

Improving Outcomes for Work-Related Concussions

A Mental Health Screening and Brief Therapy Model

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Objective: This study assessed the efficacy of a neurocognitive screening evaluation and brief therapy model to improve RTW outcomes for workers who experienced mild head injuries. **Methods:** Patients referred were evaluated using a neurocognitive and psychological screening battery. Work-focused cognitive behavioral therapy was provided when appropriate, addressing the role of negative emotional adjustment and functional sleep disturbance in prolonging recovery. **Results:** Average time to RTW was 7 weeks post-evaluation, despite workers being off an average of 10 months between injury and referral dates. Overall, 99% were released to full-duty work without restrictions or accommodations. **Conclusions:** This study demonstrates the favorable outcomes achieved via a structured, clinically driven program for workers who experience head-involved injuries, validating previous research on the importance of recognizing the role of psychological factors in prolonging concussion recovery.

Keywords: assessment, brief therapy, cognitive behavioral therapy, concussion, intervention, mental health, mild head injury, mild traumatic brain injury, postconcussional syndrome, return-to-work, screening, telehealth, work-related cognitive-behavioral therapy

There has been increased interest in both the immediate and long-term consequences of mild head injuries in basic and applied health sciences for the past few decades.^{1–6} To some extent, this interest has been fueled by the very public debate about the dangerousness of sports-related repeated mild head trauma in both children and adults.^{7–10} There has also been media interest in non-sports-related head trauma in adults^{11–13} especially the elderly due to falls, in military populations,¹⁴ and after motor vehicle accidents.^{15,16} The increased public attention to

these issues has also increased awareness and concern regarding mild head injuries in the workplace. Many patients with work-related mild head trauma show delayed recovery resulting in significant increases in both medical services utilization and work leave.^{16,17,20}

Work-related mild head injuries can be caused by various mechanisms of injury including motor vehicle accidents (MVs), falls, moving or falling objects, bodily movement collisions, and violence. In work-related injury cases,^{16,17} as with military/veteran,¹⁸ and litigated non-industrial cases, in addition to considerations about the most effective strategies for assessment and treatment, there are concerns about symptom validity and delayed recovery due to psychosocial and secondary gain factors.^{19,20} The management of head trauma in the workplace most often involves brief, acute care with an emphasis on screening out more serious injuries, reassuring anxious clients about the recovery process, and then prescribing over-the-counter analgesics, icepacks, and rest. For many, however, pain complaints persist along with vestibular, sleep, and cognitive features, and it is not clear whether these are directly due to the mechanical injury or to the subsequent affective and psychosocial response to the injury.²¹

The basic and applied science literature on mild brain injuries due to acceleration–deceleration, rotational forces, and shockwave trauma has clarified the nature of both immediate and delayed symptoms.^{4,11,13,21–25} Recently, however, many outcome studies have emphasized the etiological role of negative affect and distress in response to concussion injuries including anxiety, depressed mood, and post-traumatic stress symptoms, in prolonging recovery.^{41,45,47–49} It appears that the transition from concussion to postconcussional syndrome (PCS) can often be attributed to these psychosocial factors. Reassurance about recovery is an understandable rational response to the anxiety of clients with headaches, sleep disturbance, dizziness, tinnitus, and cognitive complaints; however, it appears that many will require mental health assessment and intervention to effectively resolve these persisting complaints.^{68–73}

Neuropsychological assessment to clarify the extent of cognitive features and psychosocial factors can be used effectively to rule out symptom magnification and secondary gain issues, as well as to provide additional objective data to clients about their subjective distress and cognitive complaints. Unfortunately, the timeframe for these comprehensive assessments can be very lengthy, delaying the initiation of mental health treatment and further prolonging the recovery process.^{16,19,22,25} Although neuropsychological assessment of individuals with complex postconcussion features may be necessary, initiation of mental health supports can be implemented much more quickly if the initial assessment is done using a brief screening assessment. For individuals with concussion injuries with primarily psychosocial features, mental health treatment can be initiated more quickly so that the recovery and return to work process can be expedited.

Current Best Practices in Assessment and Management of Concussion/mild traumatic brain injury (mTBI)

Assessment of Concussion/mTBI

Injuries to the head often present with signs and symptoms on initial physical examination, for example, contusions and

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Clinical significance: Work-related head injuries are a significant healthcare concern and recovery is often complicated by anxiety, mood, and sleep problems. The results of this study showed that a neurocognitive mental health screening combined with brief work-focused cognitive behavioral therapy significantly accelerated recovery and return-to-work rate for employees with concussions and postconcussion syndrome.

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lacerations of the face and scalp, ocular injuries, soft-tissue injuries, fractures, oral trauma (tooth and gum injury), muscle strains, and otolith organ injuries. It is critical that these injuries are identified for acute management but also documented to help differentiate neurophysiological versus functional etiology in the future.^{23,26,27}

The initial presentation of individuals with concussion can vary widely,^{13,23} making diagnosis and treatment planning more difficult.^{11,22,28–31} Injury to the brain may entail neurophysiological changes due to alterations in the intracellular,³² vascular, immune,³³ and blood–brain–barrier systems.^{34,35} Despite improvements in the basic science investigations of putative neurophysiological changes associated with physical force, standard brain imaging techniques have traditionally shown that mild trauma to the brain does not result in consistent findings on brain CT scans.^{36,37}

Many of the symptoms of concussion involve a high degree of subjectivity and overlap with each other (eg, balance problems and vertigo; irritability and depressed mood; and fatigue/lethargy and feeling “slowed down”). In addition, there are no clear guidelines as to how to differentiate or establish the causes of these symptoms. Nor are there guidelines regarding the usual onset, course, duration, or prognosis for these features, although many of those variables are discussed in the ONF Guidelines and in Silverberg et al.¹¹ Another complicating factor that is often discussed in the mTBI literature is the cooccurrence of anxiety and post-traumatic stress symptoms, which both overlap with and potentially exacerbate symptoms resulting directly from the physical injury, especially in MVAs and presentations involving assault. A concomitant or subsequent referral for mental health assessment may be warranted unless the initial evaluation is also being done by a mental health provider.^{28,38–41}

Sleep disturbance is commonly reported and if overlooked and not addressed during the acute phase of injury, sleep disturbances can linger and become a complicating factor in post-acute outcomes,⁴² that is, features of sleep deprivation can mask or exacerbate other cognitive features. Sleep disturbance is generally considered a sub-acute or chronic issue; however, and ongoing monitoring and management of sleep disturbance is often a necessary feature of care in the case of PCS.⁴³ Sleep disturbance, like many concussion symptoms, has been construed by some as either a direct effect of the mechanical force effects on the central nervous system,⁴⁴ or as a combination of neurophysiological and psychological adjustment features, such as anxiety and depressed mood.^{28,45} Fatigue or poor sustained task focus is a symptom that clearly overlaps with some of the affective features like depressed mood and irritability, as well as with both dizziness and sleep disturbance.

