PSYCHOSOCIAL RISK FACTORS PREDICT PRESCRIPTION OPIOID USAGE AFTER SPINE SURGERY

by

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ABSTRACT

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Outcomes associated with spine surgeries are not universal. Moreover, some patients continue to remain on prescription strength opioids after surgery. Pre-surgical psychological screenings (PPS) are conducted to assess for psychosocial factors that may affect surgical outcomes. The purpose of this investigation was to examine whether patients tended to continue taking prescription pain medications shortly after spine surgery (approximately 6-months post-surgery). In addition, analyses examined whether scale scores of the MMPI-2-RF predicted a greater likelihood of remaining on prescription pain medications following spine surgery/SCS after controlling for self-reported pre-surgical medication status and pre-surgical pain levels. Patients (n = 821) were administered the MMPI-2-RF and given a pre-surgical packet of other self-report measures including pain levels, pain medications, and surgery type. Analyses were calculated to explore the incremental validity of the scale scores of the MMPI-2-RF in predicting post-surgical prescription pain medication after controlling for pre-surgical prescription pain medication status, pre-surgical baseline pain ratings, and surgery type. Using presurgical prescription pain medications prior to surgery was the strongest predictor of post-surgical prescription pain medication use. Patients who underwent a spinal fusion reported less pain at the post-operative follow-up. Higher scale scores on Demoralization (RCd) incrementally predicted post-surgical prescription pain medication use and post-operative pain after controlling for presurgical prescription pain medication use, pre-surgical pain levels, and surgery type. Somatic Complaints (RC1) also incrementally predicted higher post-operative pain after controlling for pre-surgical opioid use, surgery type, and pre-surgical pain levels. Consistent with the literature, many patients continue to use prescription strength pain medications shortly following surgical intervention for back pain. However, patients who tended to be sad, unhappy, and incapable of dealing with life circumstances pre-surgery were more likely to continue to be on prescription strength pain medications post-surgery.

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CHAPTER I:

LITERATURE REVIEW

Healthcare in the United States is increasingly benefited by the inclusion of clinical psychologists. In fact, multidisciplinary teams often include psychologists who conduct psychological assessments in their practice. For instance, psychologists routinely conduct pre-surgical psychological evaluations to aid surgical teams in determining whether patients are suitable for higher risk surgeries, such as organ transplant, bariatric, and spine surgery (Block & Sarwer, 2013). The information obtained as a function of pre-surgical psychological evaluation (PPE) is collected through examining the patient's medical chart, conducting psychology interviews with patients and family, and administration of psychometric testing. The goal of these evaluations is to identify psychological risks that may impede surgical outcomes.

Spine Surgical Interventions

In the United States, up to 85% of individuals experience back pain (Freburger et al., 2009; Rubin, 2007; Taylor & Curran, 1985); however, only about 1% of the population seeks surgical intervention to assist in diminishing their back pain and increasing their functionality (Block & Sarwer, 2013; Block, Gatchel, Deardorff, & Guyer, 2003). Spine surgery has three patient-focused objectives: to restore or diminish the effect of harmful "physical structure" of the spine, improve the patient's functionality, and decrease the patient's pain level (Block & Sarwer, 2013). Although most patients go on to have decreased pain and increased functional ability after surgery (Atlas et al., 2000), outcomes can be somewhat varied (Sherman et al., 2010). The destructiveness of the surgery itself (e.g., spinal fusion vs. artificial disc replacement), defined by the extent to which tissue is damaged, has been associated with poorer outcomes in spine surgery (Block & Sarwer, 2013). A spinal fusion is a process by which two or more vertebrae are fused together so that they “heal into a single, solid bone” restoring spine stability and minimizing motion pain (Park, 2018). In an artificial disk replacement, worn material between vertebrae is “removed and replaced” with an artificial disk in order to reduce pain and provide more motion than what is experienced with spinal fusions (Jenis, 2016). Destructiveness is a description used to determine the overall less-conservative nature of specific surgical interventions that are utilized to combat and assist in remediating back pain.

