*n* = 47)	[b]	[b]	[b]
Psychology Log[8]			
Pain Intensity	1.47 ± 2.69	3.60 ± 3.00	6.26, $p < 0.001$***
Stress	7.04 ± 2.78	7.15 ± 1.87	0.30, $p = 0.764$
Relaxation Skills	4.22 ± 2.34	4.04 ± 2.03	-0.56, $p = 0.575$
Energy Levels	4.13 ± 2.16	3.55 ± 1.98	-2.07, $p = 0.039$*
Sleep (hours/night)	5.0 (4.0, 6.0)[†]	4.75 (4.0, 6.0)[†]	1.53, $p = 0.126$
Mood	4.30 ± 1.99	3.72 ± 1.76	-2.29, $p = 0.023$*
Readiness to RTW	32.19 ± 27.97	21.98 ±23.27	-3.75, $p < 0.001$***
BDI-II[9]			15.98, $p < 0.001$***
Minimal-to-Mild	67 (55.8)	53 (44.2)	
Moderate-to-Severe	119 (35.0)	221 (65.0)	
BAI[10]			2.05, $p = 0.152$
Minimal-to-Mild	23 (39.7)	35 (60.3)	
Moderate-to-Severe	60 (29.7)	142 (70.3)	

Table 5. (*cont'd*).

Full Sample Variable	Return-to-Work at Pre-accident Levels: Yes Mean ± SD or *n* (%)	Return-to-Work at Pre-accident Levels: No Mean ± SD or *n* (%)	*t* or χ^2
TSI-2 Factor Scores			
Trauma (TR)			26.82, $p < 0.001$***
Not Significant	36 (52.9)	32 (47.1)	
Clinically Elevated	29 (18.7)	126 (81.3)	
Self-Disturbance (SE)			11.11, $p = 0.001$**
Not Significant	48 (36.6)	83 (63.4)	
Clinically Elevated	10 (14.3)	60 (85.7)	
Externalization (EX)			0.78, $p = 0.378$
Not Significant	43 (30.7)	97 (69.3)	
Clinically Elevated	15 (24.6)	46 (75.4)	
Somatization (SO)			8.48, $p = 0.004$**
Not Significant	49 (35.0)	91 (65.0)	
Clinically Elevated	9 (14.8)	52 (85.2)	
TSI-2 Subscale Scores			
TR – Dissociation			5.67, $p = 0.017$*
Not Significant	45 (34.4)	86 (65.6)	
Clinically Elevated	16 (19.3)	67 (80.7)	
TR – Avoidance			19.60, $p < 0.001$***
Not Significant	35 (47.3)	39 (52.7)	
Clinically Elevated	26 (18.6)	114 (81.4)	
TR – Intrusions			5.83, $p = 0.016$*
Not Significant	21 (42.0)	29 (58.0)	
Clinically Elevated	40 (24.4)	124 (75.6)	
TR – Hyperarousal			11.88, $p = 0.001$**
Not Significant	28 (45.2)	34 (54.8)	
Clinically Elevated	33 (21.7)	119 (78.3)	

Table 5. (*cont'd*).

Full Sample	Return-to-Work at Pre-accident Levels		
Variable	Yes Mean ± SD or *n* (%)	No Mean ± SD or *n* (%)	*t* or χ^2
SE – Depression			19.81, $p < 0.001$***
Not Significant	43 (43.9)	55 (56.1)	
Clinically Elevated	16 (15.4)	88 (84.6)	
SE – Insecurity			4.87, $p = 0.027$*
Not Significant	44 (32.8)	90 (67.2)	
Clinically Elevated	10 (17.2)	48 (82.8)	
SE – Self-Reference			4.23, $p = 0.040$*
Not Significant	41 (33.1)	83 (66.9)	
Clinically Elevated	13 (19.1)	55 (80.9)	
EX – Anger			0.87, $p = 0.351$
Not Significant	37 (31.4)	81 (68.6)	
Clinically Elevated	21 (25.3)	62 (74.7)	
EX – Tension Reduction			2.18, $p = 0.139$
Not Significant	40 (31.3)	88 (68.8)	
Clinically Elevated	14 (21.2)	52 (78.8)	
EX – Sex Disturbance			0.62, $p = 0.432$
Not Significant	45 (29.4)	108 (70.6)	
Clinically Elevated	9 (23.1)	30 (76.9)	
EX – Suicidality			3.90, $p = 0.048$*
Not Significant	44 (31.9)	94 (68.1)	
Clinically Elevated	10 (17.9)	46 (82.1)	
SO – Somatization			8.48, $p = 0.004$**
Not Significant	49 (35.0)	91 (65.0)	
Clinically Elevated	9 (14.8)	52 (85.2)	

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. TPI = Traumatic psychological injury; RTW = Return-to-work; ICD-9 = International Classification of Diseases – 9; SF-36 = 36 Item Short-Form Health Survey; PDI = Pain Disability Index; Pain VAS = Pain Visual Analog Scale; BDI-II = Beck Depression Inventory - II; BAI = ; TSI-2 = Trauma Symptom Inventory-2; TR = TSI-2 Posttraumatic Stress Factor Scale; SE = TSI-2 Self-Disturbance Factor Scale; EX = TSI-2 Externalization Factor Scale; SO = TSI-2 Somatization Factor Scale.

1 Number of days from the accepted injury on file to the time of admission to WCB-Alberta.

2 Cumulative number of previous compensation claims accepted by WCB-Alberta on file.

[3] Level of TPI programming worker was first admitted to between the years of 2014 – 2016.
[4] Length of TPI programming from the date of first admission to date of final discharge, regardless of TPI Program Level.
[5] SF-36 subscale scores range from 0 to 100.
[6] Pain Disability Index scores are expressed as a percentage ranging between 0 and 100.
[7] Pain Visual Analog Scale scores are expressed as a percentage ranging between 0 and 100.
[8] Psychology Log subscale scores are expressed as an integer ranging between 0 and 10, with the exception of 'Sleep', in which workers indicate their average hours of sleep per night, and 'Readiness to RTW', in which workers indicate their readiness to RTW expressed as a percentage ranging between 0 and 100.
[9] BDI-II total scores fall into one of two categories: Minimal-to-Mild, Moderate-to-Severe.
[10] BAI total scores fall into one of two categories: Minimal-to-Mild, Moderate-to-Severe.
[11] TSI-2 Factor and Subscale total scores fall into one of two categories: Not Significant, Elevated.
[a] All demographic/administrative and injury-related variables, with the exception of education (n = 148), had complete data (n = 488).
[b] Associations of the SF-36, PDI, and Pain VAS with RTW were not calculated, as these measures were unique to the Physical Injury + TPI subgroup.
[†] Variables violated assumptions of normality (skewness, kurtosis); Median (IQR) are reported rather than Mean (SD). Non-parametric Mann-Whitney U tests were substituted for t-tests.

as elevations on TSI-2 factors and subscales, including: TSI-2 Posttraumatic Stress, Self-Disturbance, and Somatization factor scores; TSI-2 Dissociation, Defensive Avoidance, Cognitive Intrusions, and Hyperarousal subscale scores of the Posttraumatic Stress factor; TSI-2 Depression, Insecure Attachment, and Impaired Self-Reference subscale scores of the Self-Disturbance factor; TSI-2 Suicidality subscale scores of the Externalization factor; and TSI-2 Aomatization subscale scores, were associated with not returning to work at pre-accident levels at the time of program discharge.

4.3.2 TPI + Painful Physical Injury and TPI Only Subgroups

Factors differentially associated with return-to-work in Groups 1 and 2 are reported in *Appendix E,* Table 3. Contrary to our hypotheses, and previous research evidence, a substantial number of factors did not reach statistical significance in Group 2. This indicates potential issues of statistical power resulting from small sample sizes, where only 39 individuals in Group 2 had successfully returned to work at the time of program discharge (see *Table 4*). Accordingly, our confidence in the results and potential conclusions are diminished. Results are, therefore, provided as a supplement, rather than for informing statistical inferences and conclusions about the differences between factors associated with return-to-work in Groups 1 and 2.

In Group 1, factors significantly associated with unsuccessful return-to-work at pre-accident levels included: the presence of comorbid injuries, longer lengths of time from the date of injury to admission, being admitted to TPI Level 3, and greater average lengths of program duration. Injury-related variables did not reach statistical significance. In terms of patient-reported outcome measures, lower average levels of pain intensity, greater mood levels, and greater self-reported readiness to return-to-work scores on the Psychology Log were significantly associated with successful return-to-work. Additionally, elevated scores on the BDI-II scores

were associated with unsuccessful return-to-work, as well as elevations on the following TSI-2 factor and subscale scores: TSI-2 Posttraumatic Stress, Self-Disturbance, and Somatization factor scores; TSI-2 Defensive Avoidance, Cognitive Intrusions, and Hyperarousal subscale scores of the Posttraumatic Stress factor; TSI-2 Depression subscale scores of the Self-Disturbance factor; TSI-2 Suicidality subscale scores of the Externalization factor; and TSI-2 Somatization subscale scores of the Somatization factor. In Group 2, the only factors significantly associated with return-to-work were the average length of program duration and self-reported readiness to return-to-work, where greater average lengths of program duration were associated with unsuccessful return-to-work and greater self-reported readiness to return-to-work was associated with successful return-to-work (see *Appendix E*, Table 3).

4.4 Logistic Regression Modelling

4.4.1 Full Sample

Results of logistic regression analyses are reported in *Table 6*. Models 1 – 6 display model building procedures using complete data only (i.e., demographic/administrative, and injury-related variables), where Model 6 is considered the full, final model. Models 7a – 7e display the independent associations of various patient-reported outcome measures that were significant in relation to their associations with return-to-work within the final model. Results of additional models where psychological variables did not reach statistical significance are reported in *Appendix E*, Table 4. Models 7a and 7b examine the associations of Psychology Log pain intensity and readiness to return-to-work scores with return-to-work outcomes; Model 7c examines the association of BDI-II severity with return-to-work outcomes; Models 7d and 7e examine the associations of elevated TSI-2 Posttraumatic Stress factor and Defensive Avoidance subscale scores with return-to-work outcomes. The final model consisted of age, sex, the

Table 6. Logistic Regression Modelling Return-to-Work Output – Full Sample.

Variable	(β)	S.E.	Wald	p-value	Exp(β)	95% CI Exp(β)	Model Fit Statistics	
							-2 Log	R_2
Model 1 (n = 488)								
DV: RTW Outcome							658.85	0.001
Step 1 Age	0.004	0.008	0.22	= 0.642	1.00	0.99-1.02		
Model 2 (n = 488)								
DV: RTW Outcome							658.29	0.002
Step 1 Age	0.004	0.008	0.29	= 0.587	1.00	0.99-1.02		
Step 2 Sex[a]	0.142	0.189	0.56	= 0.453	1.15	0.80-1.67		
Model 3 (n = 488)								
DV: RTW Outcome							654.75	0.036
Step 1 Age	0.006	0.008	0.47	= 0.492	1.01	0.99-1.02		
Step 2 Sex (Female)[a]	0.125	0.192	0.42	= 0.515	1.13	0.78-1.65		
Step 3 Comorbidity (Yes)[b]	-0.927	0.276	11.32	= 0.001**	0.40	0.23-0.68		
Model 4 (n = 488)								
DV: RTW Outcome							608.86	0.132
Step 1 Age	0.005	0.009	0.40	= 0.526	1.01	0.99-1.02		
Step 2 Sex (Female)[a]	0.270	0.201	1.81	= 0.179	1.31	0.88-1.94		
Step 3 Comorbidity (Yes)[b]	-0.977	0.283	11.89	= 0.001**	0.38	0.22-0.66		
Step 4 Program Length	-0.010	0.002	26.59	< 0.001***	0.991	0.987-0.994		
Model 5 (n = 488)								
DV: RTW Outcome							583.69	0.193
Step 1 Age	0.005	0.009	0.26	= 0.608	1.01	0.99-1.02		
Step 2 Sex (Female)[a]	0.166	0.207	0.64	= 0.424	1.18	0.79-1.77		
Step 3 Comorbidity (Yes)[b]	-0.583	0.298	3.83	= 0.050*	0.56	0.31-1.00		
Step 4 Program Length	-0.011	0.002	31.23	< 0.001***	0.989	0.985-0.993		
Step 5 PICD-9 (Pain)[c]	-1.16	0.238	23.51	< 0.001***	0.32	0.20-0.50		

Table 6. (*cont'd*).