The one associated feature of acute concussion that has been most often identified as a possible early indicator of complications and delayed recovery is evidence of negative affect.^{46–49} Anxiety, irritability, mood disturbance, post-traumatic stress symptoms, and somatization resulting from the injury itself, or pre-existing mental health issues and vulnerabilities, have emerged as conditions most likely to complicate and prolong recovery.^{1,38,50–54} The assessment tools for acute care settings most recommended are the PHQ-9⁵⁵ for depressive symptoms; GAD-7;⁵⁶ and for post-traumatic stress symptoms, the PC-PTSD-5.⁵⁷ Regardless of the specific screening tool used, most outcome studies recommend using some standardized, norm-referenced assessment for emotional adjustment, post-traumatic stress, and premorbid or comorbid psychiatric conditions as part of the initial assessment.

Intervention and Management of Concussion/mTBI

As Prince and Bruhns⁵⁸ have found, few acute care settings have standardized protocols for the assessment and treatment of mTBI. McCrory et al.⁷ also report that although there are existing guidelines and methods for acute assessment and management, they

are not widely used, and many or most patients presenting with likely mTBI at trauma centers are not adequately evaluated and diagnosed. One of the goals of standardized assessment and care for individuals with mTBI in acute care settings is to anticipate and reduce the likelihood of the occurrence of more chronic features.

Polinder et al²³ proposed a multidimensional model of concussion and PCS which categorizes primary concussion features as somatic, emotional/behavioral, or cognitive symptoms expressed within the context of pre-injury factors, injury characteristics, overlapping symptoms, and post-injury factors, all of which contribute to the overall outcome. This model is well designed to help clarify the nature of various contributing factors in concussion and PCS but does not offer much clarification for the purposes of assessing and treating individual patients. From that perspective, Mittenberg, Canyock, Condit, and Patton,⁵⁹ ONF,²² and Zwibel et al,³⁷ concur that directing patients to rest and heal on their own is not likely to be effective: some level of support and direction regarding active recovery is recommended. Otherwise, sleep disturbance, post-traumatic and psychosomatic anxiety, depressed mood, and substance abuse issues have a greater chance of affecting outcomes.

Current Best Practices in Assessment and Management of Postconcussional Syndrome

Assessment of PCS

The diagnosis of PCS is a controversial one. One of the main problems has been translating the diagnosis into a set of standardized procedures for use in healthcare program settings and for research purposes, in which case researchers seem to prefer to use the term chronic or prolonged mTBI, rather than PCS (eg, de Freitas Cardoso,⁶⁰ Vikane et al,⁵¹ ONF,²² McInnes, et al⁶¹). Part of the problem for practitioners arises from the fact that in the ICD-10 system, concussion is a medical diagnosis in the category of physical injury, while PCS is considered a mental health disorder. This creates problems since, from a clinical management perspective, providers cannot simply add a “chronic,” modifier to concussion, but must consider adding a mental health diagnosis. As such there is some expectation of qualitative rather than quantitative differences between the two diagnoses, and yet the diagnostic criteria overlap, and the diagnostic criteria for PCS include that it results, at least in part, from a mTBI/concussion.⁶²

Additional problems with the current ICD-10 diagnostic criteria for PCS include the fact that the criteria require a history of loss of consciousness associated with the injury, which is not a commonly accepted diagnostic feature.^{7,22} Kashluba et al⁸⁴ have also demonstrated that the symptoms of PCS were effective in discriminating self-reports of symptoms in PCS patients compared with controls at 1-month post-injury, but the criteria were not able to accurately classify PCS from unaffected controls at 3 months post-injury. Boake et al⁸⁵ reported a similar problem with the ICD-10 criteria not being able to accurately distinguish patients who had CNS symptoms versus those with extracranial features. Another difficulty is created by the fact that the DSM-5 dropped PCS as a diagnosis from the APA nomenclature entirely and replaced it with Mild Neurocognitive Disorder.^{23,82}

Intervention and Management of PCS

The assessment of concussion and PCS will vary depending on the clinical setting, for example, outpatient medical or psychiatric clinic, occupational medicine clinic, urgent care setting, brain injury rehabilitation center, or hospital emergency department. Regardless of the site performing the assessments, the goals are consistent: relief of physical symptoms, resolution mental health concerns, and provision of guidance regarding return to work, school, and other activities.^{22,46,63,64} As most studies show, predictors of poor outcome are often evident in the acute phase but are often not the primary focus of

TABLE 1. Participant Demographics

Overall sample: N = 157; mean age = 48 years 10 months		
Mean level of education: 14.6 years		
Occupational level	n	%
Professional	6	3.8
Intermediate and management	9	5.7
Skilled labor and trades	35	22.3
Semi-skilled and clerical	67	42.7
Unskilled labor	40	25.5

Gender: Female: N = 84, mean age = 46 years 2 months, SD = 14:0 years. Male: N = 73; mean age = 51 years 8 months, SD = 14:0 years.

assessment or therapy.^{51,65} It is understandable that providers in the acute care setting prioritize assessment of physical and neurological injury (head and brain), and provide reassurance, support, and advice to reduce one’s physical and cognitive demands for several weeks. Unfortunately, it is during this phase that anxiety, dysphoria, post-traumatic re-experiencing, sleep disturbance, somatic concerns, and catastrophic ideation set in.^{8,41,51,65–68}

As a result of extensive and careful review of numerous longer term outcome studies, researchers such as Vikane et al,⁵¹ Polinder et al,²³ Moore et al,⁶⁹ Silverberg and Iverson,⁶⁸ and Al Sayegh et al,⁷⁰ have emphasized the need to view concussion as both a physical and psychological trauma from the outset. Although it has been common to do so in situations in which there was obvious evidence of emotional trauma (eg, assaults), recent studies have examined the benefits of early assessment and treatment of negative affect features of mTBI to reduce the likelihood of PCS or prolonged symptoms using cognitive behavioral therapy (CBT)⁷¹ modified versions of CBT,^{70,72,73} or psychological treatment in general.^{38,69}

Although the types and severity of concussions and prolonged mTBI sequelae do not differ significantly between work and non-work settings,¹⁶ there are some additional concerns in helping those with workplace injuries.⁷⁴ Employment status and employment outcome have been a concern for patients with mild to moderate TBI according to clinicians and researchers in general practice settings.^{19,75,76} In workers compensation settings, however, there is additional focus on work-related functional recovery due to the potential financial and compensation issues,^{51,74} as well as the immediate benefit for both employee and employer in facilitating stay-at-work and timely return-to-work.⁷⁷

Lilley et al⁷⁸ directly addressed the question of whether no-fault workers compensation systems such as those in the United States may influence patient outcomes after mTBI and perhaps predispose individuals to report higher rates of disability or slower recovery, as has been discussed by Silver.⁷⁹ Subsequent studies have shown high risks for delayed recovery from work-related concussions,^{17,74} but not much evidence that wage indemnity itself played much of a role in overall outcome.¹⁶ In Terry et al,¹⁶ which was similar to Chu et al,⁷⁴ it was found that the best predictors of favorable return-to-work status were decreased PCS features and improved neurocognitive functioning, rather than compensation issues.

