Predictors of treatment completion and outcomes for individuals with borderline personality disorder

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1. ABSTRACT

Background: Borderline personality disorder (BPD) is a pervasive mental disorder characterized by emotional instability, unstable interpersonal relationships, and impulsive behaviours. The disorder is associated with heightened sensitivity to chronic pain, a high prevalence of co-occurring mood, anxiety and substance use disorders, and severe functional impairment in several domains. Specialized treatments have demonstrated superiority to treatment as usual but there is still a proportion of individuals who dropout of treatment early.

Objectives: The objective of this study was to examine factors predictive of treatment completion and outcomes among individuals entering specialized treatment for BPD. Baseline measures were also compared at intake between individuals with and without a drug or alcohol problem to determine if substance abuse was associated with greater psychiatric symptom severity. Outcome variables examined at 3- and 6-month follow-up included treatment completion, severity of psychological symptoms, substance use, and depressive symptoms.

Methods: This study was conducted at the Personality Disorders Clinic at the Allan Memorial Institute of the McGill University Health Centre in Montreal. Information was collected from 65 patients that met DSM-IV criteria for BPD and were enrolled in a 3-month outpatient treatment program. Patients' baseline psychological distress, lifetime Axis I comorbidity, subjective experiences of pain, objective measures of physiological sensitivity, employment, medical, and family/social functioning, and severity of substance problems were examined.

Results: At baseline, substance abuse was associated with greater psychiatric symptom severity, mood disturbance, impulsivity, and number of lifetime Axis I comorbidities. However, problem substance use did not predict treatment dropout or outcomes of psychopathology or

functional improvement at follow-ups. Treatment completers were less likely to have had substance abuse, recent suicide attempt, or severe depressive symptoms at 3 months compared to non-completers. Psychiatric severity and depressive symptoms decreased over time, but impairment in medical, employment, and family/social functioning did not improve by 6-month follow-up. Regression analysis indicated the most significant predictor of moderate to severe depressive symptoms at 3 months was a lifetime history of sexual abuse.

Conclusions: Together these findings suggest that physiological sensitivity, comorbid psychiatric disorders, and severity of substance use do not predict treatment dropout or improvements in psychopathology and psychosocial functioning. Nonetheless, the association of substance abuse with psychiatric severity, impulsivity, mood disturbance, and lifetime comorbidities provide insight into the effects of drug and alcohol problems on the presentation of BPD. The relationship between treatment dropout and greater psychological distress highlight the importance of treatment retention on psychopathology outcomes. Sexual abuse history and functional impairment should be targeted in future interventions to improve outcomes for individuals with BPD.

2. RÉSUMÉ

Contexte : Le trouble de la personnalité limite (TPL) est une maladie mentale répandue caractérisée par une instabilité émotionnelle, des relations interpersonnelles instables et des comportements impulsifs. On l'associe à une sensibilité accrue à la douleur chronique, à une forte prévalence de troubles concomitants (troubles de l'humeur, troubles anxieux et troubles liés à une substance) et à une déficience grave du fonctionnement dans plusieurs domaines. Bien que les traitements spécialisés se soient révélés supérieurs au traitement habituel, une partie des patients l'interrompent avant la fin.

Objectifs : L'objectif de notre étude était d'examiner les facteurs prédictifs de l'achèvement du traitement et les résultats thérapeutiques chez les patients commençant un traitement spécialisé d'un TPL. Nous avons cherché à déterminer si les problèmes de consommation pouvaient aggraver les symptômes psychiatriques. Les variables de résultats telles que l'achèvement du traitement, la gravité des symptômes psychologiques, la consommation de substances et les symptômes dépressifs ont fait l'objet d'une évaluation lors de suivis au bout de trois et six mois.

Méthodes : Cette étude a été menée à la Clinique des troubles de la personnalité de l'Institut Allan Memorial du Centre universitaire de santé McGill à Montréal auprès de 65 patients inscrits à un programme de traitement ambulatoire d'une durée de trois mois et présentant les critères diagnostiques du TPL décrits dans le DSM-IV. L'évaluation des caractéristiques initiales des patients a pris en compte la détresse psychologique, la comorbidité d'axe I sur la vie entière, la douleur en tant qu'expérience subjective, les mesures objectives de sensibilité physiologique, le fonctionnement en milieu professionnel, médical et familial/social, ainsi que la gravité des problèmes de consommation.

Résultats : Les mesures de référence ont révélé que l'abus de substances était généralement associé à des symptômes psychiatriques plus graves, à des troubles de l'humeur et à une impulsivité accrus ainsi qu'à davantage de comorbidités d'axe I sur la vie entière. Toutefois, cette caractéristique ne nous a ni permis de prédire l'abandon de traitement, ni les résultats de psychopathologie, ni une amélioration de fonctionnement à l'occasion des suivis. Comparés aux patients ayant abandonné le traitement, ceux l'ayant terminé ont présenté moins de risque de problème de consommation, de tentative de suicide ou de symptômes dépressifs graves après trois mois. En outre, la gravité des symptômes psychiatriques et dépressifs a diminué avec le temps, mais nous n'avons pas noté d'amélioration en ce qui a trait aux déviances de fonctionnement professionnel, médical et social/familial lors du suivi après six mois. L'analyse de régression a révélé que la présence d'antécédents de violence sexuelle constituait le meilleur prédicteur de l'apparition de symptômes dépressifs d'intensité modérée à grave au bout de trois mois.

Conclusions : L'ensemble de ces découvertes suggère que la sensibilité physiologique, les troubles psychiatriques comorbides et la gravité des problèmes de consommation ne permettent de prédire ni l'abandon du traitement, ni une amélioration relative à la psychopathologie ou au fonctionnement psychosocial. Malgré tout, la corrélation entre l'utilisation de substances et les troubles psychiatriques, l'impulsivité, les troubles de l'humeur et les comorbidités durant toute la vie met en lumière les effets de la toxicomanie et de l'abus d'alcool en cas de TPL. De plus, le rapport entre l'aggravation de la détresse psychologique et l'interruption du traitement souligne les bienfaits de son maintien sur les résultats psychopathologiques. À l'avenir, il serait avisé de cibler les antécédents de violence sexuelle et

la déficience fonctionnelle afin d'améliorer les résultats de traitement des personnes atteintes d'un TPL.

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4. INTRODUCTION

4.1 Overview of Borderline Personality Disorder

Borderline personality disorder (BPD) is a major mental disorder characterized by emotional instability, identity disturbance, unstable interpersonal relationships, and impulsive behaviours such as suicide attempts, self-harm, and substance abuse (American Psychiatric Association, 2013). BPD affects 1-2% of the general population (Lenzenweger, Lane, Loranger, & Kessler, 2007; Tomko, Trull, Wood, & Sher, 2014) and it is the most common personality disorder (PD) in clinical settings, affecting about 10% of psychiatric outpatients and 20% of inpatients (Zimmerman, Rothschild, & Chelminski, 2005). Subsequently, BPD poses a substantive economic burden as evidenced by frequent emergency room visits and utilization of psychiatric inpatient services (Comtois & Carmel, 2014; Pascual et al., 2007). Individuals with BPD were more likely to have received almost every class of psychosocial treatment and psychotropic medication compared to those with major depressive disorder (MDD) and other PDs (Bender et al., 2001; Zanarini, Frankenburg, Hennen, & Silk, 2004b). Individuals with clinically significant borderline features had significantly higher numbers of therapists and physical health visits at 2-year follow-up compared to below-threshold scorers for borderline features (Bagge, Stepp, & Trull, 2005).

Mortality rate by suicide is about 10% and 70-80% of BPD patients engage in non-suicidal self-injury (NSSI) as a way to regulate emotions (Clarkin, Widiger, Frances, Hurt, & Gilmore, 1983; Klonsky, 2009; Paris, 2002). The disorder is associated with severe impairment in several domains, including social, family, and employment functioning (Skodol et al., 2005; Tomko et al., 2014), as well as legal and financial problems (Coid et al., 2009). Although longitudinal studies have shown a reduction in the proportion of individuals meeting criteria for

BPD over time, this improvement in psychopathology did not correspond with an improvement in psychosocial functioning (Gunderson et al., 2011; McMain, Guimond, Streiner, Cardish, & Links, 2012; Skodol et al., 2005).

While functional impairment remains stable, specialized psychotherapeutic interventions for BPD have demonstrated superiority to treatment as usual (TAU) for the improvement of personality psychopathology and other outcomes (Biskin & Paris, 2012; Stoffers et al., 2012).

4.2 The Treatment of BPD

Dialectical behaviour therapy (DBT) is the most systematically tested specialized treatment for BPD. DBT is a 1-year manualized cognitive behavioural treatment for individuals with BPD that comprises weekly individual and group therapy sessions, skills coaching telephone calls, and weekly support meetings among therapists. DBT teaches distress tolerance, mindfulness, interpersonal effectiveness, and emotion regulation (Linehan et al., 1999) and has demonstrated effectiveness compared to TAU for the improvement of quality of life (Carter, Willcox, Lewin, Conrad, & Bendit, 2010) and reduction of anger (Koons et al., 2001; Neacsiu, Lungu, Harned, Rizvi, & Linehan, 2014) and NSSI (Koons et al., 2001; Linehan, Armstrong, Suarez, Allmon, & Heard, 1991; van den Bosch, Koeter, Stijnen, Verheul, & van den Brink, 2005).

Mentalization-based treatment (MBT) is a psychodynamic model developed for the treatment of BPD and has the second most empirical support. A randomized, controlled trial of MBT in day hospital versus TAU found that MBT reduced suicide attempts, health care utilization, and BPD symptoms post-treatment and through 8 years follow-up compared to TAU (Bateman & Fonagy, 1999, 2001, 2008). Similar results were found for the effectiveness of outpatient MBT compared to structured clinical management at 18 months (Bateman & Fonagy,

2009). An advantage of MBT over DBT is that it requires shorter training periods with moderate supervision for implementation by mental health professionals (Bateman & Fonagy, 2009); however, standard MBT is 18 months in duration.

Longer duration of therapy may not be necessary; 6-month DBT was effective in reducing NSSI, suicide ideation, and subjective distress in individuals with BPD and may also improve treatment retention (Stanley, Brodsky, Nelson, & Dulit, 2007). Moreover, specialized treatments do not differ significantly from one another in the improvement of clinical outcomes for BPD. There were no differences in treatment outcomes between 1-year DBT and general psychiatric management post-treatment and at 2-year follow-up, with both groups maintaining reductions in mental health service utilization, suicide attempts, number of NSSI behaviours, and borderline and general psychopathology (McMain et al., 2009, 2012) . Clarkin and colleagues (2007) found similar outcomes when comparing 1-year DBT, transference-focused psychotherapy, and a dynamic supportive treatment for BPD.

Despite the benefits of specialized treatments, treatment dropout still occurs; meta-analyses found overall retention rates of 71% for specialized interventions of at least 12 months duration (Barnicot, Katsakou, Marougka, & Priebe, 2011). A Cochrane review determined there was no statistical difference between DBT and TAU for treatment retention among 5 randomized controlled trials (Stoffers et al., 2012).

The current investigation examined treatment outcomes of a 3-month BPD program, which is more feasible to implement than other treatments due to shorter duration and less intensive training while still incorporating components of several specialized treatments including DBT and MBT. The present study investigated factors influencing treatment retention

and other outcomes such as psychosocial functioning, medical and employment problems, psychological severity, and substance use.

Physiological sensitivity was examined in relation to outcomes. Individuals with BPD have demonstrated higher pain thresholds and it was hypothesized that altered sensitivity to painful and non-painful stimuli may play a role in treatment outcomes.

4.3 Pain Sensitivity

Individuals with BPD have shown lower sensitivity to pain than psychiatric and healthy controls under stress and non-stress conditions (Bohus et al., 2000; Schmahl et al., 2010). Individuals with BPD required higher temperature of heat stimuli to report similar levels of pain intensity and comparable brain activation to healthy controls (Schmahl et al., 2006). Reduced pain sensitivity is not a consequence of chronic BPD, since adolescents with BPD also have greater thresholds for thermal pain compared to age-matched healthy controls (Ludäscher et al., 2015).

Pain thresholds and tolerance have been studied extensively in individuals with BPD in the context of NSSI (Cárdenas-Morales et al., 2011; Kemperman et al., 1997; Russ et al., 1992). In an undergraduate sample, greater borderline features were associated with higher report of acute pain and lower pain tolerance in a cold pressor task among individuals with no NSSI history, but not among individuals that had a history of NSSI (Carpenter & Trull, 2015). In another study, individuals with BPD who had not self-harmed in the past year had prick pain thresholds comparable to controls (Magerl, Burkart, Fernandez, Schmidt, & Treede, 2012). Heat pain thresholds were higher in individuals with BPD who currently engaged in NSSI compared to those who had not engaged in NSSI in the past 6 months, and pain threshold remained higher for the non-NSSI BPD group compared to healthy controls (Ludäscher et al., 2009). Increased

pain sensitivity among patients with BPD who discontinued NSSI could be due to a normalization of pain perception following termination of self-injurious behaviour.