Variable	(β)	S.E.	Wald	*p*-value	Exp(β)	95% CI Exp(β)	Model Fit Statistics -2 Log	Model Fit Statistics R_2
Model 6 (*n* = 488)								
DV: RTW Outcome							526.25	0.322
Step 1 Age	0.003	0.009	0.13	= 0.720	1.00	0.99-1.02		
Step 2 Sex (Female)[a]	0.015	0.223	0.01	= 0.945	1.02	0.66-1.57		
Step 3 Comorbidity (Yes)[b]	-0.149	0.320	0.22	= 0.641	0.86	0.46-1.61		
Step 4 Program Length	-0.011	0.002	28.98	< 0.001***	0.989	0.985-0.993		
Step 5 PICD-9 (Pain)[c]	-0.556	0.263	4.46	= 0.035*	0.57	0.34-0.96		
Step 6 TPI Level T1 (L3)[d]	-1.739	0.241	52.08	< 0.001***	0.18	0.11-0.28		
Model 7a (*n* = 299)								
DV: RTW Outcome							253.03	0.490
Step 1 Age	-0.004	0.014	0.07	= 0.791	1.00	0.97-1.03		
Step 2 Sex (Female)[a]	-0.332	0.333	0.99	= 0.320	0.72	0.37-1.38		
Step 3 Comorbidity (Yes)[b]	0.211	0.494	0.18	= 0.670	1.24	0.47-3.25		
Step 4 Program Length	-0.015	0.003	21.86	< 0.001***	0.985	0.979-0.992		
Step 5 PICD-9 (Pain)[c]	-0.619	0.457	1.83	= 0.176	0.54	0.22-1.32		
Step 6 TPI Level T1 (L3)[d]	-2.289	0.372	37.85	< 0.001***	0.10	0.05-0.21		
Step 7 PL-Pain Intensity	-0.128	0.064	3.93	= 0.047*	0.88	0.78-0.99		
Model 7b (*n* = 396)								
DV: RTW Outcome							395.50	0.383
Step 1 Age	-0.001	0.011	0.01	= 0.907	1.00	0.98-1.02		
Step 2 Sex (Female)[a]	-0.091	0.267	0.12	= 0.734	0.91	0.54-1.54		
Step 3 Comorbidity (Yes)[b]	0.053	0.371	0.20	= 0.887	1.05	0.51-2.18		
Step 4 Program Length	-0.015	0.003	26.90	< 0.001***	0.985	0.980-0.991		
Step 5 PICD-9 (Pain)[c]	-0.797	0.306	6.81	= 0.009**	0.45	0.25-0.82		
Step 6 TPI Level T1 (L3)[d]	-1.729	0.282	37.47	< 0.001***	0.18	0.10-0.31		
Step 7 PL-RTW	0.010	0.005	4.15	= 0.042*	1.01	1.00-1.02		

Table 6. (*cont'd*).

Variable	(β)	S.E.	Wald	*p*-value	Exp(β)	95% CI Exp(β)	Model Fit Statistics	
							-2 Log	R_2
Model 7c (*n* = 460)								
DV: RTW Outcome							487.00	0.341
Step 1 Age	-0.002	0.010	0.03	= 0.873	1.00	0.98-1.02		
Step 2 Sex (Female)[a]	-0.113	0.233	0.24	= 0.627	0.89	0.57-1.41		
Step 3 Comorbidity (Yes)[b]	-0.123	0.340	0.13	= 0.717	0.88	0.45-1.72		
Step 4 Program Length	-0.010	0.002	22.21	< 0.001***	0.990	0.986-0.994		
Step 5 PICD-9 (Pain)[c]	-0.683	0.275	6.17	= 0.013*	0.51	0.29-0.87		
Step 6 TPI Level T1 (L3)[d]	-1.709	0.250	46.68	< 0.001***	0.18	0.11-0.30		
Step 7 BDI-II (Mod-Sev)[e]	-0.564	0.253	4.97	= 0.026*	0.57	0.35-0.93		
Model 7d (*n* = 223)								
DV: RTW Outcome							180.55	0.468
Step 1 Age	-0.015	0.017	0.72	= 0.396	0.99	0.95-1.03		
Step 2 Sex (Female)[a]	-0.533	0.411	1.68	= 0.194	0.59	0.26-1.31		
Step 3 Comorbidity (Yes)[b]	-0.533	0.611	0.76	= 0.382	0.59	0.18-1.94		
Step 4 Program Length	-0.009	0.003	6.61	= 0.010*	0.991	0.985-0.998		
Step 5 PICD-9 (Pain)[c]	-0.839	0.444	3.57	= 0.059	0.43	0.18-1.03		
Step 6 TPI Level T1 (L3)[d]	-2.300	0.406	32.16	< 0.001***	0.10	0.05-0.22		
Step 7 TSI-2 TR (Elev)[e]	-0.995	0.395	6.34	= 0.012*	0.37	0.17-0.80		
Model 7e (*n* = 214)								
DV: RTW Outcome							176.30	0.445
Step 1 Age	-0.011	0.017	0.43	= 0.512	0.99	0.96-1.02		
Step 2 Sex (Female)[a]	-0.503	0.415	1.47	= 0.225	0.61	0.27-1.36		
Step 3 Comorbidity (Yes)[b]	-0.559	0.617	0.82	= 0.365	0.57	0.17-1.19		
Step 4 Program Length	-0.009	0.004	7.14	= 0.008**	0.991	0.984-0.997		

Table 6. (*cont'd*).

Variable	(β)	S.E.	Wald	*p*-value	Exp(β)	95% CI Exp(β)	Model Fit Statistics	
							-2 Log	R_2
Step 5 PICD-9 (Pain)[c]	-0.801	0.441	3.31	= 0.069	0.45	0.19-1.06		
Step 6 TPI Level T1 (L3)[d]	-2.173	0.406	28.57	< 0.001***	0.11	0.05-0.25		
Step 7 TSI-2 TR-A (Elev)[e]	-0.884	0.393	5.06	= 0.025*	0.41	0.19-0.89		

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. RTW Outcome = Return-to-Work Outcome at Time of Discharge; Program Length = Length of TPI Program from Admission to Discharge; PICD-9 Diagnosis = Primary ICD-9 Diagnosis; TPI Level T1 = Traumatic Psychological Injury Program Level on Admission (L1 = Level 1; L2 = Level 2; L3 = Level 3); PL-Pain Intensity = Psychology Log – Pain Intensity; PL-RTW = Psychology Log – Readiness to Return-to-Work; BDI-II = Beck Depression Inventory-II; Elev = Elevated; TSI-2 TR = TSI-2 Posttraumatic Stress Factor; TSI-2 TR-A = TSI-2 Posttraumatic Stress – Defensive Avoidance Subscale.

[a] Reference Category = Male.

[b] Reference Category = No.

[c] Reference Category = Primary Mental Health Diagnosis.

[d] Reference Category = TPI Levels 1 & 2.

[e] Reference Category = Minimal-to-Mild.

[f] Reference Category = Non-Significant.

presence of comorbid injuries, TPI program length, primary ICD-9 diagnosis, and TPI program level that workers were admitted to. The variables age and sex—although not significantly associated with return-to-work—were retained given their clinical importance and based on previous research findings (Cancelliere et al., 2016). Additionally, the presence of comorbid injuries was retained given its significant associations with return-to-work in Models 1 – 5 and the associated increased change in variance resulting from its inclusion.

The final model accounted for 32.2% of the variance in return-to-work outcomes, and produced a model fit statistic (i.e., log-likelihood) of 526.25. In the final model, the presence of comorbid injuries at the time of admission was associated with 0.86 odds of returning to work in comparison to those without comorbid injuries (95% CI=0.46, 1.61). Greater average program length—in days—was associated with 0.989 odds of returning to work (95% CI=0.985, 0.993). Having a primary ICD-9 diagnosis of musculoskeletal or other painful physical injury-related diagnoses was associated with 0.57 odds of returning to work in comparison to those with primarily psychological disorder diagnoses (95% CI=0.34, 0.96). Additionally, TPI Level 3 programs (i.e., multidisciplinary rehabilitation services) were associated with a 0.18 odds of returning to work in comparison to TPI Levels 1 and 2 (95% CI=0.11, 0.28).

Notably, in Models 7a – 7e, model fit statistics generally improved, ranging from 176.30 (Model 7e) to 487.00 (Model 7c); the variance accounted for by the addition of psychological variables was also seemingly greater, ranging from 34.1% (Model 7c) to 49.0% (Model 7a). In examining the addition of self-reported pain intensity to the final model (Model 7a), increases in Psychology Log pain intensity scores were associated with 0.88 odds of returning to work (95% CI=0.78, 0.99). With the inclusion of pain intensity scores into the model, primary ICD-9 diagnoses were no longer significantly associated with return-to-work in comparison to the final

model. Psychology Log energy and mood level scores (*Appendix E*, Table 4), once included into the model, were no longer significantly associated with return-to-work in comparison to chi-squared results (*Table 5*). Lastly, for every one-point increase in self-reported readiness to return-to-work were associated with 1.01 odds of returning to work (95% CI=1.00-1.02; Model 7b).

Workers scoring in the moderate-to-severe ranges of the BDI-II had 0.57 odds of returning to work (Model 7c), in comparison to those in the minimal-to-mild categories (95% CI=0.35-0.93). Similarly, those with elevated scores on the TSI-2 Posttraumatic Stress factor scale had 0.37 odds of returning to work (Model 7d), in comparison to those scoring in the non-significant range (95% CI=0.17, 0.80). TSI-2 Self-Disturbance and Somatization factor scale scores (*Appendix E*, Table 4), once included into the model, were no longer significantly associated with return-to-work in comparison to univariate chi-squared results (*Table 5*). With the inclusion of TSI-2 Posttraumatic Stress, Self-Disturbance, and Somatization factor scale scores, primary ICD-9 diagnoses were no longer significantly associated with return-to-work in comparison to the final model.

With the inclusion of the TSI-2 Posttraumatic Stress factor subscales of Dissociation, Defensive Avoidance, Cognitive Intrusions, or Hyperarousal scores into the final model, only elevated TSI-2 Defensive Avoidance subscale scores were significantly associated with return-to-work outcomes (Model 7e). Individuals with elevated scores on the TSI-2 Defensive Avoidance subscale had 0.41 odds of returning to work, in comparison to those scoring in the non-significant range (95% CI=0.19, 0.89). Again, with the inclusion of the TSI-2 Posttraumatic Stress factor subscales of Defensive Avoidance, primary ICD-9 diagnoses were no longer significantly associated with return-to-work in comparison to the final model. While TSI-2

Posttraumatic Stress factor subscales of Dissociation, Cognitive Intrusions, or Hyperarousal were not significantly associated with return-to-work beyond the final model (*Appendix E*, Table 4), primary ICD-9 diagnoses were also no longer significantly associated with return-to-work once these subscale scores were included.