A study by Zahniser et al,⁸⁰ has important implications for proactively addressing functional limitations in both general and work-related mTBI injuries. As other researchers have suggested, resilience and adaptive recovery following mTBI is supported by ameliorating symptoms of depressed mood and anxiety in addition to other physical rehabilitation strategies. In fact, the evidence overall strongly suggests that functional recovery may be undermined or stalled by negative emotional responses to injury, although

the residual physical symptoms and psychological features interact and tend to exacerbate each other.^{65,81}

In view of the above-referenced research, this study was designed to evaluate and quantify the impact of a novel assessment and management model addressing psychological features in a population of referred workers compensation claimants who sustained mild head injuries.

METHODS

The current study is a multiple time-line design within an integrated care model combining outpatient medical and mental health services to address delayed recovery from mTBI and PCS for 157 injured employees (Table 1) receiving workers compensation benefits. This analysis was approved by the Sterling Institutional Review Board. Patients were initially seen for acute assessment and care in emergency or urgent care outpatient settings, or by their occupational medicine physicians at an employee urgent care setting. Primary treating physicians referred patients who exhibited significant mental health factors that were complicating their recovery to a national behavioral health provider organization for mental health assessment and/or treatment; pre-referral diagnoses are listed in Table 2. The mechanisms of injury are presented in Table 3. The mean length of time post-injury and prior to the initial referral is presented in Table 5. The mean number of days absent from work during recovery (“lost workdays,” LWDs), which accrued following the initial DOI, and prior to the assessment by the network psychologist are presented in Table 6.

For some patients, medical treatment remained the responsibility of the occupational medicine, neurology, or psychiatry provider, while mental health services were provided on an adjunctive basis. For most of the patients, however, the primary physicians requested a transfer of care to a mental health provider, and their cases were managed as workers compensation psychiatric injury cases for the remainder of their claims. When a neurocognitive screening evaluation (NCSE) was indicated, background data including medical, educational, and employment records were reviewed, the examining psychologist or neuropsychologist completed the evaluation and then reviewed testing results and assessment report with a consulting neuropsychologist. The outcome of

TABLE 2. Pre-Referral Diagnoses

ICD-10 Code	Description	n	%
Primary referral diagnosis			
F07.81	Postconcussional syndrome	69	43.9
S06.0X0A	Concussion without loss of consciousness	42	26.8
S06.0x1A	Concussion with loss of consciousness < 30 minutes	15	9.6
F43.2X	Adjustment disorder	10	6.4
G44.309	Post-traumatic headache or other pain condition	10	6.4
R41.1/2/3	Unspecified cognitive disorder	8	5.1
F43.1	Posttraumatic stress disorder	3	1.9
Secondary diagnoses (includes multiple diagnoses)			
S06.0X0A	Concussion without loss of consciousness	79	33.9
S00.93XA/D	Head contusion	66	28.3
F07.81	Postconcussional syndrome	23	9.9
S06.0x1A	Concussion with loss of consciousness < 30 minutes	21	9.0
F43.2X	Adjustment disorder	14	6.0
G44.309	Headache or other pain condition	13	5.6
F43.1	Post-traumatic stress disorder	9	3.9
F06.4/F41.9	Anxiety disorder	4	1.7
F33.1/F32.2	Major depression	4	1.7

TABLE 3. Mechanisms of Injury Recorded in Doctor’s First Report of Injury (DFR)

Mechanism of Injury (N = 157)	n	%
Slip, trip, or fall	69	41.4
Struck by moving or falling object	32	19.1
Struck head during movement	31	17.2
Motor vehicle accident	20	12.7
Assault	6	9.6

the evaluation, including diagnosis and recommendations were communicated to the referral source.

The NCSE protocol was designed to be applicable to individuals presenting with either recent, sub-acute concussion sequelae, or later-developing PCS features, and included measures of both self-reported postconcussion symptoms, including psychopathology (depressed mood, anxiety, and PTSD), as well as computer-administered measures of neurocognitive functioning. Some of the patients were referred after being diagnosed with PCS, but most were either pre-PCS (ie, delayed, or prolonged recovery from mTBI), or had other medical diagnoses (eg, head contusion, post-traumatic headache, cervicgia).

The NCSE reports included treatment recommendations. For cases in which the patient was referred for Health Behavior Assessment and Intervention (HBAI) services, the referral medical diagnosis was used and for some of those cases, HBAI intervention services followed the NCSE. HBAI refers to health psychology services that are provided using only a medical diagnosis, without a defined mental health diagnosis. In other cases, the provider determined there was a mental health diagnosis, such as PCS, and typically, short-term, work-focused cognitive behavioral therapy (W-CBT) was provided.

Treatment included three to six sessions of individual therapy. All patients received some relaxation and mindfulness training, as well as coaching on returning to baseline activity levels, including graduated exposure for work-related anxiety-avoidance, or trauma-avoidance features, as well as guideline-based support regarding sleep disturbance and pain management as an adjunct to the primary care services. The emphasis in these cases was placed on increasing activity and decreasing avoidance, deconditioning, and/or depressed mood features, along with psychoeducation regarding concussion recovery, self-monitoring, and increasing self-efficacy and social support.

Procedure

The study was a retrospective review of data collected over a period of 25.5 months (01/31/2019 to 03/12/2021) on claims referred from California and Florida. The injured workers who were referred

to the network were on leave from work at the time of the referral due to their mTBI/PCS. All the evaluators were fully licensed, credentialled clinical psychologists. The NCSE and any subsequent treatment services were subject to ongoing quality assurance oversight by the organization’s senior licensed neuropsychologist.

Standardized NCSE Assessment Protocol

The goal of the NCSE was to provide a more in-depth assessment than could be offered by a mental-status screen (eg, MMSE, or MOCA) or self-report measures alone, providing adequate data to make initial treatment decisions (including whether to refer for further assessment), while also evaluating emotional status (anxiety, mood, and PTSD features), and collecting data on symptom validity. The NCSE was designed to be administered by a general clinical psychologist in an outpatient setting, and via telehealth if needed. This turned out to be more useful than expected given the COVID-19 pandemic triggered a much higher demand for on-line, remote assessment procedures.

The core instruments that were chosen for the NCSE included the following: CNS-VS, Neurobehavioral Symptom Inventory, Minnesota Multiphasic Personality Inventory (MMPI-2-RF), PTSD Checklist for DSM-5 (PCL-5), and the Demographic Estimate of Pre-Morbid IQ (DEP-IQ). Brief descriptions and source information for each of these psychometric tools are provided in Appendix A, <http://links.lww.com/JOM/A977>.

In addition to the standardized assessment tools listed above, the initial assessment protocol included a substance abuse screening, a mental-status checklist, and a semi-structured interview.

Aside from a structured mental-status form, the evaluators also completed detailed observations of the client’s presentation, test-taking behavior, and compliance/effort during the evaluation, including behavior/activity, speech, attitude, mood, affect, thought process, perceptual disturbances, memory/cognitive, insight, and judgment.