Neuroimaging studies support the theory that pain through NSSI could be a maladaptive mechanism of emotion regulation among individuals with BPD. Painful stimuli such as skin incision on the forearm increased connectivity of frontolimbic brain regions involved in emotion regulation among patients with BPD but not healthy controls (Reitz et al., 2015; Schmahl et al., 2006). Overall, pain perception may be related to the severity of BPD symptoms considering that there was a significant negative correlation between borderline symptom severity and pain intensity ratings (Ludäscher et al., 2009).

Since individuals with BPD experience heightened emotional sensitivity and alterations in sensitivity to pain, it is conceivable that sensitivity to non-painful sensory stimuli may also play a role in BPD. Subjective and objective measures of sensitivity to painful and non-painful stimuli were examined in the present study in order to determine whether physiological sensitivity could predict treatment outcomes.

Though self-harm may be associated with lower sensitivity to acute pain among individuals with BPD, the disorder is also associated with higher sensitivity to chronic pain; this inconsistency of pain perception has been termed the "pain paradox" (Carpenter & Trull, 2015; Sansone & Sansone, 2007). A review by Sansone and Sansone (2012) found that about 30% of patients with chronic pain have comorbid BPD. At 16-year follow-up, individuals with a baseline diagnosis of BPD were more likely to experience pain and to report higher pain intensity and greater interference of pain with functioning compared to individuals with other PDs (Biskin, Frankenburg, Fitzmaurice, & Zanarini, 2014). Individuals with non-remitted BPD were significantly more likely to have pain conditions such as fibromyalgia, temporal-mandibular joint

syndrome, and back pain compared to patients with remitted BPD (Frankenburg & Zanarini, 2004). Comorbidity of pain conditions and other Axis I disorders are hypothesized to be predictive of treatment outcomes in the current investigation.

4.4 Comorbidity

Patients with BPD have a high prevalence of co-occurring mood, anxiety, substance use, and eating disorders (Kaess et al., 2013; McGlashan et al., 2000; Skodol et al., 2002; Zanarini, Frankenburg, Hennen, Reich, & Silk, 2004a). Results from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) found that 84.8% of individuals with BPD met lifetime criteria for anxiety disorder, 82.7% had a lifetime mood disorder, and 78.2% had a lifetime substance use disorder (Tomko et al., 2014).

In longer-term follow-up, comorbid Axis I disorders were associated with longer time to remission and accelerated time to relapse of BPD (Gunderson et al., 2014; Zanarini et al., 2004a) but the impact of comorbidity on treatment outcomes is less clear (Barnicot et al., 2012). Regression analyses indicated that BPD and comorbid Axis I diagnoses uniquely contributed to the impairment of psychosocial functioning among adolescent psychiatric patients (Kaess et al., 2013). In another study of 483 treatment-seeking women with BPD, concurrent bulimia nervosa was significantly associated with higher prevalence of NSSI and suicide attempts during treatment (Reas, Pedersen, Karterud, & Rø, 2015). However, current major depression and current and lifetime anxiety disorders were not significantly correlated to improvements in BPD severity, global severity, or depressive symptoms following specialized treatment for individuals with BPD (Bateman & Fonagy, 1999; Black et al., 2009). Furthermore, the number of comorbid Axis I disorders did not predict reduction in BPD symptom severity (Spinhoven, Giesen-Bloo, van Dyck, & Arntz, 2008).

In addition to the examination of mood and anxiety disorders, substance use disorder (SUD) and severity of drug and alcohol problems were explored in relation to treatment outcomes in the present study.

4.5 Substance Use

Compared to antisocial and paranoid PD, BPD was significantly associated with greater lifetime and current severity of problem drinking. Individuals with BPD also had earlier age of onset of alcohol problems among treatment-seeking alcoholics (Morgenstern, Langenbucher, Labouvie, & Miller, 1997; Zikos, Gill, & Charney, 2010). Cluster B PD was a significant predictor of treatment dropout among alcoholic outpatients (Zikos et al., 2010) and inpatients undergoing detoxification (Coupland, Fraser, Palacios-Boix, Charney, & Negrete, 2014) or residential treatment for substance dependence (Tull & Gratz, 2012). Cluster B PD was also associated with a shorter time to first slip and relapse among alcoholic outpatients compared to other PDs and no PD (Zikos et al., 2010). Furthermore, BPD was uniquely predictive of less adaptive coping among substance abusers after controlling for comorbid disorders (Morgenstern et al., 1997).

The association between BPD and poorer drinking outcomes suggests that individuals with BPD and substance problems may have more difficulty completing a treatment program and showing improvement of clinical outcomes. At seven-year follow-up, subjects with BPD and substance abuse had greater borderline psychopathology compared to former inpatients with BPD or substance abuse alone (Links, Heslegrave, Mitton, van Reekum, & Patrick, 1995). Individuals with BPD with a current or past SUD also had higher levels of self-reported impulsivity compared to participants with BPD only (Coffey, Schumacher, Baschnagel, Hawk, & Holloman, 2011).

In summary, there are potentially a number of factors influencing the outcome of treatment for BPD, including variations in pain sensitivity, as well as the severity of substance problems and other psychiatric comorbidity. Collectively these factors may contribute to early treatment dropout and they may modify the degree of improvement in symptomatology and psychosocial functioning among individuals with BPD.

4.6 Objectives

Objective 1: To assess the baseline characteristics of individuals with BPD entering 3-month specialized outpatient treatment in terms of impulsivity, psychological distress, psychopathology severity, depressive symptoms, Axis I comorbidity, functional impairment, substance use, and objective and subjective measures of sensitivity to painful and non-painful sensory stimuli.

Hypothesis 1: Individuals with problem substance use at baseline will have greater psychiatric severity compared to participants without substance abuse.

Objective 2: To examine treatment retention rates and outcomes at 3- and 6-month follow-up among all patients. Treatment outcomes include psychopathology severity, psychological distress, depressive symptoms, substance use, and psychosocial functioning.

Hypothesis 2: Predictors of treatment dropout and poorer outcomes will include lower pain thresholds, higher psychiatric comorbidity, and substance abuse.

5. METHODS

5.1 Study Design

The procedure consisted of the following steps: 1) standard Personality Disorders (PD) Clinic initial assessment and psychiatric interview; 2) identification of potential subjects and application of study inclusion criteria; 3) informed consent and research interviews; 4) BPD treatment program; 5) follow-up research interviews at 3 and 6 months; 6) statistical analyses.

Details of each step in the procedure are provided below, including research instruments.

5.2 Standard PD Clinic Initial Assessment and Psychiatric Interview

All individuals referred to the PD Clinic at the Allan Memorial Institute of the McGill University Health Centre (MUHC) were assessed to determine whether they met inclusion criteria for treatment in the program. Initial assessment, conducted by a senior psychiatrist, included the following measures: The **Revised Diagnostic Interview for Borderlines** (DIB-R; Zanarini, Gunderson, Frankenburg, & Chauncey, 1989) is a semi-structured interview used in the diagnosis of BPD. The DIB-R consists of 186 questions that are divided into 4 sections: Impulsivity, Interpersonal Relationships, Affect, and Cognition. These sections are scored independently to yield a total DIB-R score that ranges from 0 to 10. A cut-off score of 8 or more is indicative of BPD (within a 2-year time frame). The DIB-R has demonstrated excellent inter-rater (r_s = 0.94) and test-retest (r_s = 0.91) reliability for the diagnosis of BPD (Zanarini, Frankenburg, & Vujanovic, 2002) and is valid to discriminate from other Axis II disorders (Zanarini et al., 1989).

The **Hamilton Rating Scale for Depression** (HAM-D; Hamilton, 1960) and **Hamilton Anxiety Rating Scale** (HAM-A; Hamilton, 1959) are clinician-administered checklists that measure the degree of symptom severity of depression and anxiety, respectively. They have demonstrated excellent inter-rater reliability and have been used extensively in research and clinical settings.

5.3 Identification of Potential Subjects and Application of Study Inclusion Criteria

Patients that scored 8 or higher on the DIB-R met criteria for enrolment in the short-term outpatient program for BPD. Borderline diagnosis was also confirmed using the clinical criteria described in *DSM-5* (American Psychiatric Association, 2013). All patients that were eligible for

the treatment program were asked to meet with a research assistant to discuss the study and obtain informed consent.

5.4 Informed Consent and Research Interviews

The Research Ethics Board of the MUHC approved the consent form and protocol. Patients were informed that the research interviews were confidential and that information would not be placed in their hospital or clinic charts. Following consent procedures, the research assistant completed baseline assessments using various research instruments, pain measurements and self-report questionnaires as described below, over the course of 2 sessions scheduled 1 week apart. Upon completion of both research interviews participants received $50 in the form of gift card vouchers.

Research Interview 1: A trained research assistant administered the following instruments in a single session of approximately 1.5 hours duration. The **Addiction Severity Index** (ASI; McLellan, Parikh, & Bragg, 1990) is a semi-structured interview that was used to assess lifetime and past month problems in seven domains: medical, education/employment, drug and alcohol use, legal, family/social, and psychiatric. Within each of these domains, a quantitative severity index is produced based on the number, duration, frequency, and intensity of symptoms experienced during the past 30 days. Each composite severity score ranges from 0.00 to 1.00, with 1.00 indicating the most severe problems in the specified domain. The psychometric properties of the ASI have been found to be excellent, with inter-rater reliability ranging from r_s = 0.86 to 0.96 and test–retest reliability of r_s = 0.92 (Alterman, Brown, Zaballero, & McKay, 1994; Leonhard, Mulvey, Gastfriend, & Shwartz, 2000).

The **Profile of Mood States** (POMS; McNair, Lorr, & Droppleman, 1971) was used to assess transient and fluctuating mood states experienced on the day of assessment. The POMS is

a 65-item self-report in which participants describe the extent to which they have experienced each feeling rated on a 5-point scale from 0 (not at all) to 4 (extremely). Six mood states are assessed including tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment. The POMS has excellent internal consistency, ranging from $\alpha = 0.63$ for confusion to $\alpha = 0.96$ for depression, as well as good test-retest reliability from r_s = 0.65 to 0.74 (McNair et al., 1971).

Subjective and objective physiological sensitivity were measured using several instruments. The **Highly Sensitive Person Scale** (HSPS; Aron & Aron, 1997) examined individual sensory processing sensitivity, which is defined by physical, social and emotional sensitivity. The HSPS is a 27-item self-report questionnaire that determines how an individual responded to environmental and emotional stimuli in the past week by asking participants to rate statements that describe reactions to intense stimuli such as spiciness or smells, whether they are easily startled, and whether otherwise innocuous situations evoke disproportionate reactions. Responses are rated on a scale from 1 (not at all) to 7 (extremely). Some studies have found two- or three-factor solutions (for review, see Aron, Aron, & Jagiellowicz, 2012), but factor analyses in the present study were inconsistent with data previously reported. Therefore, a single construct of sensory processing sensitivity was used since this model has been shown to have strong internal consistency ($\alpha = 0.85$) and discriminant and convergent validity (Aron & Aron, 1997). Neural correlates of sensory processing sensitivity as defined by the HSPS support the construct validity of this model (Jagiellowicz et al., 2011).

The **McGill Pain Questionnaire** (MPQ; Melzack, 1975) is a self-report questionnaire that aims to quantify the quality and intensity of pain. Individuals are asked to describe their pain by selecting adjectives along different dimensions of pain (sensory, affective, evaluative,

miscellaneous) and the intensity. Pain ratings are calculated based on the words selected, the number of words chosen and the present pain intensity. The MPQ has been found to demonstrate high internal consistency ($\alpha > 0.9$) for all four pain categories (Melzack, 1975). The MPQ has been used extensively in research investigating pain phenomena (Melzack, 2005).

The **Von Frey Test** is a non-invasive method used to determine an individual's tactile sensitivity threshold. Nylon monofilament "hairs" of differing diameters and lengths, requiring increasing force to be applied, are pressed perpendicularly against a participant's skin (back of hand). A threshold can be determined by the minimum size of fibre detected by each individual. Since the development of this procedure in 1896, the Von Frey hair test has been used extensively in research. Despite this fact, little research has investigated the reliability and validity of the measure (Bryce et al., 2007). The use of standardized sets of hairs, each of which is individually calibrated within a 5% standard deviation, allows for consistent and reliable measurements of tactile sensitivity thresholds (Stoelting Co., 2001).

Examiners explained the rationale of the test to patients, the hairs were shown to the patients and they were given a chance to touch them before the procedure. The test was conducted on the inner wrist of both the dominant (the hand used to write with) and non-dominant hands. Participants were instructed to look away during the procedure and to tell the examiner when they were able to feel the hair touching their wrist. Two protocols were followed at each testing session utilizing the method of limits: first, examiners began with the thinnest hair and increased diameters until the participant indicated they detected the hair. The second protocol began by applying the thickest hair and continued with decreasing diameter fibres until the participant no longer indicated detecting the hair. In analyses, the data was averaged over increasing and decreasing thresholds, resulting in an overall threshold for both the dominant and

non-dominant arms.