Spinal cord stimulation (SCS) involves a mechanism implanted under the skin that delivers pulses to a targeted spinal cord area, ideally used to treat chronic pain or failed back surgery syndrome (FBSS). Failed back surgery syndrome occurs in 10%-40% of patients who have undergone spine surgery to reduce back pain, and consists of experiencing recurrent chronic pain, even after spine surgery (Kumar et al., 2008). SCS stems from Melzack and Wall’s (1965) gate control theory which asserts that the perception of pain is complex and dependent on the reaction of specific nerve fibers to either a painful or non-painful stimulation . As such, SCS utilizes low voltage stimulation to the spinal nerves, essentially blocking pain signals from transmitting through the central nervous system (CNS) and minimizing the amount of pain experienced by the patient. The use of thoracic SCS interventions has demonstrated positive long-term clinical outcomes (Deer et al., 2013). Studies have demonstrated that SCS was 50% effective in terms of diminishing extreme back pain, post-surgery (Oakley & Prager, 2002). SCS was shown to reduce pain level and in turn reduce opioid use, post-operatively. For example, a study conducted by Al-Kaisey et al. (2014), obtained a statistically significant decrease in opioid use within a 24 month follow-up.

Although SCS and traditional surgical interventions often showcase favorable outcomes, effectiveness of procedures tend to vary. It has been observed that spine interventions are not always effective in providing pain relief or improving functionality, and in turn may not always determine successful patient satisfaction outcomes (Marek, Block, & Ben-Porath, 2017; Sherman et al., 2010). For example, a study conducted by Sherman et al. (2010) showcased that 28% of patients reported less-than-favorable surgical outcomes, with some patients undergoing additional intervention post-initial intervention. Similarly, both SCS and traditional surgical interventions, do not always report consistent long-term effectiveness. For example, a literature review conducted on SCS effectiveness regarding leg pain, where the criterion consisted of meeting 50% pain reduction as "successful", demonstrated that although a large portion (64%) of patients achieved some pain reduction, there is still a fairly significant percentage of patients reporting minimal pain reduction (Eldabe, Kumar, Buchser, & Taylor, 2010). The most noteworthy component of this finding was that the patients undergoing SCS and other medical management approaches were doing so after having had previous surgical interventions. There are many applicable components to unsatisfactory patient outcomes, with the literature showing emotional, behavioral, and psychosocial characteristics predicting poorer outcomes, often above and beyond medical problems. Indeed, previous empirical studies have demonstrated that factors such as pre-surgical somatization, depression, demoralization, anxiety, poor coping, pain sensitivity, anger, abuse history, catastrophizing, and substance use/abuse are predictive factors for poor surgical outcomes in spine surgery (Block, Ben-Porath, & Marek, 2013; Block, Ben-Porath, & Marek, 2017; Celestin, Edwards, & Jamison, 2009). Thus, presurgical psychological evaluations (PPEs) in spine surgery/spinal cord stimulator (SCS) settings routinely use multimethod assessments to aid in the identification of risk factors (Block, Ohnmeiss, Guyer, Rashbaum, & Hochschuler, 2001). PPEs are aimed to assess for these risk factors and, if present, find ways to mitigate these risk factors to help the patient have favorable surgical outcomes. Many of the aforementioned risk factors have been linked to substance use/misuse in individuals with chronic back pain, spine injury, and post-intervention (Block, Ben-Porath, & Marek, 2013; Epker & Block, 2014).