Causation

A unique feature of work-related assessments is the necessity to clarify the extent to which the condition arose from and occurred during the course of employment, which in this study, was limited to the occurrence of a closed head injury. Although all cases had been accepted as industrial claims for the initial referral diagnosis, cases for which additional mental health diagnoses, including PCS, were to be considered or were diagnosed, providers were asked to offer an opinion as to whether the current mental health condition continued to be predominately due to the initial injury. This determination did not affect the diagnosis or treatment recommendations in general, but the feedback to the referral sources included a causation opinion, which in turn affected the extent to which the individual might need to seek treatment using

TABLE 4. Mean Length of Time From Date of Injury to Date of Referral for NCSE by Referral Primary Diagnosis and Gender

	N	Days	SD	Weeks	Range (days)	Range (weeks)
Total	157	290.4	312.3	41.5	10–1484	1.4–212.0
Female (all dx)	84	207.4	289.8	29.6	10–1059	1.4–151.2
Male (all dx)	73	352.1	360.3	50.3	16–1484	2.3–212.0
Psych dx (all genders)	82	262.3	296.5	37.4	11–1188	1.6–169.7
Psych dx (female)	47	251.9	293.5	36.0	11–1412	1.6–201.7
Psych dx (male)	35	268.0	222.4	38.1	39–912	5.6–130.3
Medical dx (all genders)	75	307.2	364.0	43.9	10–1484	1.4–212.0
Medical: dx (female)	32	133.0	173.7	19.0	15–729	2.1–104.1
Medical dx (male)	43	421.0	415.1	60.1	10–1484	1.4–212.0

NCSE, neurocognitive screening evaluation.

TABLE 5. Average Number of LWDs From Date of Injury to Date of Referral for NCSE

	<i>N</i>	Mean	SD	Range	Median
Total	157	202.3	237.1	7–1059	117
Female (all dx)	84	143.2	206.6	7–1059	110
Male (all dx)	73	244.4	257.8	11–848	144
Psych dx (all)	82	182.3	206.7	6–840	147
Psych dx (female)	47	174.9	202.6	7–1001	115
Psych dx (male)	35	187.4	153.8	25–646	181
Medical dx (all)	75	214.3	252.9	7–1059	176
Medical dx (female)	32	91.0	122.0	10–516	54
Medical dx (male)	43	293.6	291.4	7–1059	179

LWDs, lost workdays; NCSE, neurocognitive screening evaluation.

private health care resources. Obviously, causation was not a consideration for cases in which there was no diagnosis, or a determination of malingering was made.

Assessment Feedback

The outcome results reported in this study were collected based on mental health assessment and interventions that were provided by clinical psychologists working in private practice settings. The assessment report written by the psychologist was reviewed with a consulting neuropsychologist to ensure that the client’s needs were adequately addressed by the assessment, and that the recommendations were consistent with best practice guidelines. If the results of the screening assessment indicated any significant, credible neurocognitive complaints, the referring physician and administrative team were notified immediately, and the primary treating physician was given written feedback as soon as possible. Some clients were given mental health diagnoses in addition to the mTBI diagnoses made by the referring occupational medicine physicians. These diagnoses were reviewed and assessed in the NCSE and if present, were addressed in the W-CBT treatment plan.

Work-Focused CBT with Psychoeducation and Support

The primary treatment approach was to focus on the work-related injury features, prioritizing those that restricted work status and return-to-work planning. W-CBT, combined with gradually increased activity rates, including daily exercise and social activities, was used to address anxiety and avoidance, catastrophic ideation, somatic concerns, sleep-disturbance, depressed mood, social withdrawal, inactivity, and fatigue.

RESULTS

There were 157 patients, 84 females and 73 males, who ranged in age from 22 to 78 years. Occupational level and average age by gender are presented in Table 1. The most common pre-referral diagnosis was postconcussional syndrome (*n* = 69), followed by concussion (*n* = 42), see Table 2. The most common mechanism of injury for work-related concussions was slip and fall,

or trip and fall (*n* = 69), followed by being struck by a moving or falling object (*n* = 32), see Table 3.

Pre-Referral Timeline

The mean duration of time from the date of injury to the date of the referral for mental health evaluation and treatment overall was 290.4 days, or just over 10 months. Most patients were not working during this time, or if they had returned to work, they did so briefly and were then off work again. No patients included in this study were working in any capacity at the time of referral for services. There was a wide range of duration of time prior to referral, from a low of 10 days, to a high of just over 4 years. There was a tendency for female patients to be referred somewhat sooner (mean = 30 weeks) than males (mean = 50 weeks), see Table 4 and Figure 1. The number of LWDs was also calculated for each patient, showing a very high number of LWDs prior to referral, with a mean of 202 days (see Table 6, and Fig. 2).

Post-Referral Timeline

The mean duration of time from the date of referral to the initiation of the NCSE—first date of mental health services—was just over a month (31.5 days), with a mean additional number of LWDs during that timeframe of 20.5 days. This referral time lag added only marginally to the overall duration of recovery time and LWDs from date of injury to date of initiation of mental health services (see Tables 7 and 9). The result though was that patients were off work for a mean total of 45 weeks, with a mean number of LWDs of 220.

Diagnoses and Treatment Recommendations

The diagnoses that were made based on the NCSE’s are reported in Table 8. Overall, the most frequent single diagnosis was PCS (*n* = 47), but there were fewer who met diagnostic criteria for PCS after the NCSE than were initially referred (*n* = 69). Of the clients who were given an initial primary diagnosis of PCS, there were only 25 (36.2%) who retained that diagnosis after the NCSE. Many of the clients who were referred with medical-only diagnoses (*n* = 75) received mental health diagnoses in the NCSE (*n* = 37), the

TABLE 6. Mean Total Length of Time From Date of Injury to Date of NCSE

	<i>N</i>	Days	SD	Weeks	Range (DAYS)	Range (WEEKS)
Total	157	318.1	242.3	45.4	21–1529	3.0–218.4
Female	84	245.5	235.6	35.1	28–1223	4.0–174.7
Male	73	381.2	239.6	54.5	30–1529	4.3–218.4

NCSE, neurocognitive screening evaluation.

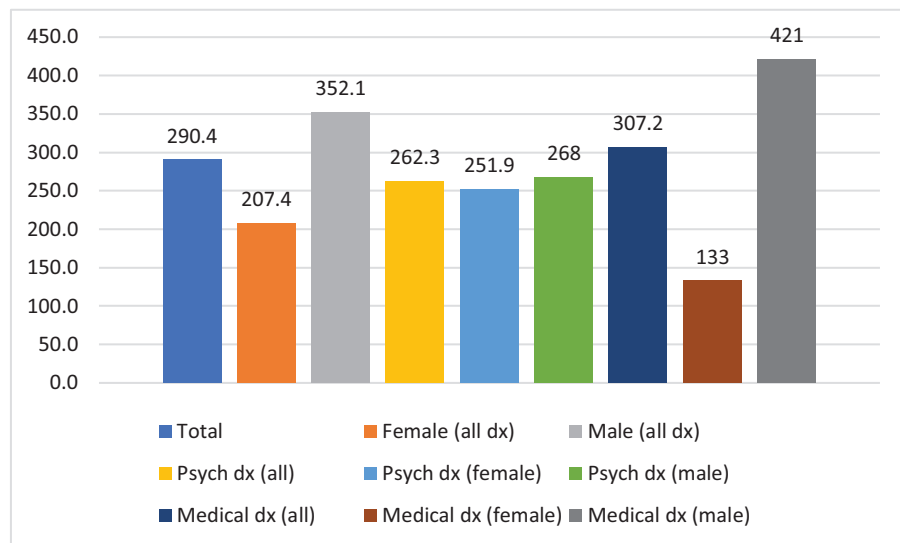


FIGURE 1. Mean length of time from date of injury to date of referral for NCSE (days). NCSE, neurocognitive screening evaluation.

most frequent of which was PCS ($n = 19$). As a result, although 44 clients previously diagnosed with PCS were given a different mental health diagnosis ($n = 27$), or no work-related diagnosis ($n = 17$), 25 of the initial PCS diagnoses were confirmed and 22 were added, most of whom had been previously given medical-only diagnoses ($n = 19$).