The **Algometer Pressure Test** was used to measure pressure pain threshold. A rubber probe is pushed against an area of the body until the participant indicates that a noxious threshold is reached, and a measurement in kilograms is obtained. Studies have shown that flat, broad surfaces are most appropriate for use, and the thumbnail specifically has been described as a "neutral" region accurately reflecting an individual's overall pressure-pain sensitivity (Geisser et al., 2008). The algometer has been used extensively in pain research in both patients and normative populations (Buchanan & Midgley, 1987) and provides an accurate measure of hyper- or hypo-algesia.

The algometer test was described to participants as a measure of sensitivity to pressure. In order to acclimate participants to the procedure, patients were allowed to handle the algometer and to try it on themselves before conducting the procedure. They were instructed to rest their thumb on the table and to look away while the examiner pressed the probe down on their nail, slowly increasing exerted force until the patient indicated that the stimulus had become uncomfortable. As soon as the patient indicated that the stimulus was uncomfortable, the examiner relieved the pressure and noted the force in kilograms that had been exerted.

Take-Home Package of Self-Report Questionnaires: At the end of the first research interview all participants were given a package of self-report questionnaires to take home and complete during the week between research interviews. The participants received instructions on the types of questions and the timeframe covered by the self-reports. The following instruments were included in the take-home package: Levels of impulsivity were measured using the **Barratt Impulsiveness Scale** (BIS-11; Patton, Stanford, & Barratt, 1995). The BIS-11 is a 30-item self-report questionnaire measuring impulsivity in 3 domains: motor, nonplanning, and attention. The

BIS-11 has been widely used in adults and has been validated in impulsive and normal populations. There is evidence of good internal consistency (α = 0.59 to 0.74) and test–retest reliability (r_s = 0.61 to 0.72) at 1 month and 1 year follow-up (Patton et al., 1995; Stanford et al., 2009).

The **Beck Depression Inventory** (BDI; Beck & Steer, 1987) is a 21-item self-report questionnaire that assesses subjective depressive symptoms. It uses a 4-point Likert scale from 0 to 3, with the total score reflecting overall levels of depressive symptoms experienced during the past week. Widespread clinical and research use has demonstrated sound psychometric properties including internal consistency (α = 0.86) (Beck, Steer, & Garbin, 1988). Scores can be classified into minimal to mild (0-18), moderate (19-29), and severe (30-63) depressive symptoms (Beck et al., 1988).

The **Symptom Checklist-90 Revised** (SCL-90-R; Derogatis, 1994) is a self-report instrument designed to assess psychopathology and psychological distress in terms of 9 symptom dimensions and three global indices. Respondents rate the extent to which each item has distressed them during the past week from 0 (not at all) to 4 (extremely). Mean scores are calculated for each symptom dimension, including somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The Global Severity Index (GSI) is calculated as the mean of all 90 items. The Positive Symptom Total (PST) counts the number of positive (non-zero) symptom responses. The Positive Symptom Distress Index (PSDI) indicates the mean distress level reported and is calculated by dividing the grand total by the PST. The SCL-90-R has been validated with many groups, has shown convergent and divergent validity, and acceptable reliability ranging from α = 0.79 to 0.90 (Derogatis, 1994).

The **Adolescent/Adult Sensory Profile** (AASP; Brown, Tollefson, Dunn, Cromwell, & Filion, 2001) is a 60-item self-report questionnaire that probes six categories of sensory processing: taste/smell, movement, visual, touch, auditory, and activity level. Participants are scored in four quadrants: low registration, sensation seeking, sensory sensitivity, and sensation avoiding. Construct validity was established by demonstrating an association between physiological responses in skin conductance and AASP quadrant scores. The AASP has strong internal consistency of each category (Cronbach's α values: low registration 0.78; sensation seeking 0.60; sensory sensitivity 0.78; sensation avoiding 0.77).

The **Self-Harm Behavior Questionnaire** (SHBQ; Gutierrez, Osman, Barrios, & Kopper, 2001) is a self-report instrument designed to collect information about a participant's self-harm and suicide-related behaviours including method, age of onset, frequency, recency, and need for medical treatment. The SHBQ has demonstrated good test-retest reliability (r_s = 0.89 to 0.99), internal consistency (α = 0.95) and convergent validity with widely validated measures of self-harm and suicidality (Fliege et al., 2006; Gutierrez et al., 2001). The SHBQ was administered approximately 30 minutes prior to the first group session with similar instructions to the take-home research package.

Research Interview 2: The **Computerized Diagnostic Interview Schedule** (CDIS-IV) (Robins et al., 2000) was administered by a trained research assistant in a second session of approximately 1.5 hours duration. The CDIS-IV was used to determine the presence or absence of lifetime DSM-IV Axis I disorders including mood, anxiety, eating, substance use, and pain disorders. Due to the fully structured nature of the DIS, non-clinicians are capable of administering the DIS with adequate training, ensuring reliability and validity (Robins et al., 2000).

5.5 BPD Treatment Program

The 3-month outpatient treatment program consisted of one individual session plus one group psychotherapy session per week. Group therapy focused on psychoeducation and skills training similar to DBT. Distress tolerance, emotion regulation, interpersonal effectiveness, and mindfulness techniques were developed through exercises and discussion during group sessions. Individual sessions incorporated behavioural and psychodynamic techniques. If a patient missed three sessions they were discontinued from the program.

5.6 Follow-Up Research Interviews at 3 and 6 Months

All patients that consented to participate in the study were contacted at 3- and 6-month follow-up including individuals that dropped out of treatment prior to completing the program. Detailed locating information for each subject was provided at the time of consent, including the names, addresses, and telephone numbers of three friends/family members who would be likely to have long-term contact with the patient. The follow-up research interviews each consisted of the ASI, SCL-90-R, and BDI. Participants received $20 voucher coupons upon completion of each of the follow-up interviews.

5.7 Statistical Analyses

All statistical analyses were performed using SPSS version 22 (IBM Corp.). Independent samples *t* tests and chi square tests were performed for continuous and categorical variables, respectively. Repeated measures analyses were conducted to assess changes in ASI composite, SCL-90-R, and BDI scores over time. All analyses were Bonferroni corrected for multiple comparisons by dividing the critical P value ($\alpha = 0.05$) by the number of comparisons made for an instrument. The unmodified P value is reported and statistical significance is determined based on the new critical P value for that family of tests. Levene's test for equality of variances

was performed for *t* tests and statistics of equal variances not assumed are reported where appropriate. Post hoc tests used Bonferroni method for ANOVA; z-test with Bonferroni correction and standardized residuals were used for chi square, where a standardized residual > |2| indicated statistical significance. Effect sizes are reported as Cohen's *d* for Student's *t* tests, phi (Φ) coefficient and Cramer's V (Φ_C) for chi square tests, and partial Eta squared (η^2) for ANOVAs. Cohen's *d* effect sizes are referred to as small (*d* = 0.2), medium (*d* = 0.5), and large (*d* = 0.8); effect sizes for phi and Cramer's V with df = 1 are small (Φ = 0.1), medium (Φ = 0.3), and large (Φ = 0.5), according to benchmarks suggested by Cohen (1988). Continuous data are reported as mean ± standard deviation.

Multivariate hierarchical logistic regression analyses were performed to identify the most significant predictors of treatment completion, substance abuse, and moderate/severe depressive symptoms at 3-month follow-up. One variable from each hypothesized category of predictors (pain sensitivity, psychiatric comorbidity, substance use) was entered into the models, based on significant baseline variables from independent samples *t* tests and chi square tests. Pain sensitivity predictors included objective and subjective physiological measures of sensitivity and the DSM-IV lifetime diagnosis of pain disorder. The number of lifetime Axis I disorders from the CDIS was used as a measure of psychiatric comorbidity. If psychiatric comorbidity was not a significant predictor of outcome, other variables of psychological distress were used in the regression, including variables from the family/social and psychiatric sections of the ASI. Substance use variables that could be entered into the regression models included the CDIS diagnosis of SUD and current substance abuse as determined by the ASI. Hosmer-Lemeshow goodness of fit is reported.

6. RESULTS

6.1 Sample Description

A total of 66 individuals scored 8 or higher on the DIB-R and signed consent to participate in the study. One participant signed consent only, did not attend any research interviews and was therefore excluded from analyses. Of the 65 participants with baseline data collected, 5 did not start treatment and were not contacted for follow-ups. Individuals that did not start treatment did not differ compared to those that started treatment on socio-demographics, ASI composite scores, Axis I comorbidities, physiological measures, or other measures of psychopathology. The only significant difference was that individuals who did not begin treatment had a higher number of days of psychological problems in the past month compared to those that attended at least one treatment session (29.60 ± 0.89 vs. 22.44 ± 10.67) [$t(61.85) = 4.95$, $p = 0.0001$]. Sixty participants completed the second baseline research interview, which consisted of the CDIS interview to determine prevalence of lifetime Axis I disorders.

6.2 Baseline Characteristics

6.2.1 Socio-demographics

See Table 1 for a summary of baseline demographic variables of the sample (n = 65). Age of the sample ranged from 18 to 59, with a mean age of 25.54 ± 6.66. Only one participant was male. The majority of the sample was single (81.5%) and approximately half of the sample had completed post-secondary education (CEGEP or higher). Most of the participants were employed (47.7%) or students (38.5%), but 2 participants were on disability (3.1%) and 7 (10.8%) were unemployed.

Table 1. Sample Demographics (n=65)

Mean age	25.54 ± 6.66
Female	98.5% (64)
Race	
Caucasian	83.1% (54)
Highest level of education	
Elementary school	9.2% (6)
High school	43.1% (28)
Post-secondary	47.7% (31)
Employment Status	
Full-time	36.9% (24)
Part-time	10.8% (7)
Student	38.5% (25)
Unemployed/disability	13.8% (9)
Mean number of days worked (past month)	7.72 ± 8.74
Mean monthly income from employment	$688.08 ± 915.68
Marital status	
Single	81.5% (53)
Married	12.3% (8)
Divorced/separated	6.1% (4)
Values are presented as % of sample or group mean ± SD.	

6.2.2 Mental Health

Table 2 shows lifetime and past month mental health variables of the full sample. The prevalence of lifetime Axis I disorders was high; 55% of individuals met DSM-IV criteria for post-traumatic stress disorder (PTSD), 20% had attention deficit hyperactivity disorder, and at least 16.7% had bulimia nervosa. There was a high prevalence of self-injurious behaviour, including cutting (81.4%), hitting (36.7%), scratching (33.3%), and burning (22.9%), with 50.9% of individuals engaging in multiple forms of NSSI. The age of onset of NSSI ranged from 8 to 29 years, with mean age of 14.84 ± 4.18. A high proportion of individuals had been prescribed psychiatric medications in their lifetime (90.8%) and in the 30 days prior to assessment (78.1%). Severity of psychiatric and employment problems were quite high, with mean ASI composite scores of 0.63 ± 0.21 and 0.64 ± 0.30, respectively.

Table 2. Baseline Mental Health Variables (n = 60 for CDIS variables)

Past Month Psychiatric Variables	
Suicidal thoughts	51.6% (33)
Suicide attempt	12.5% (8)
Self-harm behaviour	39.7% (25)
Moderate to severe depressive symptoms (BDI; past week)	80.0% (48)
Lifetime Psychiatric Variables	
Eating disorder (CDIS)	31.7% (19)
Anxiety disorder (CDIS)	86.7% (52)
Mood disorder (CDIS)	95.0% (57)
Suicidal thoughts	93.8% (61)
Suicide attempt	69.2% (45)
Self-harm behaviour	92.1% (58)
History of Abuse	
Sexual abuse	36.9% (24)
Physical abuse	60.0% (39)
Emotional abuse	93.8% (61)
Values are presented as % (n).	

6.2.3 Substance Use

Overall, 58.5% of participants had problem substance use at baseline as determined by the drug and alcohol use status from the ASI. To determine substance abuse status, frequency and amount of substance use as well as problems related to drugs and alcohol in the past month were considered. The most common problems were with alcohol (24.6%) and cannabis (18.5%). Additional treatment for alcohol and drug related problems were rated as important for 24.6% and 21.5% of the sample, respectively. From the CDIS, lifetime prevalence rate of any SUD was 72%. Rates were highest for alcohol (53.3%) and cannabis dependence (30.5%). DSM-IV lifetime diagnosis of drug dependence was also present for cocaine (15.0%), amphetamine (11.9%), sedatives (10.0%), and opiates (7.0%).