Narcotic Use

Opioid/narcotic therapy is used to reduce the intensity of pain by working within a person's nervous system or specific brain receptors (Centers for Disease Control and Prevention [CDC], 2018). The literature supports that chronic narcotic (opioid) therapy and preoperative use of narcotics for pain relief are associated with poorer postoperative spine surgery outcomes, especially in terms of pain relief (Epker & Block, 2014). Lee et al. (2014), demonstrated that preoperative opioid use was a significant predictor of overall unfavorable self-reported outcomes. Additionally, a review by Yoshihara (2015) reported that many spine surgery patients continue taking medications one year after surgery, particularly narcotics. Armaghani et al., (2014) demonstrated that increased preoperative opioid use was a negative predictor of eventual post-surgical opioid decrease, which can likely be associated with the heightened tolerance for opioid intake experienced by patients after consistent preoperative narcotic use. Literature has also demonstrated that continued use of narcotic medications postoperatively tends to be associated with less successful spine surgery results and post-operative pain level management (Block, Ben-Porath, & Marek, 2013; Menendez, Ring, & Bateman, 2015). As Lin et al. (2018) stated, there is "limited evidence" of effective long term use of opioids to improve a patient's overall pain management, functionality, and quality of life. Heightened use of post-surgical narcotics has increased concern regarding post-surgical outcomes, in that patient success cannot be pinpointed solely on surgical intervention success. Further, ongoing opioid use after surgery could eventually lead to substance abuse (Marek, Block, & Ben-Porath, 2015). A major concern for pre- and post-operative patient well-being is derived from the current opioid epidemic in the United States. Although there are specific clinical and prescription guidelines provided by the Centers for Disease Control and Prevention (CDC, 2018), studies have shown that opioid prescription, specifically for low back pain, has doubled within the past decade (Deyo, Von Korff, & Duhrkoop, 2015; Lin et al., 2018). Insurance companies have also reported long term use of opioids for patients who were prescribed narcotics for at least three months (Deyo et al., 2015). Overall, there is an alarming rise in drug misuse, complications, and overdoses that are associated with the current rise in opioid use (Deyo et al., 2015).

Minnesota Multiphasic Personality Inventory - 2 - Restructured Form in Spine Surgery/SCS Evaluations

The original Minnesota Multiphasic Personality Inventory (MMPI) and MMPI-2 were historically used to assess patients with different forms of chronic pain. Constructs assessed on the MMPI-2, primarily on Clinical Scales 1 (Hypochondriasis), 2 (Depression), 3 (Hysteria), and 7 (Psychasthenia) have been consistently associated with poor outcomes in spine surgery patients (Block, Ohnmeiss, Guyer, Rashbaum, & Hochschuler, 2001). The scales, however, were not psychometrically optimal and the scale scores often demonstrated poor discriminant validity. Using Watson & Tellegen's (1985) theory of the structure of mood and anxiety, Tellegen et al., (2003) found that demoralization - a pervasive and affect-laden dimension of unhappiness and dissatisfaction with life – was embedded within the original Clinical Scales. Tellegen (1985) theorized that demoralization likely hampered the performance of most self-report instruments and that the goal as a profession was to find ways of *not* measuring it. Demoralization is often conceptualized in behavioral medicine as taking a patient's temperature (Ben-Porath, 2012). An elevated temperature signals that something is wrong, but does not necessarily tell the provider what is wrong. Using factor analytic methods, demoralization was identified and removed from the Clinical Scales (now measured on Restructured Clinical [RC] Demoralization [RCd]). Items on the rest of the scales were retained if they aimed to assess core features associated with the Clinical Scales and demonstrated high factor loadings. The resultant effort led to the creation of the nine, non-item overlapping RC scales (Tellegen et al., 2003). The rest of the MMPI-2 item pool was later examined to augment RC scale interpretation and led to the creation of the MMPI-2-Restructured Form (MMPI-2-RF) (Ben-Porath & Tellegen 2008/2011; Tellegen & Ben-Porath 2008/2011).