None of the patients were found to meet diagnostic criteria for PTSD, which was somewhat unexpected given that other researchers have found that PTSD is not an uncommon comorbid diagnosis in the mTBI/PCS population in general.^{40,57} It is possible that PTSD may be more common in other populations (eg, veterans, MVA clients), but even in the six cases in which the mechanism of injury was assault, the injured workers did not meet criteria for a diagnosis of PTSD. This finding is likely to reflect the duration of time between the date of injury and date of the NCSE, a mean of which was over 11 months (see Table 9). The long delay from date of injury to date of referral also resulted in many claimants

diagnosed initially with an adjustment disorder having their diagnoses revised since those diagnoses expire after six months unless the stressor is continuous or recurring, per DSM-5 criteria.⁸² Clients who did not meet diagnostic criteria for a mental health diagnosis either prior to or after the NCSE ($n = 19$), but whose recovery may have been adversely affected by biopsychosocial behavioral health issues were offered behavioral health services under the HBAI CPT codes, and their primary diagnosis remained the initial medical diagnosis.

Many clients referred for the NCSE were found to have no mental health diagnosis, and they had been released at maximum medical improvement (MMI) by their primary treating physician, so they had no diagnosis at all ($n = 31$). This was based on the absence of self-reported and psychometric data indicating current significant neurocognitive, psychopathological, or subjective distress features. The finding of no diagnosis and no treatment recommendation was communicated to the clinical and administrative referral sources. A

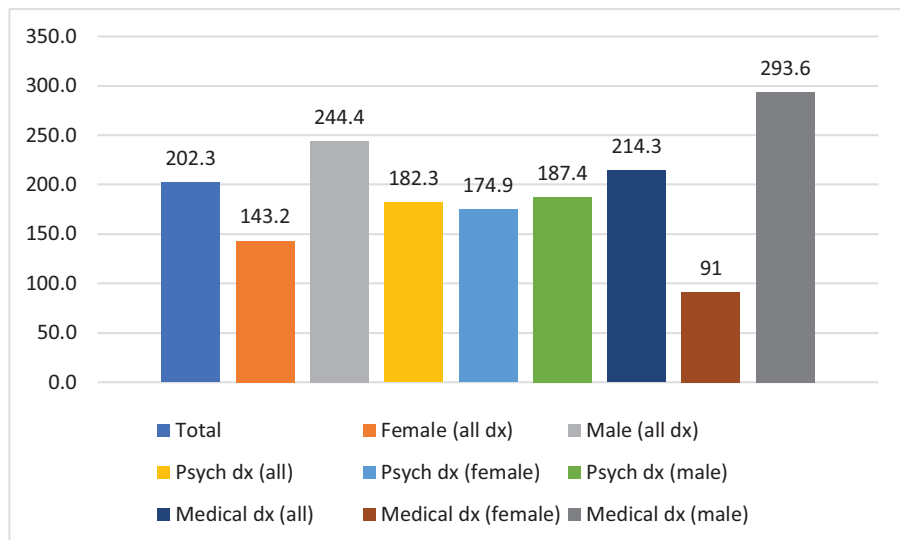


FIGURE 2. Mean LWDs from date of injury to date of referral for mental health services. LWDs, lost workdays.

TABLE 7. Average Total of LWDs From Date of Injury to Date of NCSE

	<i>N</i>	Mean	SD	Range	Median
Total	157	220.1	173.0	16–1090	189
Female	84	165.3	161.2	9–598	283
Male	73	265.2	171.0	20–1119	148

LWDs, lost workdays; NCSE, neurocognitive screening evaluation.

joint decision was then made by the psychologist, claimant, referring provider, and claims administrator to consider the case to be at MMI for the mental health portion of the claim as well as the medical portion.

The total number of clients who were determined to be malingering, as opposed to simply being at MMI, was relatively low (*n* = 16, 10.2%), which is generally consistent with findings from some researchers,⁷⁸ but possibly lower than suggested by others.²⁰ It is possible that the number may have been affected by the pre-referral timeline: the long duration from date of injury to referral may have decreased the likelihood that individuals would continue to actively feign symptoms. For the purposes of subsequent data analysis to compare the pre-referral and post-referral timelines and outcomes, patients were divided into subgroups based on their initial primary diagnoses which were either medical (ICD-10 S-codes or G-codes, *N* = 75), or mental health (ICD-10 F-codes, *N* = 82). The specific mental health and physical conditions diagnosed and treated are presented in Table 9.

Clinical Outcome Post-NCSE

All 157 individuals referred for NCSE and brief mental health therapy were seen for at least one assessment visit during which the NCSE was administered. Based on the outcome of the assessment, clients were either determined to be at MMI and discharged, or treatment recommendations were made for either mental health or HBAI services. In a few cases, further assessment

was recommended. The most common outcome was a recommendation for brief W-CBT to address work-related mental health conditions: PCS, somatoform, mood, anxiety, or adjustment disorders (combined *n* = 98, see Table 9).

As mentioned above, there were also several clients (*n* = 19, 12.1%) who were not given a mental health diagnosis by either the referral source or the psychologist doing the NCSE, but biopsychosocial factors were identified which appeared to be affecting the individual’s recovery, that is, poor sleep patterns, inactivity, or other health behaviors, or anxiety, depressed mood, psychosomatic or post-traumatic symptoms which did not rise to the level of warranting a mental health diagnosis. In those cases, the client, referring physician, treating psychologist, nurse case manager, and claims administrator agreed to address interfering factors through HBAI services. In other cases (*n* = 9, 5.7%), the clients were found to have a mental health condition that was not causally related to the concussion injury, and they were given the option of being referred for non-occupational mental health services. Those clients were also considered to be at MMI due to the lack of evidence of physical or mental health work-related symptoms or limitations. In total then, of the 157 clients who were referred for NCSE, 117 (74.5%) were recommended to receive mental health services: 98 were given a recommendation for brief W-CBT and 19 were recommended for HBAI.