5.0 Discussion

The broad aim of this study was to examine factors associated with return-to-work among workers with or without comorbid TPI and pain conditions undergoing rehabilitation through WCB-Alberta. Generally, results provided further support for the conclusion that physical injuries and psychological trauma frequently co-occur (Akerblom, Perrin, Fischer, & McCracken, 2017; Andersen, Andersen, & Andersen, 2014; Fishbain et al., 2017; Giummarra et al., 2017; Siqveland, Hussain, Lindstrom, Ruud, & Hauff, 2017a; Siqveland, Ruud, & Hauff, 2017b), and that the co-occurrence of these conditions is associated with worse return-to-work outcomes (Hensel et al., 2011; Herrera-Escobar et al., 2018a; Laisné et al., 2013). Novel findings of the current study arise from having examined return-to-work in workers with or without comorbid TPI and physical injuries in the context of psychologically-based occupational rehabilitation, as opposed to multidisciplinary pain rehabilitation services, which the majority of studies have focused on to date (e.g., Akerblom et al., 2017; Andersen et al., 2014; Langford et al., 2018; Siqveland et al., 2017a). Further, to our knowledge, this is the first study to examine specific PTSD symptom domains in their association with return-to-work for workers with TPI. Although results generally supported our hypotheses, evidence in support of specific hypotheses regarding the associations of factors with return-to-work in workers with or without comorbid pain conditions were not found. Discussion in relation to specific hypotheses are outlined in the following sections.

5.1 Research Question 1

What are the return-to-work outcomes at time of program discharge for injured workers undergoing of WCB-Alberta's TPI rehabilitation programs (TPI Levels 1, 2, and 3)? Contrary to our hypotheses, TPI Levels 1 and 2 programs were associated with greater return-to-work rates

in comparison to more comprehensive and multidisciplinary TPI Level 3 programs. As previously mentioned, TPI Level 3 programs involve the provision of multidisciplinary rehabilitation services, and are intended for workers with multiple barriers to returning to work, such as those with comorbid TPI and pain conditions. The finding that these programs were associated with significantly lower rates of return-to-work are likely a reflection of injury severity, rather than the program itself. That is, workers admitted to TPI Level 3 programs are those with more severe injuries and present with multiple return-to-work barriers. Not surprisingly, then, those admitted to TPI program Levels 1 and 2 may already be more likely to return-to-work primarily based solely on the lower severity of their conditions. For example, researchers have found that consulting with a psychiatrist or psychologist is associated with worse return-to-work outcomes, and have also speculated that this counter-intuitive finding was a reflection of injury severity (Prang et al., 2016). If this is the case, the current findings would support previous research that has identified those with greater injury severity are less likely to return-to-work (Cancelliere et al., 2016). Nonetheless, the finding that workers in TPI Level 3 programs scored significantly higher across many psychological domains in comparison to those in TPI Levels 1 and 2 would support the conclusion that TPI Level in the current study is a reflection of injury severity, and indicate potential selection bias which may explain this unexpected finding.

While TPI Level 1 and 2 programs had significantly greater return-to-work rates in both the full sample and Group 1, this was not found in Group 2. It may be the case that all injured workers with comorbid TPI and physical injuries would benefit from being admitted to TPI Level 3 programs, as TPI Levels 1 and 2 may not provide the same level of supports in facilitating return-to-work for these workers. However, it is also possible that this difference is

also a reflection of injury severity, as the results in both the full sample and Group 1 would suggest.

Previous research efforts have identified that multidisciplinary rehabilitation interventions, such as TPI Level 3 programs, are most effective for achieving sustainable return-to-work outcomes. (Cancelliere et al., 2016). These findings do not support the conclusion that TPI Level 3 programs are not worthwhile. Despite the low return-to-work rates of TPI Level 3 programs identified in the current study, these programs would still be most likely to benefit injured workers with complex injuries, such as co-occurring TPI and physical injuries. It is possible that the low return-to-work rates for TPI Level 3 programs found in the current study, then, reflect that there are other return-to-work barriers that remain to be addressed. For example, given difficulties in assessing and diagnosing complex injuries, many workers experience a delay in the provision of appropriate services (McEachen et al., 2010). As previously mentioned, when these injuries go untreated, the workers' likelihood of recovery and return-to-work diminishes (Kang et al., 2006; Park, 2012; Pransky et al., 2005). It is likely that time delays between workers injuries and subsequent referral and admission to WCB-Alberta's TPI programs in the current study influence return-to-work outcomes. Early identification of TPI in injured workers may help to facilitate return-to-work for workers admitted to TPI Level 3 programs.

5.2 Research Question 2

What factors predict return-to-work at time of program discharge in injured workers undergoing rehabilitation for TPI? In the full sample, a number of factors were identified as significantly associated with return-to-work. Many of the included administrative/demographic variables which would have been expected to be associated with return-to-work (e.g., Cancelliere

et al., 2016) did not emerge as significant. Though unexpected, this finding would suggest that injury-related and psychosocial factors are more predictive of return-to-work outcomes in workers having sustained TPI. This is consistent with other research that has found insignificant associations with return-to-work for demographic and injury-related variables (e.g., Kendrick et a., 2017). It is also possible that these findings reflect differences in sampling methods in comparison to previous research. As previously mentioned, the majority of research to date has relied on samples referred to multidisciplinary rehabilitation services for painful physical injuries (e.g., Akerblom et al., 2017; Andersen et al., 2014; Langford et al., 2018; Siqveland et al., 2017a), as opposed to psychological injuries. Previous research may not have fully captured the associations of injury-related and psychosocial variables in relation to return-to-work in workers having sustained TPI.

Our final model predicting return-to-work consisted of workers' age and sex, as well as the presence of comorbid injuries, length of TPI programming, primary ICD-9 diagnosis, and TPI Level in which workers were admitted to. Supporting previous research findings (Cancelliere et al., 2016), the current study found that the presence of comorbid injuries was associated with significantly lower odds of returning to work. The finding that greater program length was associated with unsuccessful return-to-work may also likely reflect injury severity; as those with complex injuries are often granted program extensions for continued treatment if they have not improved over the initial course of treatment through WCB-Alberta. For this reason, TPI Level 3 program durations are inherently longer. In line with previous research findings, workers who sustained both TPI and physical injuries were significantly less likely to return-to-work in comparison to those with primarily psychological injuries.

5.3 Research Question 3

Do factors associated with return-to-work at time of program discharge differ between workers with or without co-occurring TPI and painful physical injuries? Results demonstrate that those with comorbid TPI and painful physical injuries are not only less likely to RTW, but that Groups 1 and 2 differ in a variety of domains, including demographic/administrative and psychological variables. Factors associated with return-to-work in Group 1 followed a similar pattern to those in the full sample, with the exception of Psychology Log energy level scores, TSI-2 Dissociation, TSI-2 Insecure Attachment, and TSI-2 Impaired Self-Reference subscales scores, which were not found to be significant. It is surprising, however, that the only factors significantly associated with return-to-work in Group 2 were program length and readiness to return-to-work. We would have expected to see that many of these variables would emerge as significantly associated with return-to-work, especially given the distribution of this groups' scores on the various patient-reported outcome measures, among other variables.

Despite the contradictory evidence of factors associated with return-to-work in injured workers with or without co-occurring TPI and pain conditions, the current results suggest that further examination of factors associated with return-to-work in these groups independently is warranted. This is supported by the many significant findings of differences between these groups on a variety of demographic/administrative and psychological variables, as well as by the significantly lower return-to-work rates of workers in Group 2. These significant differences between Groups 1 and 2 suggest that psychological factors may be associated with return-to-work in those with co-occurring TPI and pain conditions, and that further research in this area is also warranted.

5.4 Research Question 4

What can important psychological factors (e.g., trauma symptoms) add to our understanding of factors associated with return-to-work at time of program discharge in workers with or without co-occurring TPI and painful physical injuries? The current study found evidence that greater levels of self-reported pain intensity and depression (Cancelliere et al., 2016; Steenstra et al., 2017) were associated with unsuccessful return-to-work, and that greater self-reported energy levels (de Vries, Koeter, Nabitz, Hees, & Schene, 2012), mood, and expectations of return-to-work (Steenstra et al., 2017) were associated with successful return-to-work. Extending previous research efforts that have examined psychological factors associated with return-to-work (Ghisi et al., 2013; Kendrick et al., 2017; Steenstra et al., 2017), the current study also identified specific PTSD symptom domains associated with return-to-work. Elevated scores across all four PTSD symptom domains (i.e., dissociation, defensive avoidance, cognitive intrusion, hyperarousal), as measured by the TSI-2, were associated with not returning to work at the time of program discharge.

Further examination of psychological factors in predicting return-to-work identified that levels of self-reported pain intensity, expectations of return-to-work, depression, and posttraumatic stress symptoms, namely defensive avoidance, at the time of program intake added significant predictive value in return-to-work outcomes beyond other established factors (i.e., age, sex, comorbid injuries, program length, primary ICD-9 diagnosis, TPI Level at the time of admission). Notably, logistic regression model fit indices improved with the inclusion of psychological variables across all domains, and the amount of variance predicted by psychological variables also improved. While our findings do not provide conclusive evidence of psychological factors in predicting return-to-work, they do suggest that these factors are

important considerations, at least in relation to TPI and psychological rehabilitation. When taking into account self-reported pain intensity, as well as TSI-2 Posttraumatic Stress factor scores and Defensive Avoidance subscale scores, primary ICD-9 diagnoses were no longer significantly associated with return-to-work in the full logistic regression model. This finding suggests that these specific factors may be a better indicator of return-to-work than workers' underlying injuries. Additionally, this finding indicates that these factors likely hold clinical importance; and that targeting these factors in treatment may help to improve return-to-work outcomes for workers with or without co-occurring TPI and conditions undergoing TPI rehabilitation (e.g., Taylor et al., 2006).

Notably, defensive avoidance emerged as the strongest predictor of return-to-work across PTSD symptom domains, even beyond the contributions of demographic/administrative and injury-related variables in the current study. Previous efforts have identified defensive avoidance, cognitive intrusions, and hyperarousal PTSD symptom domains as important consideration in the relationship between TPI and pain associated with physical injuries (Cho et al., 2011; Ghisi et al., 2013; Taylor et al., 2006). Researchers have suggested, however, that defensive avoidance is a particularly important consideration, worsening pain-related disability through promoting the behavioural avoidance of physical pain (i.e., fear of movement/re-injury; Cho et al., 2011). Here, pain may trigger reminders of the traumatic event, resulting in hyperarousal symptoms and subsequent avoidance. Our findings not only support this idea, but extend the contributions of defensive avoidance specifically to return-to-work in comorbid TPI and pain conditions. There are possible relations of PTSD symptoms to one another (e.g., Cho et al., 2011), which the current study was unable to examine. Further research examining these domains and their associations with return-to-work is warranted.

5.6 Limitations

An important limitation of the current study is our use of return-to-work, defined as returning to pre-accident levels of work at the time of program discharge, as our primary outcome measure. Return-to-work at the time of program discharge is only one indicator of treatment outcomes. There are many other potential reasons why workers may not return-to-work at the time of program discharge. For example, workers who are not job attached (i.e., have not maintained linkages with their workplace, and have no job to return to) may be more likely to not be working at the time of program discharge (e.g., MacEachan et al., 2010). This was not found in the current study, but this conclusion is supported by previous research efforts. Future research may wish to examine longer term return-to-work outcomes, such as factors associated with return-to-work during follow-up periods (e.g., receiving wage replacement benefits), as this may be a more accurate indicator of long-term worker impairments (e.g., Gross, Park, Rayani, Norris, & Esmail, 2017).