Demoralization (RCd) was found to be one of the strongest predictors of poor functional and overall outcome post-surgery in terms of SCS & conservative surgical interventions (Marek, Block, & Ben-Porath, 2015). Further, research suggests that higher scores on the Demoralization scales demonstrate modest associations with RCd and poorer post-surgical outcomes, including less pain improvement, continued workers' compensation, and use of narcotics (Marek, Block, & Ben-Porath, 2015). Additionally, the Somatic Complaints Scale (RC1) has also demonstrated an association with spine surgical outcomes. The RC1 assists identification of individuals who have genuine medical problems, but tend to somaticize (Ben-Porath, 2012). In a recent study, higher scores on the RC1 were significantly correlated with poor pain reduction and less functionality (Block, Marek, Ben-Porath, & Kukal, 2015). Also, Epker & Block (2014) reported that higher scores on Low Positive Emotions (RC2) – a scale that assesses anhedonia and other vegetative symptoms more closely aligned with Major Depression Disorder – were also modestly associated with reduced outcomes, regarding pain and emotional functioning.

In terms of Restructured Clinical (RC) scales, the aforementioned scales were determined as the strongest presurgical predictors of negative outcomes (Block, Marek, Ben-Porath, & Ohmeiss, 2014; Block, Marek, Ben-Porath, & Kukal, 2015). These scales have demonstrated predictive validity regarding post-surgical pain level (Marek, Block, & Ben-Porath, 2015). Moreover, some of the externalizing scales, such as Antisocial Behaviors, have been associated with measures of substance use and potential opioid use/misuse by patients in this setting (Block, Ben-Porath, & Marek, 2013).

Purpose & Hypotheses

The objective of this study was to explore whether pre-operative MMPI-2-RF scale scores predict change in pain level and narcotic pain medication use shortly after spine surgical interventions (approximately 3 to 6 months post-surgery). First, it was hypothesized that opioid medication use would decrease between the pre-surgical evaluation and the post-surgical follow-up. It was also hypothesized that mean pain level scores would decrease as a function of surgery. Using previously reviewed literature, it was hypothesized that patients undergoing a more deconstructive surgery would report more pain and ongoing opioid use after surgery than those who had less evasive surgeries. Finally, it was hypothesized that higher pre-surgical MMPI-2-RF scale scores on Demoralization (RCd), Somatic Complaints (RC1), Low Positive Emotions (RC2), and Dysfunctional Negative Emotion (RC7) would be associated with higher levels of pain and prescription pain medication use after surgery after controlling for surgery type and pre-surgical pain and opioid use.

CHAPTER II:

METHOD

Participants

A de-identified longitudinal archival database was used. The database was developed and maintained through collaborations between Kent State University and the Texas Back Institute. Participants were referred to the Texas Back Institute's Behavioral Medicine Division to undergo a presurgical psychological evaluation (PPE) prior to being cleared to take part in a spine surgical intervention. Participants were selected if they completed the MMPI-2-RF, produced a valid protocol, consented to have their data used for the outcome study, and were being evaluated for conventional spine surgery or a spinal cord stimulator (SCS). The sample included 821 participants (58.2% women, 41.8% men) with a mean education level of 13.24 years of education (SD = 3.27) and mean age of 49.98 (SD = 13.1). In regards to surgery type, 30.9% of patients received a SCS, 46.5% underwent a spinal fusion, and the rest (22.6%) underwent other types of surgery (e.g., artificial disc replacement). Use of these data were approved by University of Houston-Clear Lake's Committee for the Protection of Human Subjects.

Measures

Minnesota Multiphasic Personality Inventory–2–Restructured Form (MMPI-2-RF).

The MMPI-2-RF consists of 338 items scored on 9 protocol validity scales & 42 substantive scales. The scale scores are hierarchically structured in consistency with contemporary models of psychopathology (Kotov et al., 2017) and assess domains that include emotional, thought, behavioral, somatic, and interpersonal functioning. The scores from the instrument have been validated in spine surgery and SCS settings (Block, Ben-Porath, & Marek, 2013; Marek et al., 2018).

Patient Self-Report Survey Data.