Of the 98 clients who were recommended to participate in brief W-CBT, 22 (22%) declined services, so there were 76 clients

TABLE 8. Pre-Referral Initial Diagnosis and Post-NCSE Diagnosis

Pre-referral Diagnosis	NCSE Diagnosis	<i>n</i>	%
All (<i>N</i> = 157)	PCS	47	29.9
	No diagnosis or malingering	31	19.7
	Adjustment, anxiety/dep mood	30	19.1
	Somatoform disorders	21	13.4
	Concussion	13	6.4
	Not work-related mental health	9	5.7
	Other medical condition	6	3.8
PCS (<i>n</i> = 69)	PCS	25	36.2
	No diagnosis or malingering	13	18.8
	Adjustment, anxiety/dep mood	16	23.1
	Somatoform disorders	11	15.9
	Not work-related mental health	4	5.8
Adjustment disorders and other psych (<i>n</i> = 13)	PCS	3	23.1
	No diagnosis or malingering	3	23.1
	Adjustment, anxiety/dep mood	5	38.5
	Somatoform disorders	1	7.7
	Not work-related mental health	1	7.7
Concussion or other medical Dx (<i>n</i> = 75)	PCS	19	25.3
	No diagnosis or malingering	15	20.0
	Adjustment, anxiety/dep mood	9	12.0
	Somatoform disorders	9	12.0
	Not work-related mental health	4	5.3
	Concussion or other medical	19	24.0

NCSE, neurocognitive screening evaluation; PCS, postconcussional syndrome.

TABLE 9. Specific Mental Health Diagnoses From NCSE and Physical Injury Diagnoses From Referral Source Offered Treatment (N = 117)

ICD-10 Code	Description	n	%
Mental health disorders (n = 98)			
F07.81	Postconcussional syndrome	47	48.0
F32.1/2	Major depressive disorder, single episode	4	4.1
F33.9	Major depressive disorder, unspecified	9	9.2
F34.1	Dysthymic disorder	1	1.0
F45.1	Undifferentiated somatoform disorder	14	14.3
F45.9	Somatoform disorder, unspecified	5	5.1
F45.8	Other somatoform disorders	2	2.0
F45.41/42	Pain disorder, related to psychological factors	3	3.1
F43.23	Adjustment disorder, mixed	12	12.2
F43.21	Adjustment disorder with depressed mood	8	8.2
F43.22	Adjustment disorder with anxiety	7	7.1
F43.9	Reaction to severe stress, unspecified	3	3.1
F41.1	Generalized anxiety disorder	2	2.0
Medical conditions (n = 19)			
G44.309/329	Post-traumatic headache	4	21.1
R41.1/2/3	Amnesia	3	15.8
R41.9/82	Unspecified cognitive disorder	4	21.1
S06.0X0A	Concussion without loss of consciousness	5	26.3
S06.0X1	Concussion with loss of consciousness < 30 minutes	3	15.8

NCSE, neurocognitive screening evaluation.

who accepted the recommendation. Of the medically diagnosed HBAI services clients, all 19 accepted the recommendation for treatment, but only 12 attended at least one therapy session. It should be noted that during the first 12 months of this study, 67% of the therapy was being provided in-person, and one-third was being provided via telehealth. During the second 12 months, beginning in March of 2021, COVID-19 pandemic restrictions were in place, and 100% of the assessment and treatment services were provided via telehealth.

The decision of some clients not to participate in mental health services recommended by the psychologist after completing the NCSE was communicated to the primary treating provider and claims administrator, and they had their claims subsequently placed at MMI. In the group of mental health clients who were accepted the recommendation for brief W-CBT, 18 either did not schedule or did not attend therapy. In those cases, the decision was also made to place them at MMI, and they were discharged from mental health services. Ultimately, 51 of the W-CBT clients, and 12 of the HBAI clients attended at least one therapy session. The mean number of therapy sessions provided for the whole group (N = 157) was only 1.5 (SD = 3.7), but that was due to the large number of clients who did not participate in therapy at all (N = 94). For those who did

receive either psychotherapy or HBAI services, the mean number of sessions was 4.7 (SD = 3.0), with a range of 1 to 20. Female clients attended therapy somewhat more often (6.5 sessions) than male clients (2.5 sessions); however, this seemed to be specific to psychotherapy. Females who received mental health services attended a mean of 5.5 sessions, compared with males who attended only 3.5 sessions, while for HBAI services, males attended a mean of 8.2 sessions, which was more than female clients attended (4.5). Of the 63 clients who participated in either brief W-CBT therapy or HBAI services, all of them satisfactorily completed therapy and were discharged at the time of MMI and return-to-work (RTW), or soon afterwards, with no further recommendations. As noted above, there were six clients who initially returned to work on modified duty for a mean of 2 weeks (range: 1 to 4 weeks) but were also subsequently placed at full duty by the primary treating physician or treating psychologist and were subsequently discharged at MMI.

Return to Work Data

The average length of time from the date of initiation of mental health services (date of the NCSE) to the date of return-to-work on full or modified duty is reported in Table 10. There were only six cases (3.8%) in which there were work limitations

TABLE 10. Mean Length of Time From Date of NCSE to Date of RTW by Diagnosis and Gender

	N	Days	SD	Weeks	Range (Days)	Range (Weeks)
Overall total	157	47.2	55.2	6.7	2–147	<1–21.0
Female (all diagnoses)	84	47.7	57.4	6.8	2–141	<1–20.1
Male (all diagnoses)	73	46.8	51.5	6.9	2–147	<1–21.0
Psych diagnoses (all genders)	82	44.1	52.3	7.6	2–141	<1–20.1
Psych diagnoses (female)	47	48.0	57.6	6.8	2–135	<1–19.3
Psych diagnoses (male)	35	46.2	62.2	8.9	2–141	<1–20.1
Medical diagnoses (all genders)	75	49.0	68.1	7.0	2–147	<1–21.0
Medical diagnoses (female)	33	39.9	62.1	5.7	2–112	<1–16.0
Medical diagnoses (male)	42	55.6	71.5	7.9	2–147	<1–21.0

NCSE, neurocognitive screening evaluation; RTW, return-to-work.

TABLE 11. Average Number of LWDs From Date of NCSE to Date of RTW by Diagnosis and Gender

	<i>N</i>	Mean	SD	Range	Median
Total	157	33.7	36.4	0–124	21
Female (all diagnoses)	84	33.1	38.0	0–110	22
Male (all diagnoses)	73	32.4	34.6	0–124	20
Psych diagnoses (all genders)	82	28.0	32.9	0–129	15
Psych diagnoses (female)	47	31.5	36.6	0–187	17
Psych diagnoses (male)	35	29.0	45.0	0–221	10
Medical diagnoses (all genders)	75	33.0	43.6	0–273	12
Medical diagnoses (female)	33	26.5	40.6	0–268	10
Medical diagnoses (male)	42	36.7	47.2	0–294	18

LWDs, lost workdays; NCSE, neurocognitive screening evaluation; RTW, return-to-work.

TABLE 12. Student’s Pair-Wise *t* Tests of Differences Between Pre-Referral and Post-Referral LWDs by Diagnosis and Gender

	<i>N</i>	<i>df</i>	<i>t</i> Value	<i>p</i> Value
Total	157	156	2.45	<0.01
Female (all diagnoses)	84	83	4.87	<0.01
Male (all diagnoses)	73	72	3.48	<0.01
Psych diagnoses (all genders)	82	81	7.98	<0.01
Psych diagnoses (female)	47	46	8.97	<0.01
Psych diagnoses (male)	35	34	1.30	<0.01
Medical diagnoses (all genders)	75	74	4.58	<0.01
Medical diagnoses (female)	33	31	1.94	<0.01
Medical diagnoses (male)	42	41	1.83	<0.05

LWDs, lost workdays.

identified and temporary accommodations were requested in the return-to-work recommendations. In those cases, the mean duration of modified duty was 2 weeks. There were also six cases (3.8%) which were not considered for return to work immediately but were recommended to have further medical and/or neuropsychological assessment. This determination was made by an interdisciplinary team (psychologist, referring physician, nurse case manager, and neuropsychologist quality assurance advisor) reviewing the client’s status and needs, including the NCSE results, medical records, subjective observations, and other objective assessment data.