Secondary data analysis is limited in that data have already been collected, and may not have been collected to address the specific research question researchers are seeking to answer (Cheng & Phillips, 2014; Cole & Trinh, 2017), as in our case. Completeness and accuracy of data often cannot be verified, and important data on variables that may have helped the investigation are often not available (Cheng & Phillips, 2014; Cole & Trinh, 2017). During the time period that workers within our database underwent TPI rehabilitation through WCB-Alberta (2014 to 2016), reporting of patient-reported outcomes were not standardized across WCB-Alberta service providers, so there were many missing data points on the included psychological variables, which may have impacted our results. We were unable to examine more recent data, and unable to include a broader time period of injured workers undergoing rehabilitation for TPI.

Data contained within the administrative database, however, were complete for all workers, resulting in greater confidence in the logistic regression model using only demographic/administrative and injury-related variables. Despite this limitation, associations of psychological variables with return-to-work were able to be examined.

Power and sample size limitations were also likely caveats of the current results. As demonstrated, results did not provide evidence of factors associated with return-to-work in Group 2, which had a sample size of 170 injured workers—only 23% of which had returned-to-work at pre-accident levels at the time of treatment discharge. Further research is needed with larger sample sizes, using a more complete dataset, in order to examine whether factors associated with return-to-work differ between those with or without comorbid TPI and pain conditions. Given power and sample size limitations, logistic regression analyses were only conducted within the full sample, with variables selected for inclusion into the model using a more stringent alpha level of .05. Additionally, being as the sample size became smaller with the inclusion of psychological variables, these were only examined independently in their associations with return-to-work, as opposed to providing one coherent model including all psychological variables. Had these variables been included in one model, issues related to multiple testing would have been more profound. The current results provide at least some preliminary evidence of psychological variables and their associations with return-to-work in workers undergoing TPI rehabilitation.

Another limitation of the current study are potential issues in sample differences between Groups 1 and 2. As demonstrated, workers in Group 1 reported pain on the Psychology Log pain intensity scale, albeit of low average intensity. Although average pain intensity scores were lower in Group 1 than Group 2, this suggests that Group 1 may not have reflected a 'solely' TPI

group. It may be that these workers had pre-existing physical injuries or pain conditions unrelated to their WCB claim, which would not be captured in workers' files. Although unrelated to the underlying claim, it is possible that pre-existing physical injuries or pain conditions impacted return-to-work outcomes, which we were unable to examine. Although this finding was unexpected, it does provide some additional support for having explored pain-related variables in logistic regression analyses within the context of the full sample.

Related to the above points, a final limitation of the current study is that it could have benefitted from the inclusion of other important demographic/administrative, injury-related, and psychosocial variables. We did not have a true measure of injury severity included in the administrative data provided by WCB; inadvertently, TPI program levels at the time of admission may have been confounded by this variable. A widely used and validated measure of pain, such as the Brief Pain Inventory (Cleeland, 1989) may allow for a more comprehensive assessment of pain, and allow more rigorous investigations into comorbid TPI and pain. Additionally, a measure of injury-severity may have helped to explain the unexpected finding of differences in return-to-work between the TPI Level 1 and 2, and TPI Level 3 programs. A measure of resiliency may also have helped to explain differences between those successfully returning to work in comparison to those not having returned to work. Resiliency is an important consideration in predicting adjustment to both pain conditions and psychological trauma.

5.7 Conclusion

The current study provides evidence of factors associated with return-to-work in workers receiving psychologically-based rehabilitation services, which has not been extensively examined in the literature. Our final model predicting return-to-work in workers undergoing rehabilitation for TPI consisted primarily of administrative and injury-related variables, where

return-to-work was less likely among workers with comorbid injuries, primarily physical injuries, longer average treatment durations, and among those admitted to higher intensity interventions (i.e., multidisciplinary treatment). Of the included patient-reported outcome measures, return-to-work was less likely among workers with greater levels of self-reported pain intensity, depression, and PTSD symptoms; namely, defensive avoidance. Workers with greater levels of self-reported readiness to return-to-work were more likely to successfully return-to-work. Given power and sample size limitations, we were unable to examine whether factors associated with return-to-work differ in the TPI only and TPI + painful physical injury groups. Nonetheless, to our knowledge this is the first study to examine specific PTSD symptom domains in their association with return-to-work, and identified defensive avoidance as a particularly important consideration in return-to-work. While psychological variables added significant predictive value in return-to-work outcomes beyond other established predictors, we were unable to fully examine these factors. Further research with larger sample sizes is needed in order to delineate the relationships of psychological variables with return-to-work in workers undergoing psychologically-based rehabilitation services. Additionally, research efforts to further understand differences in factors associated with return-to-work among workers with or without comorbid TPI and pain conditions are needed.

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Appendix A

WCB-Alberta's TPI Continuum of Care Model

Appendix A. WCB-Alberta's TPI Program Continuum of Care

A Model for Managing Workers' Psychological Injury

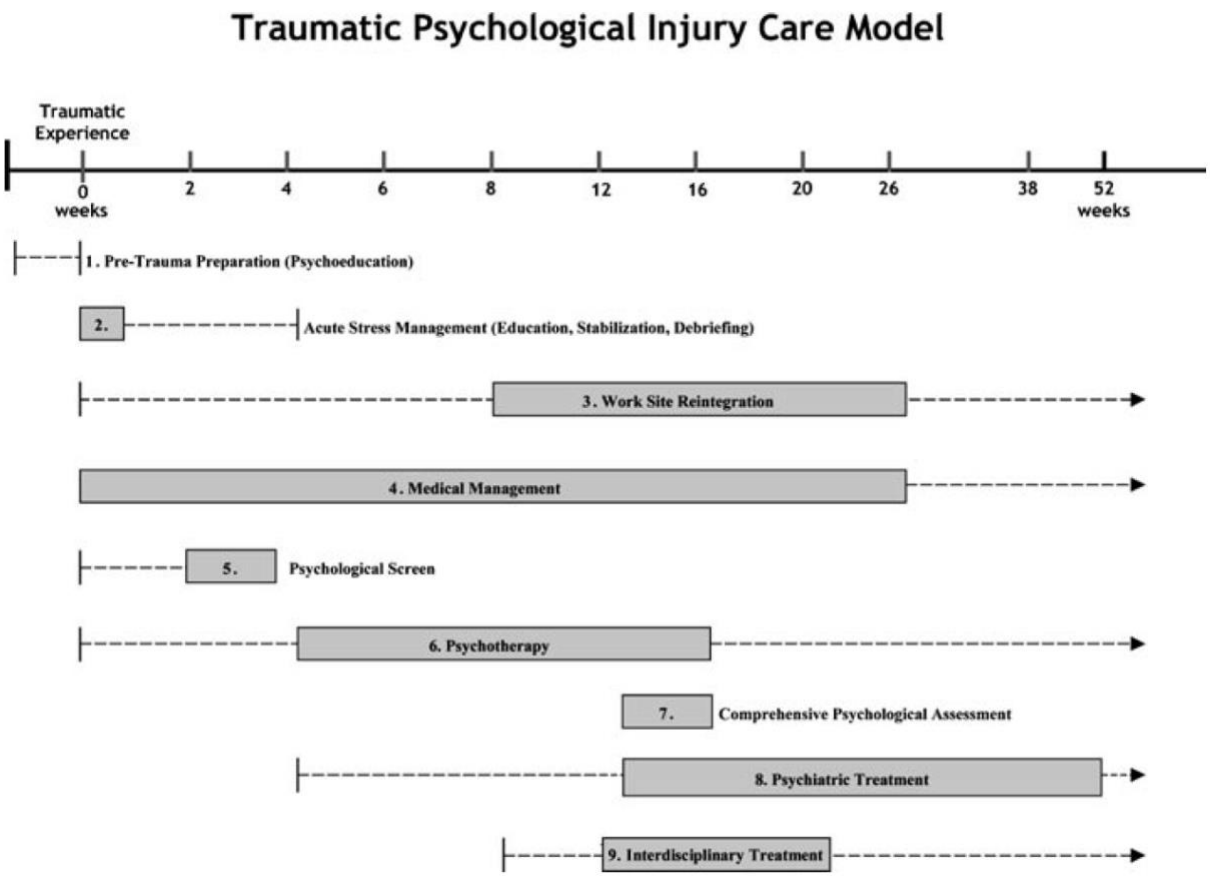
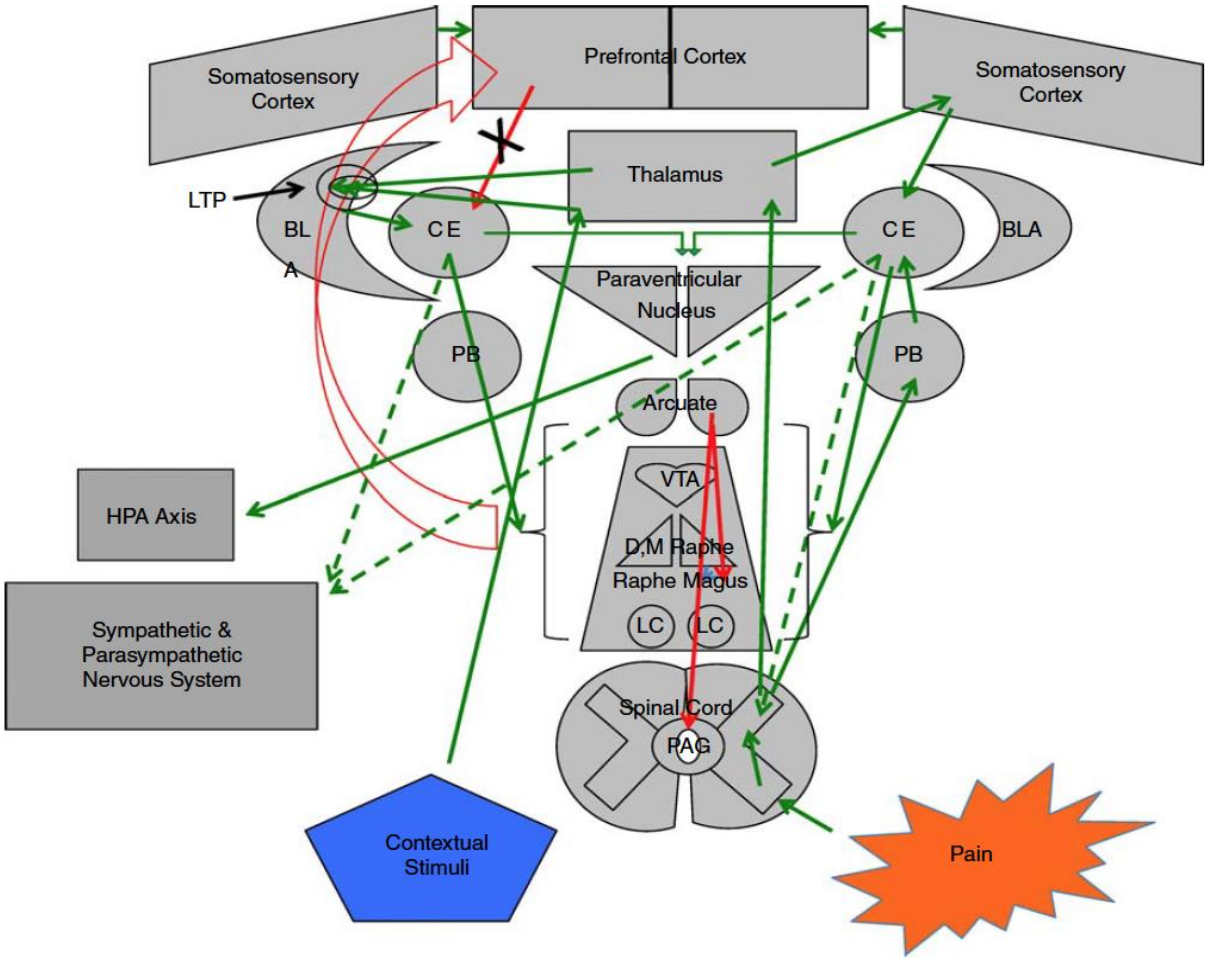


*Figure taken from Rose, J. (2006). A model of care for managing traumatic psychological injury in a workers' compensation context. *Journal of Traumatic Stress, 19,* 315-326. doi:10.1002/jts.20126

Appendix B

Neuroanatomy of Pain and Psychological Trauma Comorbidity

Appendix B. Scioli-Salter et al. (2015, p. 365). Neuroanatomy of pain and psychological trauma comorbidity.