To assess the association of drug or alcohol problems with psychiatric severity and functional impairment, baseline variables were stratified by presence or absence of current substance abuse. Participants with baseline substance abuse were significantly less likely to have completed post-secondary education compared to those without substance abuse (28.9% vs. 74.1%) [$\chi^2(2, N = 65) = 13.40$, $p = 0.001$, $\Phi = 0.45$]. Substance abusers also had a higher number of days of employment problems than non-abusers (13.71 ± 13.02 vs. 7.56 ± 10.44) [$t(62) = 2.11$, $p = 0.039$, $d = 0.52$].

Baseline substance abusers scored higher on POMS subscales of tension ($d = 0.56$), depression ($d = 0.53$), anger ($d = 0.58$), and fatigue ($d = 0.71$) as well as total mood disturbance ($d = 0.60$), none of which were significant after correction for multiple comparisons. There were also large effect sizes for the differences between groups for SCL-90-R scores; current substance abusers reported significantly greater severity on every subscale of the SCL-90-R except for somatization with effect sizes ranging from $d = 0.59$ for paranoid ideation to $d = 1.09$ for phobic anxiety. Global severity was significantly greater among individuals with vs. without current substance abuse [$t(47) = 3.05$, $p = 0.004$, $d = 0.87$]. Substance abusers also scored higher on the BIS-11 indicating greater impulsivity compared to non-abusers [$t(52) = 2.70$, $p = 0.009$, $d = 0.74$].

Substance abusers were significantly more likely to have experienced depression in the past 30 days from baseline (81.6% vs. 46.2%) [$\chi^2(1, N = 64) = 8.79$, $p = 0.003$, $\Phi = 0.37$]. Though not significant after correction for multiple comparisons, individuals with current substance abuse were more likely to have trouble controlling violent behaviour in the past month (52.6% vs. 26.9%) [$\chi^2(1, N = 64) = 4.18$, $p = 0.041$, $\Phi = 0.26$] and lifetime (86.8% vs. 63.0%) [$\chi^2(1, N = 65) = 4.75$, $p = 0.024$, $\Phi = 0.27$]. Substance abusers were more likely to have a history

of sexual abuse compared to non-abusers [$\chi^2(1, N = 65) = 6.72$, $p = 0.01$, $\Phi = 0.32$]. Substance abusers also had greater severity of ASI psychiatric composite score [$t(62) = 2.45$, $p = 0.017$, $d = 0.65$].

Excluding diagnoses of substance use disorders, individuals with current substance abuse had a significantly higher number of lifetime Axis I comorbidities [$t(58) = 2.90$, $p = 0.005$, $d = 0.76$]. There were no significant differences between groups on measures of objective or subjective physiological sensitivity. As expected, current substance abusers scored significantly higher on ASI composite severity scores for alcohol [$t(58) = 3.10$, $p = 0.003$, $d = 0.79$] and drug problems [$t(61) = 3.26$, $p = 0.002$, $d = 0.79$]. Group differences in baseline psychiatric, substance use, and ASI composite scores are presented in Table 3.

6.2.4 Physical Health

Overall, 38.5% of participants had chronic medical problems that continued to interfere with functioning. At baseline 65% of participants had experienced medical problems in the past month and 21.5% experienced problems every day. About one third of all participants perceived the need for additional medical treatment as considerably (13.8%) or extremely (20%) important. Furthermore, 65% of the sample met DSM-IV criteria for a pain disorder in their lifetime. Individuals with a lifetime pain disorder were significantly more likely to report experiencing medical problems in the past 30 days compared to those without a pain disorder (76.9% vs. 42.9%) [$\chi^2(1, N = 60) = 6.96$, $p = 0.008$, $\Phi = 0.34$]. On the MPQ, only 11.3% of participants reported no pain in the past day, whereas 69.4% of participants experienced discomforting (48.4%), distressing (12.9%), horrible (6.5%), or excruciating (1.6%) pain.

Table 3. Baseline Psychiatric, Substance Use, and ASI Composite Scores Stratified by Presence or Absence of Baseline Substance Abuse

Baseline Variables	Baseline Substance Abuse (n = 38)	No Substance Abuse (n = 27)	p Value; Effect Size
Global Severity Index (SCL-90-R; past week)*	2.40 ± 0.66	1.78 ± 0.76	$p = 0.004$ $d = 0.87$
Total mood disturbance (POMS; past day)	90.50 ± 46.67	62.50 ± 46.58	$p = 0.02$ $d = 0.60$
Moderate to severe depressive symptoms (BDI; past week)	90.9%	66.7%	$p = 0.02$ $\Phi = 0.30$
Impulsivity (BIS-11)*	82.60 ± 10.44	74.67 ± 11.11	$p = 0.009$ $d = 0.74$
History of sexual abuse	50.0% (19)	18.5% (5)	$p = 0.01$ $\Phi = 0.32$
Number of lifetime Axis I disorders (CDIS; excluding SUD)	4.38 ± 1.71	3.19 ± 1.39	$p = 0.005$ $d = 0.76$
Substance Use Variables			
Mean $ spent on alcohol (past month)	$71.84 ± $150.75	$27.56 ± $31.09	
Mean $ spent on drugs (past month)	$104.61 ± $216.03	$0.56 ± $2.12	$p = 0.005$ $d = 0.68$
History of substance abuse treatment*	39.5% (15)	0%	$p = 0.0001$ $\Phi = 0.46$
Lifetime alcohol dependence (CDIS)*	73.5% (25)	26.9% (7)	$p = 0.0001$ $\Phi = 0.46$
Lifetime drug dependence (CDIS)*	76.5% (26)	11.5% (3)	$p = 0.0001$ $\Phi = 0.64$
Lifetime substance use disorder (CDIS)*	100% (34)	34.6% (9)	$p = 0.0001$ $\Phi = 0.72$
ASI Composite Scores			
Alcohol*	0.25 ± 0.22	0.11 ± 0.12	$p = 0.003$ $d = 0.79$
Drug*	0.10 ± 0.11	0.03 ± 0.06	$p = 0.002$ $d = 0.79$
Medical	0.41 ± 0.35	0.40 ± 0.35	
Employment	0.69 ± 0.29	0.58 ± 0.31	
Legal	0.05 ± 0.15	0.003 ± 0.02	
Family/Social	0.39 ± 0.20	0.32 ± 0.23	
Psychiatric*	0.68 ± 0.20	0.55 ± 0.20	$p = 0.017$ $d = 0.65$

Values are presented as % (n) of sample or group mean ± SD.
*Significant differences between groups, $p < 0.05$ corrected for multiple comparisons.
Effect size is shown as Φ for chi square tests and Cohen's *d* for student's *t* tests.

6.3 Study Retention - Loss to Follow-Up and Attrition Analysis

Retention in the study was 85% (n = 51) at 3 months and 76% (n = 38) at 6 months for individuals that had reached the 6-month time point. There were no significant differences between those lost to follow-up at 3 and 6 months and individuals retained in the study in terms of socio-demographics, baseline ASI composite scores, psychological distress, comorbidities, physiological measures, or addiction variables.

At 3 months, 27.3% of treatment non-completers were lost to follow-up compared to 7.9% of treatment completers [$\chi^2(1, N = 60) = 4.10$, $p = 0.043$, $\Phi = 0.26$]. At 6 months, treatment non-completers were significantly more likely to be lost to follow-up compared to completers (42.9% vs. 10.3%) [$\chi^2(1, N = 50) = 7.06$, $p = 0.008$, $\Phi = 0.38$]. Due to poor study retention among treatment dropouts at 6-month follow-up, regression analyses assessed predictors of treatment completion and other outcomes at 3 months only.

6.4 Treatment Retention

6.4.1 Retention Rates

Of the 60 participants that started treatment, 63% (n = 38) completed the 12-week BPD program. Treatment non-completers either dropped out for unknown reasons (10%, n = 6), or missed three sessions and were therefore discharged from the program (27%, n = 16). Of the 6 dropouts, 3 (50%) left in the first 4 weeks of treatment. Of the 16 individuals that were discharged for missing 3 sessions, 4 (25%) discontinued in the first 4 weeks of treatment, 4 (25%) were discharged between 5 to 8 weeks, and 8 (50%) were discharged in the last 4 weeks of treatment.

6.4.2 Baseline Predictors of Treatment Completers vs. Non-Completers

To examine factors predictive of treatment completion, baseline variables were compared between treatment completers and non-completers. Treatment completers had a significantly higher number of years of education (13.68 ± 1.85 vs. 12.09 ± 1.77) [$t(58) = 3.27$, $p = 0.002$, $d = 0.88$]. In terms of psychological variables, treatment completers were less likely to have trouble controlling violent behaviour [χ^2 (1, $N = 60$) = 9.61, $p = 0.002$, $\Phi = 0.40$] and more likely to have had a mood disorder in their lifetime compared to treatment non-completers [χ^2 (1, $N = 56$) = 5.71, $p = 0.017$, $\Phi = 0.32$]. There were no other differences between groups for psychopathology severity, depressive symptoms, psychosocial functioning, ASI composite scores, comorbid disorders, physiological sensitivity, substance problems, or other variables of psychological distress (Table 4).

A hierarchical logistic regression model was performed to assess predictors of treatment completion (Table 5). The independent variable with the greatest correlation with treatment completion status from each hypothesized predictor group was entered into the analysis. Step 1 addressed physiological sensitivity using the pressure algometer pain threshold; Step 2 entered the number of lifetime Axis I diagnoses; and Step 3 addressed the lifetime diagnosis of any substance use disorder. Similarly to independent *t* and chi square tests the hierarchical regression model did not significantly predict treatment completion, accounting for 11.6% of the variance in completion status, $\chi^2 = 4.81$, df = 3, $p = 0.186$, with an H-L goodness of fit of P = 0.72.

Table 4. Baseline Psychiatric, Substance Use, and ASI Composite Scores Stratified by Treatment Completion Status

Baseline Variables	Treatment Completers (n=38)	Treatment Non-Completers (n=22)	p Value; Effect Size
Current Psychiatric and Substance Use Variables			
Global Severity Index (SCL-90-R; past week)	2.08 ± 0.79	2.17 ± 0.78	
Moderate to severe depressive symptoms (BDI; past week)	79.0% (30)	79.0% (15)	
Trouble controlling violent behaviour (past month)	37.8% (14)	50.0% (11)	
Suicidal thoughts (past month)	48.6% (18)	50.0% (11)	
Suicide attempt (past month)	10.8% (4)	13.6% (3)	
Baseline substance abuse	50.0% (19)	63.6% (14)	
Lifetime Psychiatric and Substance Use Variables			
Trouble controlling violent behaviour*	65.8% (25)	100% (22)	$p = 0.002$ $\Phi = 0.40$
Suicidal thoughts	94.7% (36)	90.9% (20)	
Suicide attempt	71.1% (27)	68.2% (15)	
Lifetime mood disorder (CDIS)	100% (36)	85.0% (17)	$p = 0.017$ $\Phi = 0.32$
Lifetime anxiety disorder (CDIS)	91.7% (33)	75.0% (15)	
Lifetime substance use disorder (CDIS)	61.1% (22)	85.0% (17)	
Number of lifetime Axis I disorders (CDIS)	4.78 ± 1.55	4.85 ± 2.66	
Baseline ASI Composite Scores			
Medical	0.38 ± 0.35	0.43 ± 0.36	
Employment	0.58 ± 0.28	0.71 ± 0.33	
Legal	0.02 ± 0.13	0.05 ± 0.11	
Alcohol	0.17 ± 0.16	0.23 ± 0.24	
Drug	0.06 ± 0.10	0.07 ± 0.09	
Family/Social	0.38 ± 0.18	0.34 ± 0.26	
Psychiatric	0.62 ± 0.21	0.61 ± 0.23	

Values are presented as % (n) of sample or group mean ± SD.
*Significant differences between groups, $p < 0.05$ corrected for multiple comparisons.
Effect size is shown as Φ for chi square tests.

Table 5. Logistic Regression – Treatment Completion Status (Treatment Completion = 1)

Predictors	Wald (df)	*p*	R^2 (Nalkerke)
Step 1: Pain			0.010
Pressure algometer pain threshold	0.381 (1) Step: $\chi^2 = 0.40$, df = 1, $p = 0.53$	0.537	
Step 2: Comorbidity			0.011
Number of lifetime Axis I diagnoses (CDIS)	0.032 (1) Step: $\chi^2 = 0.032$, df = 1, $p = 0.86$	0.857	
Step 3: Substance use			0.116
Lifetime substance use disorder (CDIS)	3.86 (1) Step: $\chi^2 = 4.38$, df = 1, $p = 0.036$	0.050	

Overall, the model accounted for 11.6% of the variance in treatment completion status [$\chi^2 = 4.81$, df = 3, $p = 0.186$], with a poor HL goodness of fit (P = 0.72).