Overall, 155 of the 157 patients (98.7%) returned to work at full duty without further restrictions or accommodations. Table 10 shows the mean length of time from the date of mental health assessment until return-to-work date which was significantly shorter than the length of time from the date of injury to the date of referral (see Table 4) for mental health services (paired Student’s *t* [156] = 2.56, *P* < .01), and the average number of LWDs was also significantly lower (paired Student’s *t* [156] = 2.45, *P* < .01; see Table 11). The duration of time prior to referral was not correlated with duration of treatment or length of time to RTW after the

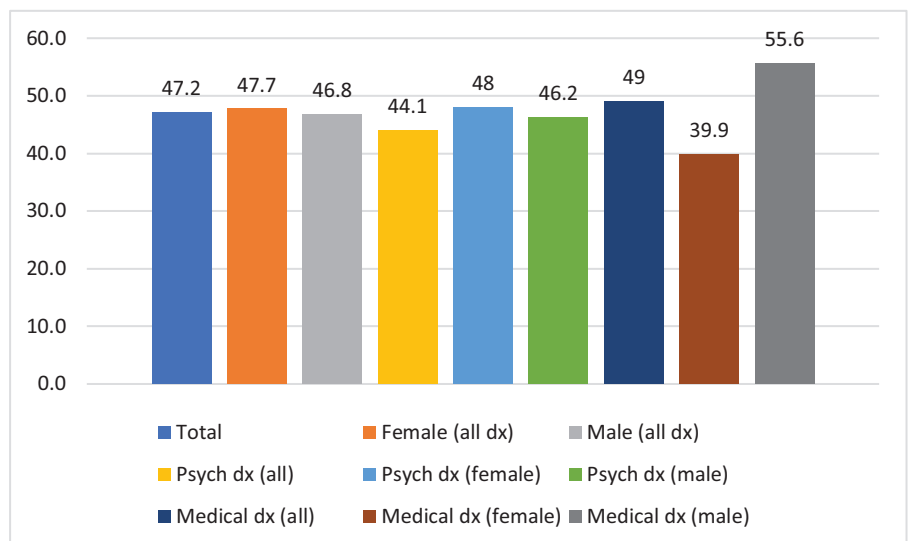


FIGURE 3. Mean length of time from date of NCSE to date of RTW (days). NCSE, neurocognitive screening evaluation; RTW, return-to-work.

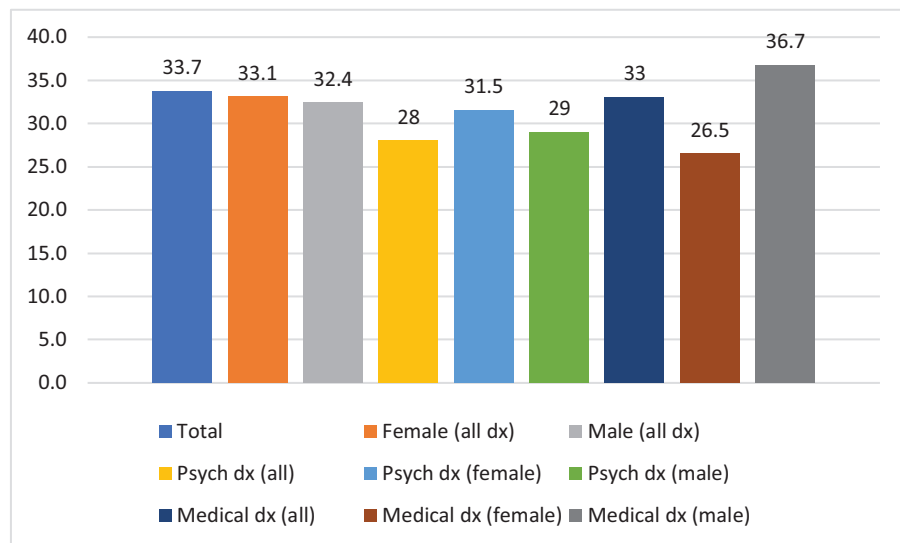


FIGURE 4. Mean LWDs from date of NCSE to date of RTW by diagnosis and gender. LWDs, lost workdays; NCSE, neurocognitive screening evaluation; RTW, return-to-work.

initiation of mental health services ($r [156] = -.02, NS$). Gender ($r [156] = .10, NS$), pre-referral diagnosis ($r [156] = .09, NS$) and post-assessment diagnosis ($r [156] = .14, NS$), were also not predictive of duration of treatment or length of time to RTW.

A two-tailed Student's *t* test of differences between the mean duration of time from assessment to RTW for female (mean = 47.7 days, $n = 84$) and male (mean = 46.8 days, $n = 73$) patients was not significant ($t [156] = .91, NS$). The only significant gender difference in outcome variables was in the medical-diagnosis-only group ($N = 75$) in which males ($n = 42$) showed both a significantly longer duration of treatment ($t [69] = 1.83, P < .05$) and LWDs ($t [69] = 1.85, P < .05$) relative to females ($n = 33$), see Table 12.

Post-Assessment Timeline

As can be seen in Table 10 and Figure 3, the mean length of time from the date of initiation of mental health services with the

NCSE until the first date of return to work (RTW) was considerably shorter than the pre-referral time duration. Prior to referral, injured workers were off work for a mean 10 months and following the NCSE and initiation of mental health services, the mean duration of time before RTW was 47 days (6.7 weeks). The mean number of LWDs prior to referral for mental health services was 202.3. After initiation of the NCSE, the mean number of LWDs was 33.7 (Table 11 and Fig. 4).

Similarly, the number of LWDs from prior to referral for mental health services is much greater compared to after initiation of mental health services for patients overall, as well as by subgroups based on gender and pre-referral diagnosis, Figure 5. The difference in LWDs during the pre-referral timeframe compared to that after initiation of mental health services overall was statistically significant ($t = 2.45, P < .01$), as well as for each subgroup (see Table 12). Note that these results are based on pair-wise Student's *t* tests, which directly compare individual patient data before and