Note. Excerpt taken from Scioli-Salter et al.'s (2015) article describing the above figure:

> "Neuroanatomy of chronic pain and PTSD. Left side of figure illustrates the convergence and learned association (via long-term potentiation or LTP) between peripheral pain signals and contextual stimuli associated with the traumatic experience in the basolateral nucleus of the amygdala (BLA) after passage through the thalamus. Projections from the BLA to the central nucleus of the amygdala (CE) activate the species specific defense response (SSDR) which includes: (1) intense activation of monoamine projections from the brainstem ventral tegmental area (VTA) (dopamine), dorsal and median raphe (serotonin), and locus coeruleus (LC) (norepinephrine) to the prefrontal cortex (PFC), which results in decrements in working memory and deactivation of the PFC brake on the amygdala; (2) activation of behavioral responses (e.g., freezing) mediated by the periaqueductal gray (PAG); (3) activation of cardiovascular responses (not shown); (4) activation of the hypothalamic-pituitary-adrenal (HPA) axis, with release of steroids and hormones that facilitate stress adaptation and contribute to stress-induced hypoalgesia and impact inflammation; and (5) activation of the sympathetic and parasympathetic nervous system. Right side of figure illustrates the convergence of peripheral pain signals in the CE of the amygdala after indirect routing through the thalamus and BLA (per previous paragraph), direct routing through the parabrachial nucleus (PB), and delayed

routing through the somatosensory cortex (which also projects to the PFC to potentially enable finer discrimination of signal inputs). Also illustrated are descending pain inhibitory pathways (red arrows) activated by release of NPY in the arcuate nucleus of the hypothalamus, which in turn project to the raphe magnus and periaqueductal gray. Dashed arrows indicate indirect projections; green arrows, excitatory; red arrows: inhibitory" (p. 365).

Appendix C

WCB-Alberta's TPI Database: Categorical Variable Categories

Appendix C: Table 1. Demographic/Administrative and Injury-Related Variable Categories.

Variable	Source
Education	Education categories are based on demographic information obtained upon intake at WCB-Alberta.
Grade 8 or Less	
Partial High School	
High School Diploma	
Partial Technical School	
Technical School	
Partial University	
University Degree	
Not Specified	
TPI Program	The TPI Level the worker was first admitted to.
Level 1	
Level 2	
Level 3	
Return-to-Work Outcome	Return-to-work outcomes at treatment discharge.
Yes	
No	
Occupational Category	Occupational categories are based on National Occupational Classification. Government of Canada (2020). National Occupational Classification: Structure list [Web page].
Management Occupations	
Business, Finance & Administration	
Natural & Applied Sciences	
Health Occupations	
Education, Law, Social, Community & Gov't Services	
Art, Culture, Recreation, & Sport	
Sales & Service	
Trades, Transport, & Equipment	
Natural Resources & Agriculture	
Manufacturing & Utility	
Unknown	
First Responder	First responder categories are based on demographic information obtained upon intake at WCB-Alberta.
Police	
Firefighter	
Ambulance Worker	
Comorbid Psychiatric Diagnoses	Comorbid diagnoses are based on ICD-9 diagnostic classifications.
Yes	
No	

Appendix C: Table 2. Type of Accident, Nature of Injury, Primary & Secondary ICD Diagnoses Categories.

Variable	Source
Type of Accident	Accident categories are based on Coding of Work Injury or Disease Information. Canadian Standards Association (2003). Coding of work injury or disease information [PDF].
Contact with Objects/Equipment	
Falls	
Bodily Reaction	
Exposure to Harm	
Exposure to Trauma	
Transport Accidents	
Fires & Explosions	
Assault & Violence	
Other Exposure	
Nature of Injury	Nature of injury categories are based on Coding of Work Injury or Disease Information. Canadian Standards Association (2003). Coding of work injury or disease information [PDF].
Traumatic Injury	
Systemic Disease	
Symptoms & Signs	
Other Disease/Illnesses	
Mental Disorder	
Anxiety, Stress	
Post-Traumatic Stress	
Depressive	
Adjustment	
Primary ICD Diagnosis	ICD Diagnoses are based on the International Classification of Diseases Diagnostic Code Descriptions (ICD-9).
Physical	
Mental Health	
Secondary ICD Diagnosis	
Physical	
Mental Health	

Appendix C: Table 3. Relevant Patient Report Outcome Measures Categories

Variable	Source
Trauma Symptom Inventory-2 Not Clinically Significant Problematic Clinically Elevated	TSI-2 categories are based on clinical cut-off scores presented in Briere (2011)
Beck Depression Inventory-II Minimal Mild Moderate Severe	BDI-II categories are based on clinical cut-off scores presented in Beck et al. (1996)
Beck Anxiety Inventory Minimal Mild-to-Moderate Moderate-to-Severe Severe	BAI categories are based on clinical cut-off scores presented in Beck et al. (1988)

Appendix D

TSI-2 Factor and Subscale Domains

Appendix D: Table 1. TSI-2 Factor and Subscale Domains.

Scale/Subscale/Factor	Domain Evaluated
Validity Scale	
Response Level (RL)	Bias toward underreporting or denying symptomatology
Atypical Response (ATR)	Bias toward ovverreporting trauma-related symptoms
Factor	
Self-Disturbance (SELF)	Difficulties associated with inadequate self-awareness and negative models of self and others
Posttraumatic Stress (TRAUMA)	Posttraumatic stress and related anxiety and dissociation
Externalization (EXT)	Tendency to engage in dysfunctional or self-destructive behaviors when distressed
Somatization (SOMA)	See SOM scale
Clinical scale/subscale	
Anxious Arousal (AA)	Anxiety and hyperarousal symptoms
Anxiety (AA-A)	Symptoms of anxiety
Hyperarousal (AA-H)	Symptoms associated with posttraumatic hyperarousal
Depression (D)	Cognitive, affective, or somatic symptoms of depression
Anger (ANG)	Angry thoughts feelings, and behaviors
Intrusive Experiences (IE)	Reliving/intrusion symptoms of posttraumatic stress
Defensive Avoidance (DA)	Avoidance of upsetting thoughts, feelings, or memories
Dissociation (DIS)	Depersonalization, derealization, detachment, amnesia, identity splits
Somatic Preoccupation (SOM)	Somatic preoccupations and distress
Pain (SOM-P)	Aches and pains
General (SOM-G)	Generalized somatic complaints
Sexual Disturbance (SXD)	Sexual problems and behaviors
Sexual Concerns (SXD-SC)	Negative thoughts and feelings associated with sexuality
Dysfunctional Sexual Behavior (SXD-DSB)	Problematic sexual behaviors
Suicidality (SUI)	Suicidal thoughts and behaviors
Ideation (SUI-I)	Suicidal ideation
Behavior (SUI-I)	Suicidal behavior
Insecure Attachment (IA)	Difficulties or insecurities regarding close relationships with others
Relational Avoidance (IA-RA)	Discomfort or avoidance regarding close relationships
Rejection Sensitivity (IA-RS)	Preoccupation with abandonment or rejection in relationships
Impaired Self reference (ISR)	Difficulties in accessing identity, self, or self determination
Reduced Self Awareness (ISR-RSA)	Lack of awareness of internal mental processes associated with a personal sense of self
Other-Directedness (ISR-OD)	Overvaluing others' views and demands in the absence of sufficient self-reference
Tension Reduction Behavior (TRB)	Use of external activities (e.g. self-injury, binging) as ways to avoid or distract from upsetting internal states

*Briere, J. (2011). *Trauma Symptom Inventory-2 (TSI-2).* Odessa, FL: Psychological Assessment Resources.

Appendix E

Supplemental Tables

Appendix E: Table 1. Collinearity of Patient-Reported Outcome Measures.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. PL-Pain	-															
2. PL-Stress	.25 c	-														
3. PL-Relax	-.12	-.39 c	-													
4. PL-Energy	-.10	-.42 c	.26 c	-												
5. PL-Sleep	-.21 b	-.26 c	.34 c	.26 c	-											
6. PL-Mood	-.17 b	-.48 c	.37 c	.60 c	.31 c	-										
7. PL-RTW	-.09	-.30 c	.19 b	.35 c	.21 c	.32 c	-									
8. BDI-II	.17 b	.37 c	-.23 c	-.31 c	-.18 b	-.34 c	-.22 c	-								
9. BAI	.17 a	.39 c	-.18 b	-.20 b	-.11	-.22 b	-.17 a	.42 c	-							
10. TSI-2 Trauma	.09	.25 b	-.14	-.21 b	-.15	-.26 b	-.20 b	.43 c	.35 c	-						
11. TSI-2 Self-Dist	.01	.22 b	-.04	-.25 b	-.16 a	-.31 c	-.20 a	.31 c	.26 c	.47 c	-					
12. TSI-2 Externalize	.03	.17 a	.04	-.15	-.03	-.11	.00	.25 c	.25 b	.35 c	.56 c	-				
13. TSI-2 Soma	.41 c	.30 c	-.07	-.29 c	-.15	-.22 b	-.10	.25 c	.31 c	.32 c	.40 c	.32 c	-			
14. TR-Dissociation	.10	.25 b	-.08	-.30 c	-.18 a	-.24 b	-.10	.28 c	.27 c	.47 c	.49 c	.46 c	.34 c	-		
15. TR-Avoidance	.09	.25 b	-.17 a	-.18 a	-.17 a	-.22 b	-.25 b	-.35 c	-.32 c	**.83** c	.44 c	.31 c	.31 c	.46 c	-	
16. TR-Intrusions	.11	.28 c	-.13	-.23 b	-.11	-.22 b	-.18 a	.28 c	.17 a	**.73** c	.37 c	.33 c	.33 c	.35 c	.67 c	-
17. TR-Hyperarousal	.08	.25 b	.06	-.16 a	-.13	-.21 b	-.27 c	.32 c	.38 c	.67 c	.38 c	.30 c	.43 c	.32 c	.55 c	.55 c

Note. a = $p < 0.05$; b = $p < 0.01$; c = $p < 0.001$. Non-significant correlations indicated in red font; Collinear of variables indicated in **bold text**; PL-Pain = Psychology Log – Pain Intensity; PL-Stress = Psychology Log – Stress; PL-Relax = Psychology Log – Relaxation Skills; PL-Energy = Psychology Log – Energy; PL-Sleep = Psychology Log – Sleep; PL-Mood = Psychology Log – Mood Levels; PL-RTW – Psychology Log – Readiness to Return-to-Work; BDI-II = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory; TSI-2 Trauma = Trauma Symptom Inventory-2 Trauma Factor Scale; TSI-2 Self-Dist = Trauma Symptom Inventory-2 Self-Disturbance Factor Scale; TSI-2 Externalize = TSI-2 Trauma Symptom Inventory-2 Externalization Factor Score; TSI-2 Soma = Trauma Symptom Inventory-2 Somatization Factor Score; TR-Dissociation = Trauma Symptom Inventory-2 – Trauma Factor – Dissociation Subscale; TR-Avoidance = Trauma Symptom Inventory-2 – Trauma Factor – Defensive Avoidance Subscale; TR-

Intrusions = Trauma Symptom Inventory-2 – Trauma Factor – Cognitive Intrusions Subscale; TR-Hyperarousal = Trauma Symptom Inventory-2 – Trauma Factor – Hyperarousal Subscale.