6.4.3 Treatment Completion Status as a Predictor of Outcomes

Repeated measures ANOVAs were performed for SCL-90-R, BDI, and ASI composite severity scores across baseline, 3- and 6-month time points, grouped by treatment completion status. There was a main effect of time [smallest $F(2, 33) = 7.56$, $p = 0.002$, $\eta^2_p = 0.31$] and a significant linear trend of time [smallest $F(1, 34) = 11.84$, $p = 0.002$, $\eta^2_p = 0.26$] for BDI and all SCL-90-R scores except for hostility, psychoticism, and paranoid ideation, which were not significant after correction for multiple comparisons. Regardless of treatment completion status, BDI and SCL-90-R scores decreased over time.

There was a main effect of completion status on interpersonal sensitivity [$F(1, 26) = 4.44$, $p = 0.045$, $\eta^2_p = 0.15$], paranoid ideation [$F(1, 26) = 5.50$, $p = 0.027$, $\eta^2_p = 0.18$], and psychoticism severity scores [$F(1, 26) = 4.73$, $p = 0.039$, $\eta^2_p = 0.15$] indicating that treatment completers had lower severity on these subscales collapsed across time; however, results were not significant after correction for multiple comparisons. There was also a time by completion

status interaction for obsessive-compulsive severity [$F(2, 25)= 4.72$, $p = 0.018$, $\eta^2_p = 0.27$] not significant after correction for multiple comparisons. Post-hoc tests revealed treatment completers had significantly lower scores at 3 and 6 months compared to baseline for global severity index, obsessive-compulsive, and interpersonal sensitivity. Treatment completers also had significantly lower paranoid ideation severity scores at 3 months but not 6 months compared to baseline (all p values < 0.05). Figure 1 shows results for the global severity index of the SCL-90-R across time stratified by completion status.

Figure 1.

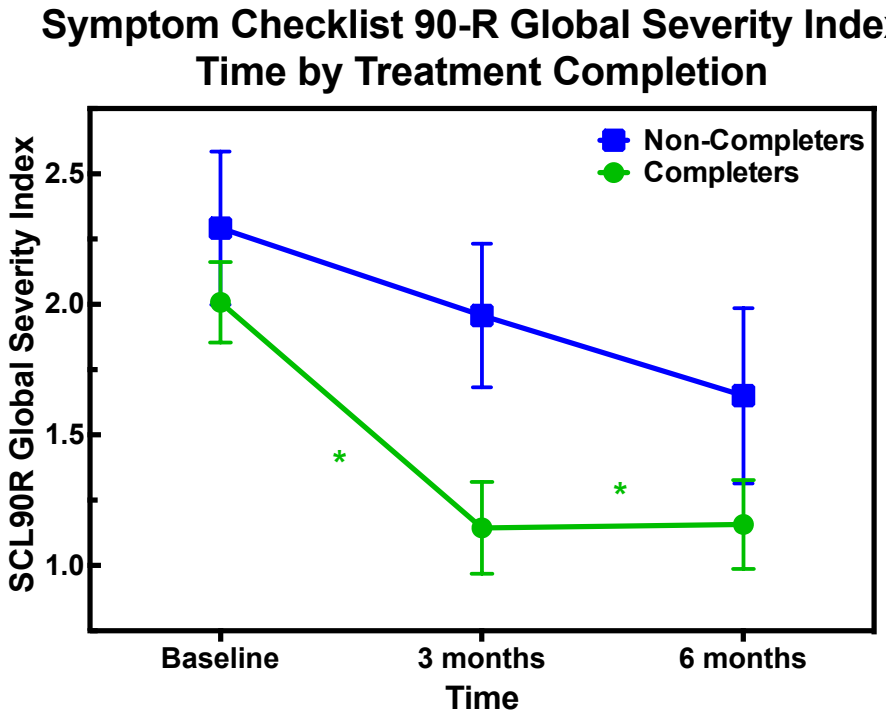

Figure 1. Mean global severity index of the Symptom Checklist 90-R grouped by treatment completion status at baseline, 3 and 6 months follow-up. Values represent the mean ± SD. Post-hoc tests were Bonferroni corrected for multiple comparisons.
*Significant difference ($p < 0.05$) between baseline and 3- and 6-month follow-up among treatment completers.

In terms of ASI composite score repeated measures, analyses revealed a significant main effect of time for family/social [$F(2, 32) = 6.85$, $p = 0.003$, $\eta^2_p = 0.30$] and psychiatric severity scores [$F(2, 32) = 8.52$, $p = 0.001$, $\eta^2_p = 0.35$]. Within-subjects contrasts found a significant quadratic trend for the effect of time on family/social composite score [$F(1, 33) = 8.66$, $p = 0.006$, $\eta^2_p = 0.21$] suggesting that severity of family/social problems may be reduced at 3-month but not 6-month follow-up (Figure 2). There was a significant linear trend of time for psychiatric composite score [$F(1, 33) = 14.12$, $p = 0.001$, $\eta^2_p = 0.30$] indicating that psychiatric severity decreased over time (Figure 3). There was no effect of treatment completion status on ASI composite severity scores. Severity of medical, employment, legal, drug, and alcohol problems did not change over time.

Figure 2.

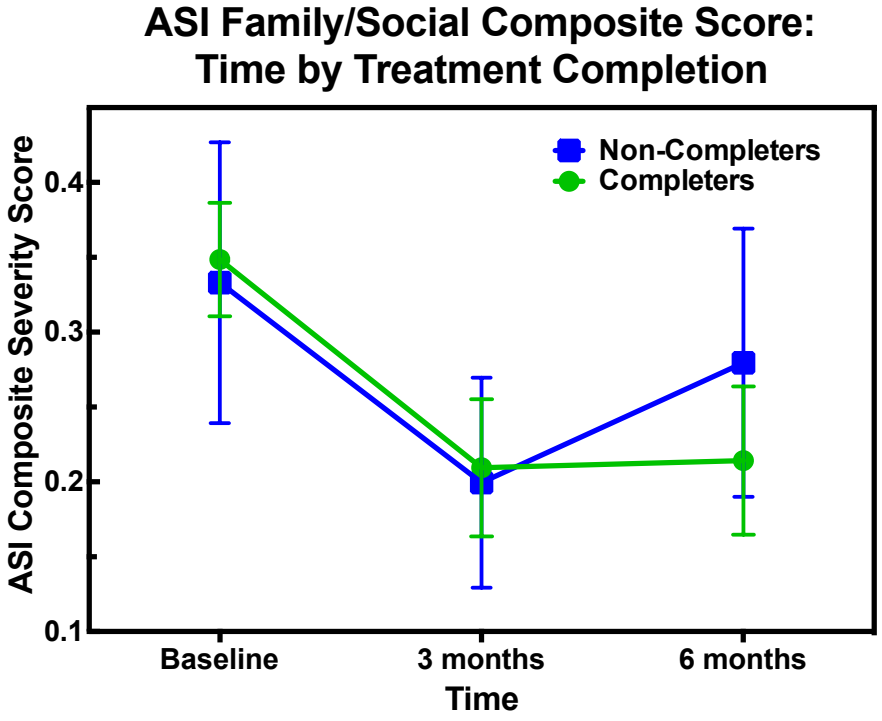

Figure 2. ASI family/social composite severity score stratified by treatment completion status at baseline, 3 and 6 months follow-up. Values represent the mean ± SD.

Figure 3.

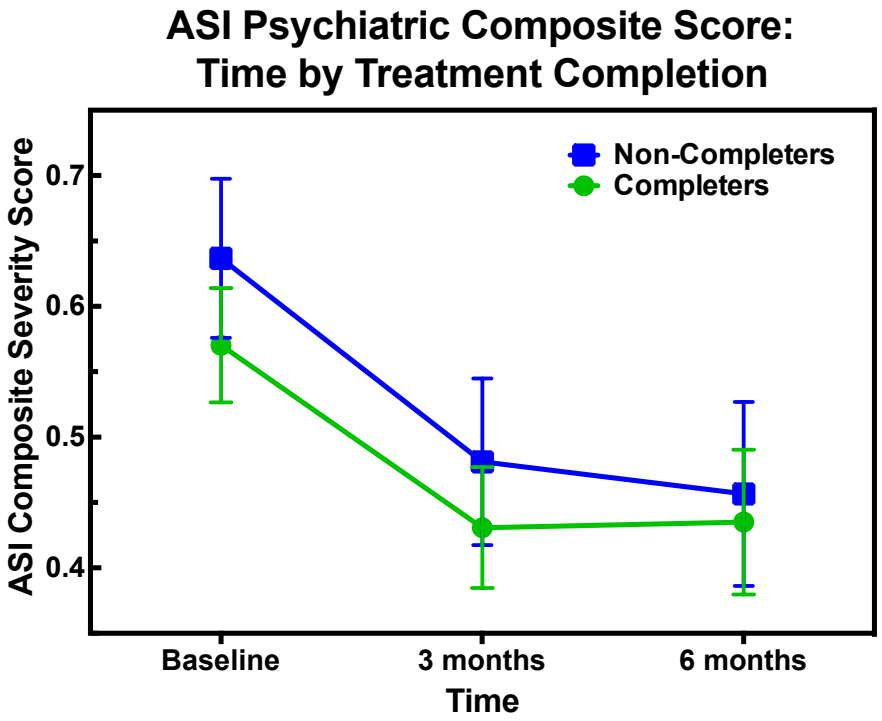

Figure 3. ASI psychiatric composite severity score stratified by treatment completion status at baseline, 3 and 6 months follow-up. Values represent the mean ± SD.

Categorical variables were compared between treatment completers and non-completers at 3- and 6-month follow-ups to assess the impact of treatment completion status on other outcomes (Table 6). Treatment non-completers were more likely to have self-reported severe depressive symptoms (BDI) at 3 months compared to completers, not significant after correction for multiple comparisons [$\chi^2(1, N = 51) = 6.05$, $p = 0.014$, $\Phi = 0.34$]. Non-completers also had a higher likelihood of suicide attempt in the past 30 days at 3 months [χ^2 $(1, N = 51) = 4.55$, $p = 0.033$, $\Phi = 0.30$]. Non-completers were more likely to have substance abuse [$\chi^2(1, N = 50) = 6.36$, $p = 0.012$, $\Phi = 0.36$] at 3-month follow-up compared to treatment completers. It is interesting to note that there was no difference between prevalence of completers (76.5%) and non-completers (81.3%) that rated additional treatment for psychological problems as important at 3-month follow-up. At 6 months, treatment completers did not differ from non-completers on

variables of psychological distress, depressive symptoms, ASI composite scores, psychosocial functioning, or substance use.

Table 6. Three-Month Psychiatric and Substance Use Variables Stratified by Treatment Completion Status

Three-Month Outcome Variables	**Treatment Completers** (n = 35)	**Treatment Non-Completers** (n = 16)	**p Value; Effect Size**
Global Severity Index (SCL-90-R; past week)	1.06 ± 0.72	1.59 ± 0.82	p = 0.024 *d* = 0.69
Depressive symptoms (BDI; past week) Minimal to mild Moderate Severe	 65.7% (23) 28.6% (10) 5.7% (2)	 56.3% (9) 12.5% (2) 31.3% (5)	 Φ = 0.36
Problems with family (past month)	52.9% (18)	56.3% (9)	
Social problems (past month)	38.2% (13)	50.0% (8)	
Trouble controlling violent behaviour (past month)	11.4% (4)	18.8% (3)	
Suicidal thoughts (past month)	22.9% (8)	43.8% (7)	
Suicide attempt (past month)	0%	12.5% (2)	Φ = 0.30
Substance Use Variables			
Current major substance problem (past month)	20.6% (7)	56.3% (9)	Φ = 0.36
Mean $ spent on alcohol (past month)	$46.00 ± $63.52	$50.00 ± 77.80	
Mean $ spent on drugs (past month)	$22.29 ± $64.40	$77.81 ± $143.38	*d* = 0.50
3-Month ASI Composite Scores			
Alcohol	0.13 ± 0.13	0.15 ± 0.16	
Drug	0.05 ± 0.08	0.07 ± 0.10	
Medical	0.37 ± 0.31	0.38 ± 0.36	
Employment	0.56 ± 0.28	0.65 ± 0.29	
Legal	0.00 ± 0.03	0.02 ± 0.06	
Family/Social	0.21 ± 0.21	0.23 ± 0.21	
Psychiatric	0.41 ± 0.23	0.49 ± 0.19	

Values are presented as % (n) of sample or group mean ± SD.
No group differences were significant after Bonferroni correction for multiple comparisons ($p > 0.05$).
Effect size is shown as Φ for chi square tests and Cohen's *d* for student's *t* tests.

6.5 Baseline Substance Abuse as a Predictor of Outcomes

Individuals with substance abuse at baseline were compared to non-abusers on measures at follow-up to determine if baseline substance abuse predicted treatment outcomes. Treatment completion rate did not differ between substance abusers and non-abusers at baseline (57.6% vs. 70.4%). There were also no significant differences between groups for study retention rates at 3 months (81.8% substance abusers vs. 88.9% non-abusers) and 6 months (66.7% abusers vs. 87.0% non-abusers).