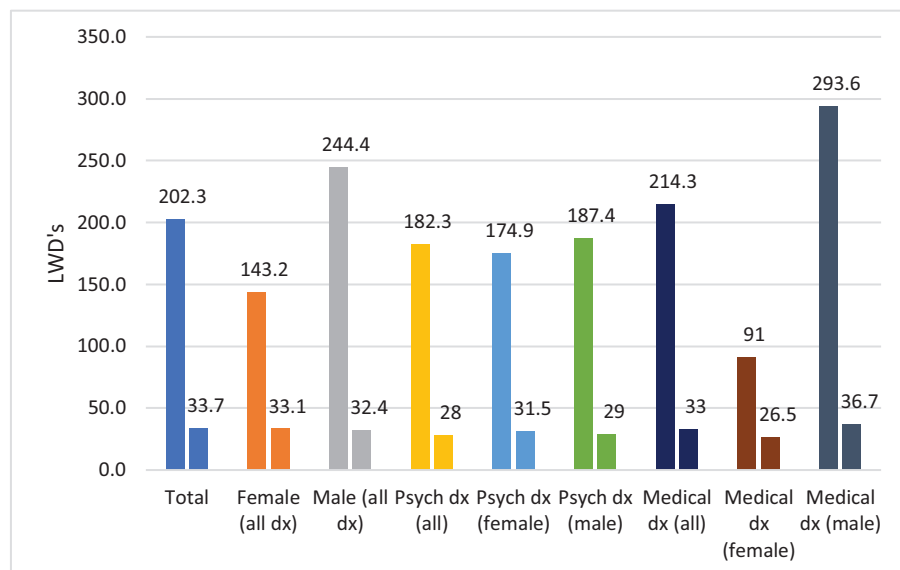


FIGURE 5. Mean LWDs from date of injury to date of referral compared to LWDs from date of NCSE to date of RTW by diagnosis and gender. LWDs, lost workdays; NCSE, neurocognitive screening evaluation; RTW, return-to-work.

TABLE 13. Student’s Pair-Wise *t* Tests of Differences Between Pre-Referral and Post-Referral LWDs by Diagnosis and Gender

	<i>N</i>	<i>df</i>	<i>t</i> Value	<i>p</i> Value
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Medical diagnoses (all genders)	75	74	4.58	<0.01
Medical diagnoses (female)	33	31	1.94	<0.01
Medical diagnoses (male)	42	41	1.83	<0.05

LWDs, lost workdays.

after referral, which decreases the impact of the wide range and high variability of the pre-treatment time and LWD data. Table 13

DISCUSSION

This study examined the utility of a screening and brief therapy model designed to improve the outcomes of individuals with work-related mTBI/PCS. Over a period of 25 months, 157 patients who had suffered a mild head injury at work and were showing signs of either delayed recovery or prolonged mTBI/PCS were referred by their primary treating physicians and workers’ compensation carriers for mental health services provided by a group of clinical psychologists with quality assurance oversight provided by a consulting neuropsychologist. Integration of care was ensured by holding teleconferences and record-sharing between the psychologist, referring physician, nurse case manager, and claims administrator.

The NCSE and work-focused brief CBT approach implemented in this study is supported by numerous researchers who have highlighted the importance of addressing the influence of negative affect in prolonging the recovery process for individuals with mTBI/PCS.^{31,45,47,51,52,64–66,80,83} Feedback from psychologists involved in administering the NCSE and providing therapy indicated that many patients reported having a positive experience in doing the assessment because they felt that their concerns about residual cognitive difficulties had been addressed in a reasonable way, and that the provider’s feedback did not minimize or dismiss their complaints. This was essential given patients often reported significant anxiety about the impact of their injuries on brain function and did not feel that the initial medical evaluation had adequately addressed those concerns. Consistent with previous research studies, the current study found that a screening assessment followed by brief work-focused CBT resulted in accelerated recovery and return to work. The decrease in mean duration of work–leave and LWDs following initiation of mental health services was statistically significant for all subgroups across diagnosis and gender.

The mean duration of work leave following the date of injury and prior to referral for mental health services (from Table 4) shows a very large degree of variability (range = 1472 days; SD = 312.3), which suggests that many more factors other than the injury itself were affecting recovery. More than 50% of the patients were determined to be at MMI based on the NCSE or were placed at MMI upon declining or failing to schedule treatment. Those patients had been off work and receiving workers compensation wage indemnity for many months prior to the assessment, but after the initial evaluation were immediately willing to be released back to work full duty and at MMI. This finding may support those researchers and clinicians who have hypothesized a significant secondary gain component in the no-fault workers compensation

population, despite the finding of a relatively small number of individuals who were determined to be malingering.

LIMITATIONS OF THE CURRENT STUDY

The results were archival rather than representing a clinical outcome study or comprehensive program evaluation. As such, there was no randomized control or matched comparison group. The comparison data used here, essentially length of time off work, is based on a timeline or waiting-list design in which patients act as their own controls, pre- and post-treatment. The argument could be made that the decreased duration of time and LWDs following initiation of mental health services was due to the natural recovery process, that is, the patients were on the verge of getting better when they were referred. The other significant limitation of the study was the lack of post-treatment clinical assessment; the outcome measures were MMI and RTW. For those who participated in brief W-CBT, it would have been informative to repeat at least some of the NCSE measures, and this is in fact being addressed as a programmatic shortcoming.

CONCLUSIONS AND RECOMMENDATIONS

Work-related mild head injuries are a frequent and often costly injury in terms of disability profile, lost workdays, and medical expenses. While some cases of work-related head injury require extensive multi-disciplinary assessment and intervention, including neuropsychological evaluation, research suggests that anxiety, negative mood, and sleep disturbance play a more significant role in delayed recovery than neurocognitive symptoms. The current study demonstrates that using a brief NCSE, combined with brief W-CBT, was successful in resolving complaints and accelerating return-to-work for employees who were showing delayed recovery from concussion and postconcussional syndrome. The screening assessment also allowed for identification of patients who warranted more in-depth evaluation. The timeframe of recovery and return-to-work from mild head trauma was reduced from a mean of 10 months prior to referral, to a mean of 7 weeks after NCSE and W-CBT. A large part of that reduction in time was due to expediting the assessment using the NCSE which can be administered by general psychologists using telehealth. This brief telehealth assessment and intervention model can greatly reduce the duration and costs of recovery and is potentially a useful model for other neurocognitive conditions which may be exacerbated by anxiety or mood issues (eg, delayed recovery from COVID-19).

The findings of this study support the view that prolonged mTBI and PCS are strongly influenced by psychological factors. Conducting a brief and readily accessible neurocognitive assessment to reassure injured workers that their concerns about mTBI/ concussion were being carefully considered and thoroughly

addressed appeared to have dramatic effects on decreasing chronicity in this study. While some of the injured workers in this study benefitted from more extensive W-CBT services to facilitate their recovery, most responded to mental health services and were able to return to work and be placed at MMI within a few weeks of the NCSE and brief course of outpatient W-CBT. The focus on work-related issues in the assessment and in therapy was clearly important, as was the establishment of a positive treatment alliance and provision of supportive, psychoeducational input with an emphasis on returning to normal daily activities including work. This model is currently also being investigated for other conditions with mild neurocognitive and exacerbating psychosocial features (eg, prolonged recovery from COVID-19).

For most patients, the brief W-CBT services were critical in helping them resolve lingering mood, anxiety, sleep, and anger/resentment issues that escalated the initial mTBI features. As the timeline data show clearly, for most individuals with mTBI/concussion and PCS with prolonged recovery, the key is being heard, understood, reassured, and encouraged. To facilitate early detection of negative emotional reactions after head injury as a risk factor for prolonged mTBI/concussion and PCS, physicians treating workers compensation claimants are encouraged to use the mental health screening tools available to them (eg, PHQ-9; GAD-7), to identify those clients who would benefit from being referred for cognitive screening and if needed, more in-depth psychological assessment and/or treatment. Without a mental health component, the road to recovery from concussion can be a very long one indeed.

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