Appendix E: Table 2. Collinearity of Patient-Reported Outcome Measures: Additional Trauma Symptom Inventory-2 Subscales.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. TSI-2 Trauma	-														
2. TSI-2 Self-Disturbance	.47 c	-													
3. TSI-2 Externalization	.35 c	.56 c	-												
4. TSI-2 Somatization	.32 c	.40 c	.32 c	-											
5. TR-Dissociation	.47 c	.49 c	.46 c	.34 c	-										
6. TR-Avoidance	**.83** c	.44 c	.31 c	.31 c	.46 c	-									
7. TR-Intrusions	**.73** c	.37 c	.33 c	.33 c	.35 c	.67 c	-								
8. TR-Arousal	.67 c	.38 c	.30 c	.33 c	.32 c	.55 c	.55 c	-							
9. SD-Depression	.52 c	.61 c	.39 c	.34 c	.49 c	.51 c	.43 c	.45 c	-						
10. SD-Insecurity	.32 c	.64 c	.48 c	.26 c	.37 c	.33 c	.28 c	.29 c	.41 c	-					
11. SD-Self-Reference	.29 c	.58 c	.46 c	.27 c	.52 c	.28 c	.23 c	.26 c	.46 c	.68 c	-				
12. EX-Anger	.36 c	.40 c	.62 c	.20 b	.41 c	.28 c	.32 c	.34 c	.35 c	.48 c	.37 c	-			
13. EX-Tension-Reduce	.37 c	.43 c	.65 c	.40 c	.38 c	.34 c	.27 c	.33 c	.32 c	.38 c	.40 c	.42 c	-		
14. EX-Sexual-Dist	.19 b	.47 c	.53 c	.40 c	.38 c	.24 b	.24 b	.24 b	.32 c	.57 c	.47 c	.38 c	.38 c	-	
15. EX-Suicidality	.30 c	.51 c	.55 c	.20 b	.37 c	.31 c	.29 c	.24 b	.47 c	.46 c	.37 c	.40 c	.38 c	.37 c	-
16. SO-Somatization	.32 c	.40 c	.32 c	1.0 c	.34 c	.31 c	.33 c	.33 c	.34 c	.26 c	.27 c	.20 c	.40 c	.40 c	.20 b

Note. a = $p < 0.05$; b = $p < 0.01$; c = $p < 0.001$. Collinearity of variables indicated in **bold text**; TSI-2 Trauma = Trauma Symptom Inventory-2 Trauma Factor Scale; TSI-2 Self-Disturbance = Trauma Symptom Inventory-2 Self-Disturbance Factor Scale; TSI-2 Externalization = TSI-2 Trauma Symptom Inventory-2 Externalization Factor Score; TSI-2 Soma = Trauma Symptom Inventory-2 Somatization Factor Score; TR-Dissociation = Trauma Symptom Inventory-2 – Trauma Factor – Dissociation Subscale; TR-Avoidance = Trauma Symptom Inventory-2 – Trauma Factor – Defensive Avoidance Subscale; TR-Intrusions = Trauma Symptom Inventory-2 – Trauma Factor – Cognitive Intrusions Subscale; TR-Hyperarousal = Trauma Symptom Inventory-2 – Trauma Factor – Hyperarousal Subscale; SD-Depression = Trauma Symptom Inventory-2 – Self-Disturbance Factor – Depression Subscale; SD-Insecurity = Trauma Symptom Inventory-2 – Self-Disturbance Factor – Insecure Attachments Subscale; SD-Self-Ref = Trauma Symptom Inventory-2 – Self-Disturbance Factor – Impaired Self-Reference Subscale; EX-Anger = Trauma Symptom Inventory-2 – Externalization Factor – Anger Subscale; EX-Tension-Reduce = Trauma Symptom Inventory-2 – Externalization Factor – Tension-Reduction Behaviours Subscale; EX-Sexual-Dist =

Trauma Symptom Inventory-2 – Externalization Factor – Sexual Disturbance Subscale; EX-Suicidality = Trauma Symptom Inventory-2 – Externalization Factor – Suicidality Subscale; SO-Somatization = Trauma Symptom Inventory-2 – Somatization Factor – Somatization Subscale.

Appendix E: Table 3. Chi-2 Tests Examining Associations of Demographic/Administrative, Injury-Related, and Clinical Factors with RTW in Physical Injury and TPI Only Subgroups of Injured Workers Admitted to WCB-Alberta's TPI Programs between the Years 2014-2016.

Subgroups	Physical Injury - Return-to-Work			TPI Only - Return-to-Work		
	Yes	No	t or χ^2	Yes	No	t or χ^2
Variable	Mean ± SD or *n* (%)	Mean ± SD or *n* (%)		Mean ± SD or *n* (%)	Mean ± SD or *n* (%)	
Demographic/Administrative Variables[a]						
Age (in years)[b]	40.44 ± 14.20	39.95 ± 11.68	-0.22, $p = 0.830$	40.48 ± 10.27	40.02 ± 11.39	-0.38, $p = 0.702$
Sex			0.18, $p = 0.672$			0.12, $p = 0.735$
Male	26 (22.0)	92 (78.0)		90 (56.6)	87 (54.7)	
Female	13 (25.0)	39 (75.0)		69 (43.4)	72 (45.3)	
Education[a]	($n = 74$)		[f]1.86, $p = 0.447$	($n = 72$)		[f]4.28, $p = 0.104$
Part/Complete Highschool[c]	6 (17.6)	28 (82.4)		0 (0.0)	10 (100.0)	
Part/Complete Tech School	1 (5.3)	18 (94.7)		9 (22.0)	32 (78.0)	
Part/Complete University	4 (19.0)	17 (81.0)		7 (33.3)	14 (66.7)	
Occupational Category			[f]5.28, $p = 0.252$			0.84, $p = 0.933$
Business, Finance, & Management Occupations	5 (35.7)	9 (64.3)		13 (48.1)	14 (51.9)	
Health Occupations	4 (40.0)	6 (60.0)		43 (47.8)	47 (52.2)	
Education, Law, Social & Community Services	3 (14.3)	18 (85.7)		32 (47.8)	35 (52.2)	
Trades	24 (23.8)	77 (76.2)		50 (52.6)	45 (47.4)	
Other	3 (12.5)	21 (87.5)		21 (53.8)	18 (46.2)	
Public Safety Personnel			[f]0.15, $p = 1.00$			1.55, $p = 0.213$
Yes	2 (5.1)	9 (6.9)		55 (34.4)	65 (41.1)	
Police	1 (50.0)	3 (33.3)		6 (10.9)	12 (18.5)	
Firefighter	0 (0.0)	2 (22.2)		8 (14.5)	6 (9.2)	
Ambulance Worker	1 (50.0)	2 (22.2)		36 (65.5)	37 (56.9)	
Corrections	0 (0.0)	2 (22.2)		5 (9.1)	10 (15.4)	
No	37 (94.9)	122 (93.1)		105 (65.6)	93 (58.9)	

Appendix E: Table 3. (*cont'd*).

Subgroups Variable	Physical Injury – Return-to-Work Yes Mean ± SD or *n* (%)	Physical Injury – Return-to-Work No Mean ± SD or *n* (%)	*t* or χ^2	TPI Only – Return-to-Work Yes Mean ± SD or *n* (%)	TPI Only – Return-to-Work No Mean ± SD or *n* (%)	*t* or χ^2
Comorbid Injury			0.45, $p = 0.501$			9.57, $p = 0.002$**
Yes	16 (25.8)	46 (74.2)		4 (18.2)	18 (81.8)	
No	23 (21.3)	85 (78.7)		155 (52.4)	141 (47.6)	
Duration[1] (days since injury)[†, b]	72 (37.0, 143.0)	85 (42.0, 181.0)	-0.92, $p = 0.358$	82 (36.0, 180.0)	34 (18.0, 98.0)	-5.79, $p < 0.001$***
Job Attached at Admission			0.08, $p = 0.777$			0.12, $p = 0.730$
Yes	32 (22.5)	110 (77.5)		139 (49.6)	141 (50.4)	
No	7 (25.0)	21 (75.0)		20 (52.6)	18 (47.4)	
Modified Duties Available			0.76, $p = 0.684$			[f]1.25, $p = 0.523$
Yes – Full-time	14 (21.5)	51 (78.5)		48 (45.3)	58 (54.7)	
Yes – Part-time	1 (11.1)	8 (88.9)		3 (50.0)	3 (50.0)	
No	21 (23.6)	68 (76.4)		100 (51.8)	93 (48.2)	
# Previous Claims[2, †, b]	2.0 (0.0, 4.0)	2.0 (0.0, 4.0)	-0.27, $p = 0.787$	2.0 (1.0, 6.0)	3.0 (1.0, 5.0)	0.11, $p = 0.917$
Type of Rehabilitation Program[3] (First Admission)			0.26, $p = 0.61$			81.74, $p < 0.001$***
TPI Program Levels 1 & 2	8 (20.0)	32 (80.0)		144 (67.9)	68 (32.1)	
TPI Program Level 3	31 (23.8)	99 (76.2)		15 (14.2)	91 (85.8)	
Program Length[4] (in days)[†, b]	52.0 (43.0, 56.0)	83.0 (55.0, 115.0)	5.44, $p < 0.001$*	103.0 (58.0, 164.0)	64.0 (51.0, 109.0)	5.14, $p < 0.001$***
Injury-Related Variables						
Type of Accident			[f]9.02, $p = 0.086$			3.06, $p = 0.690$
Contact with Objects / Equipment	8 (20.0)	32 (80.0)		5 (41.7)	7 (58.3)	
Falls	1 (9.1)	10 (90.9)		1 (20.0)	4 (80.0)	
Exposure to Harm	1 (10.0)	9 (90.0)		85 (52.1)	78 (47.9)	
Transport Accidents	24 (35.3)	44 (64.7)		19 (54.3)	16 (45.7)	
Assault & Violence	5 (14.3)	30 (85.7)		31 (46.3)	36 (53.7)	
Other	0 (0)	4 (100.0)		18 (50.0)	18 (50.0)	

Appendix E: Table 3. (*cont'd*).

Subgroups	Physical Injury – Return-to-Work			TPI Only – Return-to-Work		
	Yes	No		Yes	No	
Variable	Mean ± SD or *n* (%)	Mean ± SD or *n* (%)	*t* or χ^2	Mean ± SD or *n* (%)	Mean ± SD or *n* (%)	*t* or χ^2
Nature of Injury			[f]1.97, $p = 0.291$			0.73, $p = 0.394$
Traumatic Injury + Phys	30 (26.8)	82 (73.2)		30 (55.6)	24 (44.4)	
Other Diseases or Illnesses	1 (8.3)	11 (91.7)		104 (49.1)	108 (50.9)	
Primary ICD-9 Diagnosis			[f]1.59, $p = 0.207$			-
Mental Health Condition	2 (11.1)	16 (88.9)		159 (50.0)	159 (50.0)	
Musculoskeletal Injury	37 (24.3)	115 (75.7)		-	-	
Secondary ICD-9 Diagnosis			[f]0.87, $p = 0.352$			-
Mental Health Condition	2 (15.4)	11 (84.6)		5 (18.5)	22 (81.5)	
Musculoskeletal Injury	14 (28.0)	36 (72.0)		-	-	
Patient-Reported Outcomes Measures						
SF-36[5]						
Physical Function[††, d]	30.82 ± 27.49	37.58 ± 25.74	-0.95, $p = 0.341$	-	-	-
Role Physical[†, e]	18.75 (4.69, 25.0)	15.63 (0, 39.06)	0.11, $p = 0.912$	-	-	-
Bodily Pain[††, g]	28.25 ± 15.90	27.84 ± 27.80	0.65, $p = 0.518$	-	-	-
General Health[††, h]	57.25 ± 20.91	59.15 ± 21.37	-0.39, $p = 0.696$	-	-	-
Vitality[††, i]	35.54 ± 20.30	33.28 ± 19.40	0.69, $p = 0.488$	-	-	-
Social Function[††, j]	34.56 ± 22.76	26.74 ± 21.16	1.20, $p = 0.230$	-	-	-
Role Emotional[††, k]	31.41 ± 33.19	32.88 ± 27.69	-0.66, $p = 0.508$	-	-	-
Mental Health[††, l]	45.44 ± 19.30	42.16 ± 20.19	0.52, $p = 0.601$	-	-	-
PDI[6, †, m]	65.71 (44.3, 86.4)	65.71 (42.9, 82.9)	0.25, $p = 0.801$	-	-	-
Pain VAS[7, ††, n]	66.15 ± 19.81	57.74 ± 27.46	0.59, $p = 0.556$	-	-	-

Appendix E: Table 3. (*cont'd*).