To determine the effect of baseline substance abuse on continuous variables repeated measures ANOVAs were performed for ASI composite severity, BDI, and SCL-90-R scores over time stratified by presence or absence of substance abuse. There were no effects of baseline substance abuse on severity of psychopathological or depressive symptoms, or functional impairment in any domain of the ASI including drug and alcohol severity collapsed across time.

Chi square tests for categorical variables found no significant differences between individuals with and without baseline substance abuse for measures of psychological distress at 3- or 6-month follow-up. Baseline substance abusers were more likely to have substance abuse at 3 months (57.7% vs. 4.2%) [χ^2 (1, N = 50) = 16.43, p = 0.0001, Φ = 0.57] and 6 months (44.4% vs. 5.0%) [χ^2 (1, N = 38) = 8.16, p = 0.004, Φ = 0.46] compared to non-abusers.

6.6 Predictors of Substance Abuse at Follow-Up

Overall, 32% of participants had problem substance use at 3 months. All but one participant with substance abuse at 3 months also had problems at intake. However, 42% of baseline substance abusers no longer had problems at 3 months. To determine predictors of maintenance or discontinuation of substance abuse at follow-up, baseline non-abusers were excluded from analyses and 3-month abusers vs. non-abusers were compared on baseline

variables (Table 7). Among baseline substance abusers there was no difference between those that had maintained vs. discontinued substance abuse at 3-month follow-up on baseline measures of SCL-90-R psychopathology severity. Participants with continued substance abuse had higher baseline psychiatric composite severity scores compared to those that no longer had problem substance use at 3 months [$t(13.86) = 2.64$, $p = 0.002$, $d = 1.05$]. Individuals with 3-month substance abuse also had higher baseline BDI depressive symptom scores compared to those without continued substance abuse [$t(22) = 2.20$, $p = 0.038$, $d = 0.86$].

Table 7. Baseline Psychiatric, Substance Use, and ASI Composite Scores Stratified by Maintenance or Discontinuation of Substance Abuse at 3 Months

Baseline Predictor Variables	**Continued Substance Abuse at 3 Months** (n = 15)	**No Substance Abuse at 3 Months** (n = 11)	**p Value; Effect Size**
Global Severity Index (SCL-90-R; past week)	2.37 ± 0.58	2.23 ± 0.97	
Mean depressive score (BDI; past week)	33.93 ± 6.90	24.80 ± 13.27	$p = 0.038$ $d = 0.86$
Family problems (past month)	73.3% (11)	27.3% (3)	$p = 0.02$ $\Phi = 0.46$
Social problems (past month)	53.3% (8)	36.4% (4)	
Substance Use Variables			
Mean $ spent on alcohol (past month)	$36.67 ± $46.74	$60.45 ± $102.87	
Mean $ spent on drugs (past month)	$183.67 ± $283.50	$0.91 ± $3.02	$p = 0.026$ $d = 0.91$
Number of days of alcohol problems (past month)	3.67 ± 6.80	8.36 ± 10.16	
Number of days of drug problems (past month)	11.40 ± 13.41	0.00 ± 0.00	$p = 0.005$ $d = 1.20$
Baseline ASI Composite Scores			
Alcohol	0.23 ± 0.21	0.28 ± 0.20	
Drug*	0.15 ± 0.12	0.02 ± 0.03	$p = 0.001$ $d = 1.49$
Psychiatric*	0.75 ± 0.12	0.55 ± 0.24	$p = 0.002$ $d = 1.05$

Values are presented as % (n) of sample or group mean ± SD.
*Significant differences between groups, $p < 0.05$ corrected for multiple comparisons.
Effect size is shown as Φ for Chi square tests and Cohen's *d* for student's *t* tests.

Individuals with continued substance abuse had significantly higher drug composite severity score at baseline compared to individuals without continued substance abuse [$t(16.79) = 3.85$, $p = 0.001$, $d = 1.49$]. Continued substance abusers also spent more money on drugs [$t(14.00) = 2.50$, $p = 0.026$, $d = 0.91$] and had a higher number of days of drug problems (11.40 ± 13.41 vs. 0.00 ± 0.00) [$t(14.00) = 3.29$, $p = 0.005$, $d = 1.20$] in the past 30 days at baseline compared to individuals without current substance abuse at 3 months. There were no differences between groups on money spent on alcohol, days or severity of alcohol problems. Individuals that no longer had problem substance use at 3 months were significantly more likely to have met criteria for alcohol dependence in their lifetime compared to individuals with maintained substance abuse (100% vs. 50%) [$\chi^2(1, N = 24) = 7.06$, $p = 0.008$, $\Phi = 0.54$]. Among baseline substance abusers, 72.7% of individuals that had stopped problem use at 3 months had a baseline problem with alcohol only. Post-hocs showed that baseline alcohol abusers were significantly more likely to have stopped problem use at follow-up than to have continued (66.7% vs. 33.3%) [adjusted standardized residual > |2|], which was not the case for individuals with other primary drugs of abuse or alcohol + drug problems.

A logistic regression model was constructed to assess baseline patient characteristics that predicted the presence of substance abuse at 3 months. Number of Axis I comorbidities was not a significant predictor of substance abuse ($p > 0.05$) so this variable was replaced with psychological distress in the second step to determine the model of best fit. To control for baseline substance abuse, the ASI variable of baseline drug or alcohol abuse was entered first into the model. Step 2 addressed psychological symptoms and entered the ASI psychiatric composite severity score. Step 3 entered lifetime diagnosis of a pain disorder. As shown in Table 8, the hierarchical regression model accounted for 62.0% of the variance in 3-month substance

problem status, $\chi^2 = 27.48$, df = 3, $p = 0.0001$, with an acceptable Hosmer-Lemeshow goodness of fit ($p = 0.368$). The largest proportion of variance in 3-month substance abuse status was accounted for by the presence of substance abuse at baseline ($p = 0.002$).

Table 8. Logistic Regression – Substance Abuse at 3 Months (= 1)

Predictors	Wald (df)	*p*	R^2 (Nalkerke)
Step 1: Substance Use			0.446
Presence of substance abuse at baseline (ASI)	9.65 (1) Step: $\chi^2 = 18.04$, df = 1, $p = 0.0001$	0.002	
Step 2: Psychological Distress			0.552
ASI-psychiatric composite severity	4.39 (1) Step: $\chi^2 = 5.54$, df = 1, $p = 0.019$	0.036	
Step 3: Pain			0.620
Lifetime diagnosis of a pain disorder (CDIS)	2.74 (1) Step: $\chi^2 = 3.90$, df = 1, $p = 0.048$	0.098	

Overall, the model accounted for 62.0% of the variance in presence of substance abuse at 3 months [$\chi^2 = 27.48$, df = 3, $p = 0.0001$], with an acceptable HL goodness of fit (P = 0.37).

6.7 Predictors of Depressive Symptoms at Follow-Up

6.7.1 Physiological Predictors

Self-reported BDI depressive symptoms were grouped by minimal to mild (62.7%; n = 32) vs. moderate to severe (37.3%; n = 19) symptoms at 3-month follow-up and compared on baseline measures to determine predictors of 3-month moderate/severe depressive symptoms. In terms of physiological measures, there were no differences between groups for objective measures of physiological sensitivity. Individuals with moderate to severe depressive symptoms at 3 months had significantly lower ratings of AASP sensation seeking compared to those with minimal to mild depressive symptoms (42.31 ± 6.85 vs. 48.66 ± 6.71) [$t(43) = 3.01$, $p = 0.004$, $d = 0.94$]. On the MPQ, the moderate to severe depressive symptom group had higher ratings of

evaluative pain [$t(31.78) = 2.66$, $p = 0.012$, $d = 0.79$] and pain intensity (2.37 ± 1.17 vs. 1.73 ± 0.98) [$t(47) = 2.05$, $p = 0.046$, $d = 0.59$] than the minimal to mild depression group, not significant after correction for multiple comparisons.

At 6 months, about 64.9% (n = 24) of individuals reported minimal to mild depressive symptoms and 35.1% (n = 13) had moderate to severe ratings of depression on the BDI. The only significant physiological difference at 6-month follow-up was that individuals with moderate to severe depressive symptoms had higher baseline scores on the HSPS compared to those with minimal to mild symptoms (146.14 ± 20.26 vs. 120.61 ± 26.37) [$t(34) = 3.02$, $p = 0.005$, $d = 1.09$]. The BDI group difference in HSPS score was not present at baseline or 3 months. Participants with moderate to severe depressive symptoms at 6 months also reported a higher number of days of medical problems in the past month at baseline (17.92 ± 11.80 vs. 7.58 ± 10.93) ($t(35) = 2.67$, $p = 0.011$, $d = 0.91$], were more likely to rate the need for additional medical treatment as important (69.2% vs. 25.0%) [$\chi^2(1, N = 37) = 6.84$, $p = 0.009$, $\Phi = 0.43$] and had a higher baseline ASI medical composite severity score compared to those without depressive symptoms (0.55 ± 0.36 vs. 0.28 ± 0. 31) ($t(35) = 2.46$, $p = 0.019$, $d = 0.82$]. The depression group also scored higher on the SCL-90-R somatization subscale at baseline (2.33 ± 0.78 vs. 1.48 ± 0.77) [$t(27) = 2.94$, $p = 0.007$, $d = 1.10$].

6.7.2 Psychological Predictors

Individuals with moderate/severe depressive symptoms at 3 months were more likely to have experienced hallucinations (31.6% vs. 3.2%) [$\chi^2(1, N = 50) = 7.87$, $p = 0.005$, $\Phi = 0.40$] and trouble controlling violent behaviour (63.2% vs. 25.8%) [$\chi^2(1, N = 50) = 6.85$, $p = 0.009$, $\Phi = 0.37$] in the past 30 days at baseline compared to those with low depressive symptoms. Those with moderate to severe depressive symptoms had a lower age of first suicide attempt compared

to the low depression group (14.67 ± 3.87 vs. 18.31 ± 4.19) [$t(26) = 2.35$, $p = 0.026$, $d = 0.90$], not significant after correction for multiple comparisons. There was also a significant association between depressive symptoms at 3 months and history of sexual abuse. Individuals with mild to minimal depressive symptoms (25.0%) were significantly less likely to have a history of sexual abuse than individuals with severe depressive symptoms (85.7%) at 3 months [$\chi^2(2, N = 51) = 9.65$, $p = 0.008$, $\Phi_C = 0.44$]. There were no significant differences between groups on baseline ASI composite scores, comorbidities, substance use, or other measures of psychopathology.

Age of first suicide attempt remained significantly younger among individuals with moderate to severe depressive symptoms at 6 months compared to those with low depressive severity [$t(18) = 2.70$, $p = 0.015$, $d = 1.28$]. The moderate/severe depressive group also reported a higher number of days of psychological problems at baseline compared to the minimal to mild depressive group (26.31 ± 7.67 vs. 18.52 ± 11.39) [$t(32.78) = 2.44$, $p = 0.02$, $d = 0.80$]. There were no significant group differences on any other ASI composite scores, comorbid disorders, substance use, or other psychological variables. A higher proportion of individuals with severe depressive symptoms (75.0%) had a history of sexual abuse compared to those with minimal to moderate symptoms (34.5%) at 6 months, not significant after correction for multiple comparisons [$\chi^2(1, N = 37) = 4.19$, $p = 0.041$, $\Phi = 0.34$].

To further clarify the effect of sexual abuse history, repeated measures ANOVA was performed to assess BDI scores over time grouped by history of sexual abuse. In addition to the significant main effect of time on BDI scores, there was a significant main effect of history of sexual abuse [$F(1, 34) = 7.03$, $p = 0.012$, $\eta^2_p = 0.17$]. Post-hoc tests found that individuals without a history of sexual abuse had significantly lower BDI scores at 3 and 6 months compared to baseline ($p < 0.05$) (Figure 4).

Figure 4.