Subgroups	Physical Injury – Return-to-Work			TPI Only – Return-to-Work		
Variable	Yes Mean ± SD or *n* (%)	No Mean ± SD or *n* (%)	*t* or χ^2	Yes Mean ± SD or *n* (%)	No Mean ± SD or *n* (%)	*t* or χ^2
Psychology Log[8]						
Pain Intensity[††, o]	5.19 ± 2.83	5.02 ± 2.67	0.11, $p = 0.910$	0.77 ± 2.02	2.54 ± 2.80	5.18, $p < 0.001$***
Stress[††, p]	6.93 ± 2.91	7.19 ± 1.93	0.50, $p = 0.618$	7.07 ± 2.77	7.12 ± 1.83	0.12, $p = 0.906$
Relaxation Skills[††, q]	3.27 ± 2.09	4.35 ± 2.25	-1.84, $p = 0.066$	4.47 ± 2.36	3.79 ± 1.80	-1.89, $p = 0.062$
Energy Levels[††, r]	4.53 ± 2.55	3.61 ± 1.94	1.38, $p = 0.168$	4.03 ± 2.06	3.50 ± 2.02	-1.57, $p = 0.120$
Sleep (hours/night)[†, s]	5.0 (3.5, 6.0)	4.5 (4.0, 6.0)	-0.02, $p = 0.984$	5.0 (4.0, 6.0)	5.0 (4.0, 6.4)	1.58, $p = 0.114$
Mood[††, t]	4.33 ± 2.47	3.98 ± 1.85	0.410, $p = 0.682$	4.29 ± 1.88	3.51 ± 1.65	-2.73, $p = 0.007$**
Readiness to RTW[††, u]	36.45 ± 25.73	25.58 ± 24.23	2.19, $p = 0.028$*	31.08 ± 28.52	18.90 ± 22.04	-3.77, $p < 0.001$***
BDI-II[9]	(*n* = 158)		0.25, $p = 0.616$	(*n* = 302)		19.66, $p < 0.001$***
Minimal-to-Mild	10 (25.0)	30 (75.0)		57 (71.3)	23 (28.7)	
Moderate-to-Severe	25 (21.2)	93 (78.8)		94 (42.3)	128 (57.7)	
BAI[10]	(*n* =90)		[f]0.07, $p = 0.723$	(*n* = 170)		1.50, $p = 0.220$
Minimal-to-Mild	3 (17.6)	14 (82.4)		20 (48.8)	21 (51.2)	
Moderate-to-Severe	11 (15.1)	62 (84.9)		49 (38.0)	80 (62.0)	
TSI-2 Factor Scores						
Trauma (TR)	(*n* = 76)		[f]4.12, $p = 0.070$	(*n* = 147)		21.62, $p < 0.001$***
Not Significant	6 (30.0)	14 (70.0)		30 (62.5)	18 (37.5)	
Clinically Elevated	6 (10.7)	50 (89.3)		23 (23.2)	76 (76.8)	
Self-Disturbance (SE)	(*n* = 66)		[f]0.46, $p = 0.737$	(*n* = 135)		12.60, $p < 0.001$***
Not Significant	9 (20.5)	35 (79.5)		39 (44.8)	48 (55.2)	
Clinically Elevated	3 (13.6)	19 (86.4)		7 (14.6)	41 (85.4)	
Externalization (EX)	(*n* = 66)		[f]0.02, $p = 1.00$	(*n* = 135)		1.09, $p = 0.296$
Not Significant	8 (17.8)	37 (88.2)		35 (36.8)	60 (63.2)	
Clinically Elevated	4 (19.0)	17 (81.0)		11 (27.5)	29 (72.5)	
Somatization (SO)	(*n* = 66)		0.27, $p = 0.601$	(*n* = 135)		6.76, $p = 0.009$**
Not Significant	7 (20.6)	27 (79.4)		42 (39.6)	64 (60.4)	
Clinically Elevated	5 (15.6)	27 (84.4)		4 (13.8)	25 (86.2)	

Appendix E: Table 3. (*cont'd*).

Subgroups	Physical Injury – Return-to-Work			TPI Only – Return-to-Work		
Variable	Yes Mean ± SD or *n* (%)	No Mean ± SD or *n* (%)	*t* or χ^2	Yes Mean ± SD or *n* (%)	No Mean ± SD or *n* (%)	*t* or χ^2
TSI-2 Subscale Scores						
TR – Dissociation	(*n* = 74)		2.23, *p* = 0.136	(*n* = 140)		2.77, *p* = 0.096
Not Significant	9 (22.0)	32 (78.0)		36 (40.0)	54 (60.0)	
Clinically Elevated	3 (9.1)	30 (90.9)		13 (26.0)	37 (74.0)	
TR – Avoidance	(*n* = 74)		f2.82, *p* = 0.164	(*n* = 140)		15.69, *p* < 0.001***
Not Significant	6 (27.3)	16 (72.7)		29 (55.8)	23 (44.2)	
Clinically Elevated	6 (11.5)	46 (88.5)		20 (22.7)	68 (77.3)	
TR – Intrusions	(*n* = 74)		f0.63, *p* = 0.470	(*n* = 140)		5.99, *p* = 0.014*
Not Significant	4 (22.2)	14 (77.8)		17 (53.1)	15 (46.9)	
Clinically Elevated	8 (14.3)	48 (85.7)		32 (29.6)	76 (70.4)	
TR – Hyperarousal	(*n* = 74)		f2.34, *p* = 0.150	(*n* = 140)		8.42, *p* = 0.004**
Not Significant	5 (27.8)	13 (72.2)		23 (52.3)	21 (47.7)	
Clinically Elevated	7 (12.5)	49 (87.5)		26 (27.1)	70 (72.9)	
SE – Depression	(*n* = 68)		f1.19, *p* = 0.274	(*n* = 134)		19.35, *p* < 0.001***
Not Significant	7 (23.2)	23 (76.7)		39 (52.9)	32 (47.1)	
Clinically Elevated	5 (13.2)	33 (86.8)		11 (16.7)	55 (83.3)	
SE – Insecurity	(*n* = 65)		f1.65, *p* = 0.309	(*n* = 127)		3.09, *p* = 0.079
Not Significant	10 (22.7)	34 (77.3)		34 (37.8)	56 (62.2)	
Clinically Elevated	2 (9.5)	19 (90.5)		8 (21.6)	29 (78.4)	
SE – Self-Reference	(*n* = 65)		f1.38, *p* = 0.334	(*n* = 127)		2.43, *p* = 0.119
Not Significant	9 (23.1)	30 (76.9)		32 (37.6)	53 (62.4)	
Clinically Elevated	3 (11.5)	23 (88.5)		10 (23.8)	32 (7625)	
EX – Anger	(*n* = 68)		0.88, *p* = 0.348	(*n* = 133)		0.14, *p* = 0.713
Not Significant	8 (21.6)	29 (78.4)		29 (35.8)	52 (64.2)	
Clinically Elevated	4 (12.9)	27 (87.1)		17 (32.7)	35 (67.3)	
EX – Tension Reduction	(*n* = 66)		f1.03, *p* = 0.512	(*n* = 128)		0.98, *p* = 0.322
Not Significant	9 (22.0)	32 (78.0)		31 (35.6)	56 (64.4)	
Clinically Elevated	3 (12.0)	22 (88.0)		11 (26.8)	30 (73.2)	

Appendix E: Table 3. (*cont'd*).

Subgroups	Physical Injury - Return-to-Work			TPI Only - Return-to-Work		
Variable	Yes Mean ± SD or *n* (%)	No Mean ± SD or *n* (%)	*t* or χ^2	Yes Mean ± SD or *n* (%)	No Mean ± SD or *n* (%)	*t* or χ^2
EX – Sex Disturbance	(*n* = 65)		[f]0.13, *p* = 1.00	(*n* = 127)		0.10, *p* = 0.750
Not Significant	9 (19.6)	37 (80.4)		36 (33.6)	71 (66.4)	
Clinically Elevated	3 (15.8)	16 (84.2)		6 (30.0)	14 (70.0)	
EX – Suicidality	(*n* = 66)		[f]0.63, *p* = 1.00	(*n* = 128)		6.18, *p* = 0.013*
Not Significant	9 (18.0)	41 (82.0)		35 (39.8)	53 (60.2)	
Clinically Elevated	3 (18.8)	13 (81.3)		7 (17.5)	33 (82.5)	
SO – Somatization	(*n* = 66)		0.27, *p* = 0.601	(*n* = 128)		6.76, *p* = 0.009**
Not Significant	7 (20.6)	27 (79.4)		42 (39.6)	64 (60.4)	
Clinically Elevated	5 (15.6)	27 (84.4)		4 (13.8)	25 (86.2)	

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. TPI = Traumatic psychological injury; RTW = Return-to-work; ICD-9 = International Classification of Diseases – 9; SF-36 = 36 Item Short-Form Health Survey; PDI = Pain Disability Index; Pain VAS = Pain Visual Analog Scale; BDI-II = Beck Depression Inventory - II; BAI = ; TSI-2 = Trauma Symptom Inventory-2; TR = TSI-2 Posttraumatic Stress Factor Scale; SE = TSI-2 Self-Disturbance Factor Scale; EX = TSI-2 Externalization Factor Scale; SO = TSI-2 Somatization Factor Scale.

[1] Number of days from the accepted injury on file to the time of admission to WCB-Alberta.

[2] Cumulative number of previous compensation claims accepted by WCB-Alberta on file.

[3] Level of TPI programming worker was first admitted to between the years of 2014 – 2016.

[4] Length of TPI programming from the date of first admission to date of final discharge, regardless of TPI Program Level.

[5] SF-36 subscale scores range from 0 to 100.

[6] Pain Disability Index scores are expressed as a percentage ranging between 0 and 100.

[7] Pain Visual Analog Scale scores are expressed as a percentage ranging between 0 and 100.

[8] Psychology Log subscale scores are expressed as an integer ranging between 0 and 10, with the exception of 'Sleep', in which workers indicate their average hours of sleep per night, and 'Readiness to RTW', in which workers indicate their readiness to RTW expressed as a percentage ranging between 0 and 100.

[9] BDI-II total scores fall into one of two categories: Minimal-to-Mild, Moderate-to-Severe.

[10] BAI total scores fall into one of two categories: Minimal-to-Mild, Moderate-to-Severe.

[11] TSI-2 Factor and Subscale total scores fall into one of two categories: Not Significant, Elevated.

[a] All demographic/administrative and injury-related variables, with the exception of education (*n* = 148), had complete data (*n* = 488).

[b] Physical Injury + TPI Sample: RTW = Yes (*n* = 39), RTW = No (*n* = 131); TPI Only Sample: Yes (*n* = 159), RTW = No (*n* = 159).

[c] Partial/Completed Highschool includes 'Grade 8 or Less' (*n* = 2).