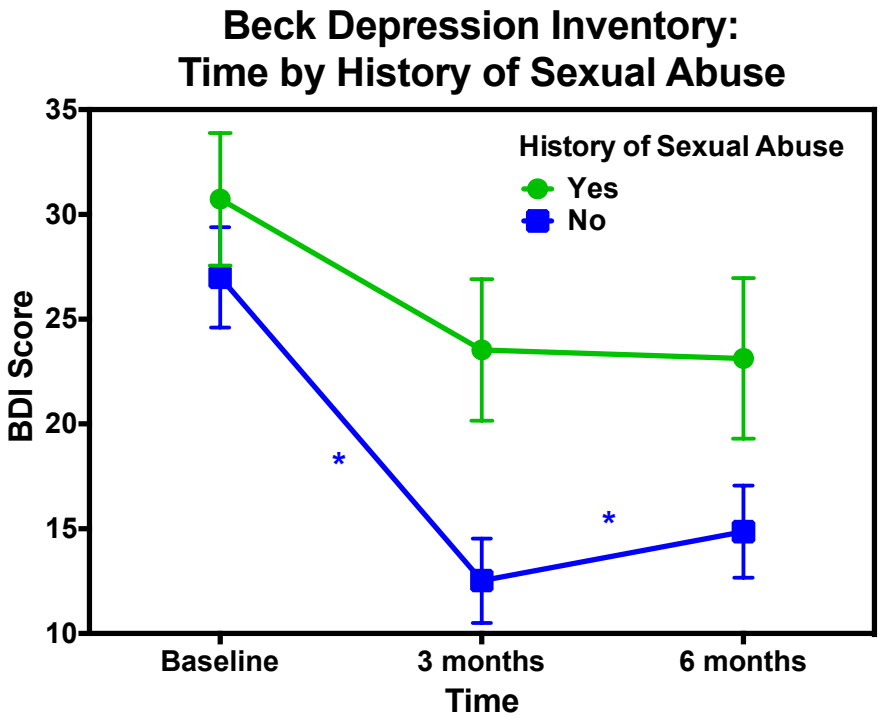

Figure 4. Beck Depression Inventory scores stratified by history of sexual abuse. Values represent the mean ± SD.
Post-hoc tests were Bonferroni corrected for multiple comparisons.
*Significant difference ($p < 0.05$) between baseline and 3 and 6-month follow-up among individuals without a history of sexual abuse.

A logistic regression model was performed to identify the most significant correlates of self-reported moderate/severe depressive symptoms at 3 months (Table 9). For this analysis BDI score at 3 months was dichotomized into minimal/mild vs. moderate/severe depressive symptoms. Correlation analysis found no significant correlation between BDI score at baseline and BDI minimal/mild vs. moderate/severe depressive group at 3 months, therefore to reserve statistical power baseline BDI score was not included in the model. Step 1 addressed physiological sensitivity using the evaluative pain rating scale; Step 2 entered information about history of sexual abuse; and Step 3 addressed the presence of substance abuse at baseline. As shown in Table 9, the hierarchical regression model accounted for 46.2% of the variance in

depressive symptoms, $\chi^2 = 20.75$, df = 3, $p = 0.0001$, with an acceptable H-L goodness of fit ($p = 0.319$). The predictor that accounted for the largest proportion of variance was history of sexual abuse ($p = 0.007$). Evaluative pain remained a significant predictor of moderate/severe depressive symptoms ($p = 0.022$) when other variables were entered into the model.

Table 9. Logistic Regression – Depressive Symptoms at 3 Months (Moderate/Severe = 1)

Predictors	Wald (df)	*p*	R^2 (Nalkerke)
Step 1: Pain			0.180
MPQ evaluative pain	6.44 (1) Step: $\chi^2 = 7.10$, df = 1, $p = 0.008$	0.011	
Step 2: Psychosocial Stressor			0.369
History of sexual abuse	7.26 (1) Step: $\chi^2 = 8.72$, df = 1, $p = 0.003$	0.007	
Step 3: Substance Use			0.462
Presence of substance abuse at baseline (ASI)	3.49 (1) Step: $\chi^2 = 4.94$, df = 1, $p = 0.026$	0.062	

Overall, the model accounted for 46.2% of the variance in 3-month depressive symptom status [$\chi^2 = 20.75$, df = 3, $p = 0.0001$] with an acceptable HL goodness of fit (P = 0.32).

7. DISCUSSION

7.1 Psychiatric Comorbidity

Treatment-seeking individuals meeting DIB-R and DSM-IV criteria for BPD demonstrated high psychiatric comorbidity of Axis I disorders in their lifetime, including mood (95%), anxiety (87%), and eating disorders (32%). Prevalence rates of mood and anxiety disorders in the current study were consistent with those previously reported in clinical and community samples and have been shown to be significantly greater than rates of comorbidity for other PDs (McGlashan et al., 2000; Tomko et al., 2014; Zanarini et al., 2004a). The psychiatric severity of the current clinical population was further demonstrated by the high prevalence of moderate to severe depressive symptoms (80%), recent self-harming behaviours

(40%), history of physical (60%) and sexual abuse (37%), and a mean ASI psychiatric composite score of 0.63 ± 0.21. ASI composite scores also provided evidence of impairment in employment and family/social functioning.

High rates of comorbidity were also present for drug (55%) and alcohol use disorders (55%), which replicated previous findings in the literature (McGlashan et al., 2000; Zanarini et al., 2004a). Overall, 72% of participants met criteria for any SUD in their lifetime. At baseline, 58.5% of individuals currently abused drugs or alcohol. The hypothesis that substance abuse would be associated with greater psychiatric severity was supported by findings that substance abusers had more fluctuations in mood, higher likelihood of moderate to severe depressive symptoms, and greater severity of psychiatric problems as demonstrated by higher SCL-90-R and ASI psychiatric composite scores compared to non-abusers.

Despite broad evidence that BPD has a negative impact on severity and outcomes of SUD (Coupland et al., 2014; Morgenstern et al., 1997; Tull & Gratz, 2012; Zikos et al., 2010) there is little information about the effects of substance abuse on BPD. Lee, Bagge, Schumacher, and Coffey (2010) found no differences between BPD patients with and without comorbid SUD on measures of impulsivity, affective lability, affective intensity, self-harm, suicidal behaviours, and externalizing behaviours such as physical fights, crime, and sexual promiscuity, concluding that SUD did not exacerbate the severity of BPD symptomatology. The current investigation partially contradicted these findings demonstrating that substance abuse was associated with greater impulsivity and trouble controlling violent behaviour among patients with BPD. Although the current study did not find a relationship between substance abuse and history of self-harm or suicidality in the past month it is clear that substance abuse at baseline was associated with greater severity of general psychiatric symptoms.

7.2 Medical Comorbidity and Pain

In addition to psychiatric comorbidity, 65% of the sample experienced medical problems in the past month at baseline and 38.5% of individuals reported chronic medical problems that continued to interfere with functioning. Among a nationally representative sample of adults in the United States enrolled in the NESARC study, BPD was associated with cardiovascular disease (adjusted odds ratio (AOR) 1.47), arthritis (AOR 1.59), and gastrointestinal disease (AOR 1.35) (Quirk et al., 2015).

Individuals with BPD are over-represented among chronic pain patients (Sansone & Sansone, 2012). In the present sample, 65% of individuals met DSM-IV criteria for a pain disorder characterized by pain causing distress or functional impairment in which psychological distress has an important role in the onset, severity, exacerbation or maintenance of the pain (American Psychiatric Association, 2000). Furthermore, about 70% of participants reported experiencing pain ranging from discomforting to excruciating on the day of baseline assessment. The prevalence of high pain intensity in the sample is consistent with findings that higher BPD features were associated with greater severity of pain and somatic complaints among chronic pain patients (Sansone, Mueller, Mercer, & Wiederman, 2010; Tragesser, Bruns, & Disorbio, 2010). In another study the association between BPD diagnosis and pain severity was no longer significant after controlling for affective scales of depression, anxiety, and hostility suggesting that heightened pain intensity among individuals with BPD is a physical manifestation of emotion regulation difficulties (Tragesser et al., 2010).

The hypothesis that physiological sensitivity would be associated with treatment outcomes was unsupported in the present study. There are several possible explanations for these negative findings. Firstly, physiological sensitivity to non-painful Von Frey filaments may not be

altered in individuals with BPD and subsequently have no relationship to treatment outcomes. Patients with BPD do not appear to have changes in their ability to perceive non-painful thermal or somatosensory (exteroceptive and proprioceptive) stimuli compared to psychiatric and healthy controls (Ludäscher et al., 2009, 2015; Pavony & Lenzenweger, 2014). Although BPD has been shown to be associated with lower pain thresholds in previous studies, a lack of comparison group in the present investigation limits the ability to interpret levels of pain sensitivity. It is possible that all individuals in the sample demonstrated low pain thresholds but the small range of variance made it difficult to determine differences that predicted outcomes. Due to small sample size at follow-ups, there may have been insignificant power to determine physiological differences. Alternatively, physiological sensitivity may not play a role in predicting treatment outcomes for individuals with BPD.

7.3 Predictors of Treatment Retention

Treatment retention rate was 63% for completion of the 3-month outpatient program. This retention rate was slightly lower than the mean treatment completion rate of 75% calculated in a meta-analysis of 19 specialized interventions for BPD of less than 12 months duration, however the present study fell within the range of retention rates of 48% to 100% (Barnicot et al., 2011). The current investigation found few variables that predicted treatment completion. Treatment completers had a slightly higher number of years of education compared to non-completers, which contradicts several studies that found no association between treatment dropout and education level (Clarkin et al., 2001; Rüsch et al., 2008). Treatment completers were less likely to have trouble controlling violent behaviour in their lifetime, and more likely to have a lifetime mood disorder (100% vs. 85%), which was not significant after correction for multiple comparisons. However, current severity of psychiatric and depressive symptoms, psychosocial

functioning, physiological sensitivity, number of Axis I comorbidities, and presence or severity of substance problems did not predict treatment completion.

These findings are generally supported by previous research of predictors of treatment outcomes among individuals with BPD. During inpatient DBT and outpatient general psychiatric treatment for individuals with BPD, treatment completers and non-completers did not differ in terms of baseline global severity of psychopathology (Bohus et al., 2004; De Panfilis et al., 2012; Rüsch et al., 2008). Furthermore, studies have found that number of Axis I disorders and BPD pathology do not predict treatment retention (Clarkin et al., 2001; De Panfilis et al., 2012; Spinhoven et al., 2008). The prevalence of SUD, mood, and anxiety disorders did not differ between treatment completers and non-completers for individuals with BPD undergoing general psychiatric outpatient care (De Panfilis et al., 2012). Furthermore, in a study of DBT versus TAU for individuals with BPD with and without comorbid SUD, the presence of SUD did not affect treatment retention in the DBT group (van den Bosch, Verheul, Schippers, & van den Brink, 2002).

Poor patient- or therapist-rated therapeutic alliance at 3 months has been shown to be predictive of time to treatment dropout in a 3-year program of schema-focused or transference-focused psychotherapy for individuals with BPD (Spinhoven, Giesen-Bloo, van Dyck, Kooiman, & Arntz, 2007). In the same study, therapists' ratings of probability of treatment success after 3 months of treatment was the only significant predictor of dropout, irrespective of level of BPD symptom severity after 3 months, Axis I and II comorbidities, and treatment condition (Spinhoven et al., 2008). The current investigation did not examine therapeutic alliance but it is possible that this variable would account for greater variance in treatment completion status than

the hypothesized predictors of physiological sensitivity, psychiatric comorbidity, and substance use, which were not significant in the hierarchical regression model.

7.4 Treatment Outcomes and Effects of Treatment Completion

Regardless of treatment completion status, severity of general psychiatric and depressive symptoms were significantly reduced from baseline to 3- and 6-month follow-up. Treatment completers had significantly lower scores at 3 and 6 months compared to baseline for measures of global severity, obsessive-compulsiveness, and interpersonal sensitivity. ASI composite score of psychiatric severity also decreased over time, but severity of psychiatric problems did not differ between treatment completers and non-completers. In terms of functional impairment, participants did not show reductions in severity of medical, employment, or drug and alcohol problems over time. Family/social functioning had a quadratic trend for the effect of time, demonstrating an improvement in severity of family/social problems at 3 months but not 6 months from baseline. Results are consistent with other reports of improvements in psychopathology but not general social and occupational functioning following specialized treatments including DBT, MBT, and general psychiatric management (Bateman & Fonagy, 2008; McMain et al., 2012). This well-supported finding highlights the need for the development of interventions to target pervasive functional problems in addition to psychopathological symptoms among individuals with BPD.

Analysis of categorical variables by treatment completion status found an association between treatment dropout and greater depressive symptoms, higher likelihood of suicide attempt, and presence of substance abuse at 3 months but not 6 months of follow-up. Reductions in psychological distress and substance abuse among treatment completers at 3 months provide support for the effectiveness of short-term specialized outpatient treatment for individuals with

BPD. Loss to follow-up of 43% of treatment non-completers at 6 months limits the interpretation of the failure to maintain group differences between completers and non-completers at this time point. It is possible that treatment non-completers with poorer outcomes at 6 months did not return for the follow-up research interview. Additionally, almost half (45.5%) of treatment non-completers that were retained in the study utilized outpatient psychiatric services between 3 and 6 months follow-up compared to 20% of treatment completers, suggesting that treatment outcomes at follow-ups may be distorted by the use of additional therapy.

7.5 Substance Abuse as a Predictor and Outcome of Treatment

Despite the association between substance abuse and greater severity of psychiatric symptoms at baseline, the hypothesis that substance abuse would be associated with treatment dropout and poorer treatment outcomes was not supported. Baseline substance abuse was not associated with greater severity of psychopathology, depressive symptoms, or functional impairment at 3 or 6 months. These negative findings may be due to the low severity of drug and alcohol problems among substance abusers in the present sample and conclusions cannot be made about the impact of concurrent SUD on treatment outcomes for individuals with BPD.

There is a paucity of research investigating the relationship between problem substance use and clinical outcomes for individuals with BPD. Among studies of specialized treatments for BPD that have examined baseline predictors of treatment outcomes, concurrent SUD is often an exclusion criterion (Bateman & Fonagy, 1999; Black et al., 2009; Bohus et al., 2004; Perroud, Uher, Dieben, Nicastro, & Huguelet, 2010). Even when participants with substance misuse are included in the study, analyses of the relationship between substance problems and clinical outcomes are often unreported (Bateman & Fonagy, 2009; Clarkin et al., 2007; Laddis, 2010; Rüsch et al., 2008; Spinhoven et al., 2008). Nonetheless, in a randomized controlled trial

examining the effectiveness of DBT compared to TAU for BPD patients with and without SUD, comorbid SUD did not modify the impact of DBT on borderline pathology or reduction of self-harming behaviour (van den Bosch et al., 2002). Furthermore, SUD did not predict suicide attempts over 5 years of follow-ups with individuals with BPD recruited from community and clinical samples (Soloff & Fabio, 2008).

In the present study the only variable that was predicted by baseline substance abuse was continued substance abuse at follow-ups. Presence of baseline substance abuse accounted for 45% of the variance in 3-month substance abuse status in a hierarchical regression model. Among individuals with initial substance abuse 42% no longer had problem use at 3 months. Despite the drop in percentage of individuals with problem substance use at follow-ups, ASI drug and alcohol composite severity scores were not reduced over time during repeated measures analyses. Stability of composite scores across baseline, 3- and 6-month follow-up may be due to a floor effect from the low severity of substance problems among the sample. Previous research of DBT for individuals with BPD and SUD has shown mixed results for the reduction of substance use severity. In a study comparing DBT to TAU, individuals with BPD and SUD did not have a reduction in the number of days of substance use, days of substance problems, or severity of problems from baseline to 18-month follow-up, regardless of treatment condition (van den Bosch et al., 2002). In contrast, Linehan et al. (1999) found that individuals with BPD enrolled in DBT had a significantly greater proportion of abstinence days compared to TAU during treatment and at 16 months.

In the present study, individuals with 3-month substance abuse had greater baseline drug use and psychiatric composite severity scores than individuals that had discontinued problem substance use. In the regression model severity of psychiatric problems at intake was a

significant predictor of substance abuse at 3 months after accounting for baseline substance abuse. These findings support the notion that individuals with BPD and problem substance use may be more difficult to treat than those with BPD alone. Recent reviews of the efficacy of interventions for co-occurring BPD and SUD concluded that further research is crucial to determine empirically supported treatments that prevent relapse and improve outcomes for this population (Lee, Cameron, & Jenner, 2015; Pennay et al., 2011).

7.6 Predictors of Depressive Symptoms at Follow-Up

Lower pain threshold, greater psychiatric comorbidity, and problem substance use – the hypothesized predictors of treatment outcomes – were not associated with self-reported depressive symptoms at follow-up. Results were consistent with previous findings that BDI scores at the end of treatment were not affected by number of Axis I diagnoses or baseline global severity index scores for individuals with BPD in 18-month outpatient MBT or structured clinical management (Bateman & Fonagy, 2013).

Lower scores of sensation seeking were significantly associated with moderate to severe depressive symptoms, which is consistent with previous literature (Carton, Jouvent, Bungener, & Widlöcher, 1992; Farmer et al., 2001). Individuals with greater depressive symptoms at 3 months had higher ratings of pain on the day of the baseline research interview. Evaluative pain, which describes the "subjective overall intensity of the total pain experience" (Melzack, 1975), was a unique predictor of 3-month moderate to severe depressive symptoms as demonstrated by hierarchical regression model. Baseline severity of medical problems and somatization score (SCL-90-R) were associated with moderate to severe depressive symptoms at 6 months. Together these findings suggest a relationship between subjective pain experience and depression outcomes among outpatients with BPD. However, pain intensity and somatic

symptoms have often been linked to depression therefore results may not be specific to individuals with BPD (Haythornthwaite, Sieber, & Kerns, 1991; Kroenke, Shen, Oxman, Williams Jr, & Dietrich, 2008; Simon, VonKorff, Piccinelli, Fullerton, & Ormel, 1999).

In the hierarchical model, the most significant predictor of moderate/severe depressive symptoms was a history of sexual abuse. Repeated measures analysis found that depression scores for individuals with a history of sexual abuse remained stable in the range of moderate to severe depressive symptoms over the course of 3-month treatment and follow-up. In contrast, BDI scores decreased over time for individuals without sexual abuse history. Structural equation modeling identified BPD features to have a mediating role between childhood physical and sexual maltreatment and the development of depression, anxiety disorders, and substance dependence (Hayashi et al., 2015). Higher rates of sexual abuse history were also shown among individuals with persistent BPD compared to BPD remitters at 4-year follow-up (Biskin, Paris, Renaud, Raz, & Zelkowitz, 2011).

Several etiological models of BPD suggest diathesis-stress interactions between trait and/or genetic vulnerabilities and psychosocial stressors like sexual abuse in the development of BPD (Arens, Grabe, Spitzer, & Barnow, 2011; Belsky et al., 2012; Bornovalova et al., 2013; Laporte, Paris, Guttman, & Russell, 2011). It is possible that treatment duration of 3 months was insufficient to effectively address the complex relationship between depressive symptoms and trauma history in this population.

7.7 Limitations

Several limitations in this study should be noted. Firstly, restricted sample variance greatly limits the generalizability of results. For example, variance in psychiatric severity among the current sample, which had a DIB-R score of at least 8 out of 10, may be too small to measure

the predictive properties of objective and subjective physiological sensitivity on psychopathology improvement. Lack of variance in the sample may also limit interpretation of the effects of substance abuse on treatment outcomes, considering the low severity of drug and alcohol composite scores among substance abusers.

Another limitation to the study is the low rate of study retention at 6 months (42.9%) among individuals that dropped out of the treatment program. Although there were no differences between individuals that were retained or lost to follow-up on any baseline measures, the impact of treatment completion status on outcomes at follow-up may be underestimated. Third, small sample size reduced statistical power and limited the number of variables that could be included in regression analyses.

A minor limitation was that history of sexual abuse was not explored beyond a categorical response of yes or no. Therefore, the occurrence of abuse during childhood or adulthood was not measured and the relationship between baseline and clinical outcomes with childhood adverse experiences could not be examined in the present study. Furthermore, BPD diagnosis was not re-assessed at follow-up, which limits comparison to previous literature that use BPD remission as an indicator of treatment response. However, measures of severity of psychopathology, functional impairment, and substance use provide a meaningful understanding of the degree of improvement, which is not possible with the dichotomous variable of presence or absence of BPD diagnosis.

8. CONCLUSIONS AND FUTURE DIRECTIONS

The present study confirms high rates of chronic pain, lifetime Axis I diagnoses, and comorbid substance abuse among individuals with BPD. Problem substance use was associated with greater psychiatric severity, impulsivity, mood disturbance, and Axis I comorbidities at

baseline, but did not predict treatment outcomes. Results suggest that psychopathology improves for treatment completers over time, but functional impairment remains stable. Future interventions should target employment, medical, and family/social functioning, and address the relationship between history of sexual abuse and pervasive depressive symptoms.

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10. APPENDIX

10.1 CONSENT FORM

"Outcomes Among Patients in the MUHC Personality Disorders Clinic".

Investigators
Dr. Lise Laporte, Research Director, Personality Disorder Program, MUHC
Dr. Joel Paris, Personality Disorder Program, MUHC
Dr. Kathryn Gill, Director of Research, Addictions Unit, MUHC
Dr. Ronald Fraser, Director, Detoxification Program, Addictions Unit, MUHC
Kevin Hamdullahpur, Research Assistant, Addictions Unit, MUHC
Laura Heath, Research Assistant, MUHC

Introduction
You are being invited to participate in this study because you are a patient at the MUHC Personality Disorders Program.

Before deciding to participate in the study, you should clearly understand its requirements and benefits. This document provides information about the study. Please read it carefully and ask the study staff any questions you may have. If you decide to participate, you will be asked to sign this form and a copy will be given to you.

Purpose of the Study
The purpose of this study is to understand if you experience exceptionally heightened physical and emotional sensitivities at the time you first come in for treatment at the Personality Disorders Clinic. We aim to gain insight into the unique sensitivities present among individuals with personality disorders.

Description of the Study
If you agree to take part in this study, you will be asked to come to the Allan Memorial Institute where you will meet with the Research Assistants Laura Heath or Kevin Hamdullahpur. You will be asked to complete interviews and self-report questionnaires in two 90-minute-sessions. During these sessions you will be asked questions about mood, personality, substance use, physical discomfort and sensory sensitivity. This will occur prior to the beginning of your treatment at the Personality Disorders Clinic. There will be questions like, "Do you find it unpleasant to have a lot going on at once?" and "Do other people's moods affect you strongly?". To better understand how physically sensitive you are, we will also administer tests to measure your sensitivity to touch and pressure discomfort. Touch sensitivity is measured by touching hairs of different diameters across your inner forearm until you notice them. Pressure discomfort threshold is measured using an algometer, a tool used to apply small amounts of pressure. This will be placed against your thumb, and you will feel increasing amounts of pressure until you indicate that you feel uncomfortable. All of these measures will give us a global indication of your physical and emotional sensitivity.

You should be informed that we will access your hospital and clinic charts to examine the information related to your initial presenting problems, diagnoses and progress in treatment. Note that the study does NOT involve any changes to your treatment or medications.

Risks and Discomforts
There are no risks of permanent physical damage of any kind when participating in the pressure discomfort threshold test or the test of sensitivity to touch. If at any point, you wish to stop the test prematurely or feel uncomfortable continuing, we encourage you to do so. It is unlikely, however, that you may experience some discomfort and/or anxiety when responding to some of the questions on the questionnaires.

Potential Benefits
You should not expect any direct benefits from participating in this study. However, the information collected from this study may benefit future patients.

Alternative to Research Participation
Your treatment is not conditional on your participation in this study. If you choose not to participate it will not influence any treatment you may receive.

Indemnification
The McGill University Health Centre, the Research Institute of the MUHC, and the investigators would not be able to offer compensation in the unlikely event of an injury resulting from your participation in this research study. However, you are not giving up any of your legal rights by signing this consent and agreeing to participate in this study.

Cost and Compensation
You will not be offered any compensation for your participation in this study. There will be no costs associated with the study.

Voluntary Participation and/or Withdrawal
Your participation in this study is strictly voluntary. You may refuse to participate or you may discontinue your participation in this study at any time, without explanation and without penalty or loss of benefits to which you are otherwise entitled. As well, if you are uncomfortable with a specific test within the protocol, you are free to decline to participate in that aspect alone. If you decide to discontinue, you will suffer no prejudice regarding medical care. You will be informed of any new findings that may affect your willingness to continue your participation.

Confidentiality
All information obtained during this study will be kept strictly confidential. Your name will be coded and the coded information will be locked in a filing cabinet in the investigator's office with limited access. The results of this study may be published, and other researchers participating in this study may have access to your records related to this research; however, your identity will not be revealed in the combined results.

In order to verify the research study data, the Quality Assurance Officers of the MUHC Research Ethics Office may review these records and report to the REB of record.

By signing this consent form, you give us permission to inform your treating physician of your participation in this research study and you give us permission to review your medical records. Your confidentiality will otherwise be protected to the extent permitted by applicable laws and regulations.

Significant Findings
During the course of this study, investigators may generate new research findings. The research results will be shared with you and you are welcome to discuss the findings with the investigators.

Control of the Ethical Aspects of the Research Project
The Ethics Research Board of the MUHC approved this research project and ensures the follow-up. In addition, it will first approve any review and amendment made to the information/consent form and to the study protocol.

Funding of the Research Project:
The principal investigator will not be paid for this research project. The funds received cover the expenses of the research.

Quality Assurance Program:
The MUHC implemented a Quality Assurance Program that includes active continuing review of projects (on site visits) conducted within our establishment. Therefore, it must be noted that all human subject research conducted at the MUHC or elsewhere by its staff, is subject to MUHC Routine and Directed Quality Improvement Visits.

Questions and Contact Information
If you have any questions regarding the study, you should contact the investigator, Dr. Kathryn Gill at (514) 934-1934 x42395 (office-voicemail). If you have any questions regarding your rights as a study participant, you should contact the Ombudsman, tel. 514-934-1934, ext. 48306.

DECLARATION OF CONSENT

I have read this consent form, and I agree to participate in this research study. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I have been given sufficient time to consider the above information and to seek advice if I chose to do so. I understand that I will be given a signed copy of this consent form. By signing this consent form, I have not given up any of my legal rights.

Participant	**(Print Name)**	**Date**
Investigator	**(Print Name)**	
Witness	**(Print Name)**	