[d] Physical Injury + TPI Sample: RTW = Yes (*n* = 15), RTW = No (*n* = 36).

[e] Physical Injury + TPI Sample: RTW = Yes (*n* = 14), RTW = No (*n* = 36).

[g] Physical Injury + TPI Sample: RTW = Yes (n = 17), RTW = No (n = 37).
[h] Physical Injury + TPI Sample: RTW = Yes (n = 17), RTW = No (n = 36).
[i] Physical Injury + TPI Sample: RTW = Yes (n = 17), RTW = No (n = 37).
[j] Physical Injury + TPI Sample: RTW = Yes (n = 17), RTW = No (n = 36).
[k] Physical Injury + TPI Sample: RTW = Yes (n = 13), RTW = No (n = 37).
[l] Physical Injury + TPI Sample: RTW = Yes (n = 17), RTW = No (n = 37).
[m] Physical Injury + TPI Sample: RTW = Yes (n = 17), RTW = No (n = 37).
[n] Physical Injury + TPI Sample: RTW = Yes (n = 13), RTW = No (n = 34).
[o] Physical Injury + TPI Sample: RTW = Yes (n = 16), RTW = No (n = 84); TPI Only Sample: Yes (n = 86), RTW = No (n = 113).
[p] Physical Injury + TPI Sample: RTW = Yes (n = 15), RTW = No (n = 83); TPI Only Sample: Yes (n = 58), RTW = No (n = 103).
[q] Physical Injury + TPI Sample: RTW = Yes (n = 15), RTW = No (n = 83); TPI Only Sample: Yes (n = 56), RTW = No (n = 102).
[r] Physical Injury + TPI Sample: RTW = Yes (n = 15), RTW = No (n = 83); TPI Only Sample: Yes (n = 58), RTW = No (n = 104).
[s] Physical Injury + TPI Sample: RTW = Yes (n = 19), RTW = No (n = 89); TPI Only Sample: Yes (n = 72), RTW = No (n = 109).
[t] Physical Injury + TPI Sample: RTW = Yes (n = 15), RTW = No (n = 83); TPI Only Sample: Yes (n = 57), RTW = No (n = 101).
[u] Physical Injury + TPI Sample: RTW = Yes (n = 31), RTW = No (n = 113); TPI Only Sample: Yes (n = 120), RTW = No (n = 132).
[f] Greater than 20% of cells within variable had an expected cell count of less than 5. Fisher's Exact χ^2 and p-value's are reported to correct for this.
† Variables violated assumptions of normality (skewness, kurtosis); Median (IQR) are reported rather than Mean (SD), Mann-Whitney U tests, rather than independent samples t-test's were conducted to examine associations of variables with return-to-work.
†† Variables violated sample size requirements for independent samples t-test's, Mann-Whitney U tests were conducted to examine associations of variables with return-to-work.

Appendix E: Table 4. Logistic Regression Modelling Return-to-Work Outcome – Full Sample (Non-Significant Results).

Variable	(β)	S.E.	Wald	*p*-value	Exp(β)	95% CI Exp(β)	Model Fit Statistics	
							-2 Log	R_2
Model 6 (*n* = 488)								
DV: RTW Outcome							526.25	0.322
Step 1 Age	0.003	0.009	0.13	= 0.720	1.00	0.99-1.02		
Step 2 Sex (Female)[a]	0.015	0.223	0.01	= 0.945	1.02	0.66-1.57		
Step 3 Comorbidity (Yes)[b]	-0.149	0.320	0.22	= 0.641	0.86	0.46-1.61		
Step 4 Program Length	-0.011	0.002	28.98	< 0.001***	0.989	0.985-0.993		
Step 5 PICD-9 (Pain)[c]	-0.556	0.263	4.46	= 0.035*	0.57	0.34-0.96		
Step 6 TPI Level T1 (L3)[d]	-1.739	0.241	52.08	< 0.001***	0.18	0.11-0.28		
Model 7a (*n* = 262)								
DV: RTW Outcome							211.87	0.450
Step 1 Age	-0.015	0.016	0.86	= 0.353	0.99	0.96-1.02		
Step 2 Sex (Female)[a]	-0.645	0.378	2.91	= 0.088	0.52	0.25-1.10		
Step 3 Comorbidity (Yes)[b]	0.220	0.504	0.19	= 0.662	1.25	0.46-3.35		
Step 4 Program Length	-0.013	0.003	15.01	< 0.001***	0.987	0.980-0.994		
Step 5 PICD-9 (Pain)[c]	-0.984	0.414	5.64	= 0.018*	0.37	0.17-0.84		
Step 6 TPI Level T1 (L3)[d]	-2.49	0.403	38.14	< 0.001***	0.08	0.04-0.18		
Step 7 PL-Energy	0.140	0.084	2.73	= 0.098	1.15	0.97-1.36		
Model 7b (*n* = 256)								
DV: RTW Outcome							208.47	0.449
Step 1 Age	-0.016	0.016	0.99	= 0.319	0.98	0.95-1.02		
Step 2 Sex (Female)[a]	-0.446	0.378	1.39	= 0.238	0.64	0.31-1.34		
Step 3 Comorbidity (Yes)[b]	0.166	0.507	0.11	= 0.744	1.18	0.44-3.19		
Step 4 Program Length	-0.014	0.004	15.40	< 0.001***	0.986	0.980-0.993		
Step 5 PICD-9 (Pain)[c]	-0.982	0.416	5.57	= 0.018*	0.38	0.17-0.85		
Step 6 TPI Level T1 (L3)[d]	-2.41	0.398	36.72	< 0.001***	0.09	0.04-0.20		
Step 7 PL-Mood	0.070	0.097	0.51	= 0.474	1.07	0.89-1.30		

Appendix E: Table 4 (*cont'd*).

Variable	(β)	S.E.	Wald	*p*-value	Exp(β)	95% CI Exp(β)	Model Fit Statistics	
							-2 Log	R_2
Model 7c (*n* = 201)								
DV: RTW Outcome							162.45	0.465
Step 1 Age	-0.018	0.018	0.97	= 0.324	0.98	0.95-1.02		
Step 2 Sex (Female)[a]	-0.372	0.421	0.78	= 0.377	0.69	0.30-1.57		
Step 3 Comorbidity (Yes)[b]	-0.409	0.652	0.39	= 0.530	0.66	0.19-2.38		
Step 4 Program Length	-0.014	0.004	11.45	= 0.001**	0.986	0.977-0.994		
Step 5 PICD-9 (Pain)[c]	-0.763	0.463	2.72	= 0.099	0.47	0.19-1.16		
Step 6 TPI Level T1 (L3)[d]	-2.295	0.425	29.21	< 0.001***	0.10	0.04-0.23		
Step 7 TSI-2 SE (Elev)[e]	-0.554	0.468	1.40	= 0.236	0.57	0.23-1.44		
Model 7d (*n* = 201)								
DV: RTW Outcome							160.63	0.474
Step 1 Age	-0.019	0.018	1.14	= 0.286	0.98	0.95-1.02		
Step 2 Sex (Female)[a]	-0.451	0.426	1.12	= 0.290	0.64	0.28-1.47		
Step 3 Comorbidity (Yes)[b]	-0.351	0.653	0.29	= 0.590	0.70	0.20-2.53		
Step 4 Program Length	-0.015	0.004	11.83	= 0.001**	0.985	0.977-0.994		
Step 5 PICD-9 (Pain)[c]	-0.524	0.483	1.18	= 0.277	0.59	0.23-1.53		
Step 6 TPI Level T1 (L3)[d]	-2.395	0.427	31.44	< 0.001***	0.09	0.04-0.21		
Step 7 TSI-2 SO (Elev)[e]	-0.902	0.515	3.07	= 0.080	0.41	0.15-1.11		
Model 7e (*n* = 214)								
DV: RTW Outcome							180.53	0.425
Step 1 Age	-0.009	0.017	0.29	= 0.592	0.99	0.96-1.03		
Step 2 Sex (Female)[a]	-0.329	0.396	0.69	= 0.406	0.72	0.33-1.56		
Step 3 Comorbidity (Yes)[b]	-0.558	0.606	0.85	= 0.357	0.57	0.17-1.88		
Step 4 Program Length	-0.010	0.003	8.93	= 0.003**	0.990	0.983-0.996		
Step 5 PICD-9 (Pain)[c]	-0.777	0.440	3.12	= 0.077	0.46	0.19-1.09		
Step 6 TPI Level T1 (L3)[d]	-2.262	0.400	32.00	< 0.001***	0.10	0.05-0.23		
Step 7 TSI-2 TR-D (Elev)[e]	-0.368	0.406	0.82	= 0.365	0.69	0.31-1.54		

Appendix E: Table 4 (*cont'd*).

Variable	(β)	S.E.	Wald	*p*-value	Exp(β)	95% CI Exp(β)	Model Fit Statistics	
							-2 Log	R_2
Model 7f (*n* = 214)								
DV: RTW Outcome							181.11	0.422
Step 1 Age	-0.011	0.017	0.40	= 0.592	0.99	0.96-1.02		
Step 2 Sex (Female)[a]	-0.344	0.398	0.75	= 0.406	0.71	0.33-1.55		
Step 3 Comorbidity (Yes)[b]	-0.596	0.602	0.98	= 0.357	0.55	0.17-1.79		
Step 4 Program Length	-0.010	0.004	8.39	= 0.003**	0.990	0.983-0.997		
Step 5 PICD-9 (Pain)[c]	-0.838	0.436	3.69	= 0.077	0.43	0.18-1.02		
Step 6 TPI Level T1 (L3)[d]	-2.270	0.401	32.00	< 0.001***	0.10	0.05-0.23		
Step 7 TSI-2 TR-I (Elev)[e]	-0.212	0.427	0.25	= 0.365	0.81	0.35-1.87		
Model 7g (*n* = 214)								
DV: RTW Outcome							179.66	0.429
Step 1 Age	-0.011	0.017	0.42	= 0.518	0.99	0.96-1.02		
Step 2 Sex (Female)[a]	-0.372	0.401	0.86	= 0.353	0.69	0.31-1.51		
Step 3 Comorbidity (Yes)[b]	-0.575	0.601	0.91	= 0.339	0.56	0.17-1.83		
Step 4 Program Length	-0.010	0.004	7.57	= 0.006**	0.990	0.984-0.997		
Step 5 PICD-9 (Pain)[c]	-0.779	0.438	3.16	= 0.075	0.46	0.19-1.08		
Step 6 TPI Level T1 (L3)[d]	-2.258	0.402	31.63	< 0.001***	0.11	0.05-0.23		
Step 7 TSI-2 TR-H (Elev)[e]	-0.519	0.397	1.71	= 0.191	0.60	0.27-1.30		

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. RTW Outcome = Return-to-Work Outcome at Time of Discharge; Program Length = Length of TPI Program from Admission to Discharge; PICD-9 Diagnosis = Primary ICD-9 Diagnosis; TPI Level T1 = Traumatic Psychological Injury Program Level on Admission (L1 = Level 1; L2 = Level 2; L3 = Level 3); PL-Energy = Psychology Log – Energy Levels; PL-Mood = Psychology Log – Mood Disturbance; TSI-2 SE = TSI-2 Self-Disturbance Factor; TSI-2 SO = TSI-2 Somatization Factor; TSI-2 TR-D = TSI-2 Trauma Factor – Dissociation Subscale; TSI-2 TR-I = TSI-2 Trauma Factor – Intrusions Subscale; TSI-2 TR-H = TSI-2 Trauma Factor – Hyperarousal Subscale.

[a] Reference Category = Male.

[b] Reference Category = No.

[c] Reference Category = Primary Mental Health Diagnosis.

[d] Reference Category = TPI Levels 1 & 2.

[e] Reference Category = Non-Significant.