This survey allowed patientsto rate current experience of pain, surgical outcome expectations, and current emotional states on a 0 to 10-point Likert scale. Scores of 10 referred to the most pain when asked "What is your current pain level?" Pain interference in lifestyle is measured on a 0 to 10-point Likert scale, with 10 being the most pain-related interference with lifestyle.. Patients also self-reported medication-type use on this survey data. This survey was administered both pre-surgical and 3-6 months post-surgery.

Pain and Spine Surgery Evaluation Survey (PASSS).

The PASSS is an unpublished measure, developed by Andrew Block, Ph.D. (unpublished). This survey allows patients to provide a self-reported assessment of their current pain, emotional state, and work status, as well as surgical outcome expectations and medication use (Block, Ben-Porath, & Marek, 2013; Block, Marek, Ben-Porath, & Ohnmeiss, 2014). This survey was administered 3-6 months post-surgery (see Appendix A for PASSS).

Procedure

A database consisting of basic demographic information, MMPI-2-RF scales scores, and pain medication variables were utilized. Pain medications were coded using the DEA Diversion Control Division's Controlled Substance Schedule list and were dichotomized as being prescription strength (Schedule I – IV) and non-prescription strength (Schedule V) (United States Drug Enforcement Administration [DEA], 2018). The dichotomization of this variable increased power for regression analyses.

Participants consented to have data collected during a specified follow-up time range and used for future research endeavors. Prior to each patient's surgical intervention, a presurgical psychological evaluation (PPE) was conducted. The PPE consists of a semistructured interview conducted by a doctoral-level clinical psychologist, psychometric testing (including the MMPI-2-RF), and a review of medical records. In terms of post-surgical intervention and follow-up, self-report questions were mailed to participants about 3-6 months following surgery.

Data Analysis

Descriptive statistics were calculated on all of the aforementioned variables. To test the first hypothesis that opioid and narcotic use will decrease over time, McNemar's Test will be used to determine if the percentage of prescription opioid use decreased over time. To test if pain-level scores decrease over time, a paired samples t-test was conducted. To test the third hypothesis that evasiveness of surgery would predict more post-surgical opioid use, logistic regression analyses were conducted after dichotomizing the different DEA schedule types into prescription vs. non-prescription medications (described in the Procedure above). In these regressions, pre-surgical opioid use was used as a control variable (Block 1). Block 2 included dummy coded surgical variables (SCS, Fusion, and Other Surgeries). To predict whether presurgical pain predicted more pain or opioid use after surgery, pre-surgical pain levels were added to Block 3 of the equations. When testing whether pre-surgical opioid use predicted more pain after surgery, linear regressions were calculated. In addition, Block 1 of the equation used pre-surgical pain levels as control, followed by surgery type (Block 2). Pre-surgical opioid use was added to the third block of the linear regression analysis. In order to test whether MMPI-2-RF scale scores incrementally predicted pain and opioid use after surgery, MMPI-2-RF scale scores were entered into Block 4 of both equations.

CHAPTER III:

RESULTS

Table 1 lists frequency of pain medication used both prior to and after surgery. The table utilizes different DEA schedules related to medical use and potential for drug abuse (United States Drug Enforcement Administration [DEA], 2018). Schedules I-IV consist of non-prescription medication while Schedule V consists of prescription medication. The study consisted of solely adult participants whose ages ranged from 18 to 83 (M=49.99; SD=13.1). From the original sample size (n=821), less than half of the participants (n=319) were captured at follow up. The MMPI-2-RF higher order scale scores ranged from 0 to 23 for RCd (M=5.51; SD=5.23), 0 to 25 for RC1 (M=8.38; SD=4.8); 0 to 16 for RC2 (M=4.69; SD=2.95), and 0 to 22 for RC7 (M=4.43; SD=4.04).Turning to the first hypothesis, 92.7% of patients reported taking some form of prescription pain medication prior to surgery and 89.2% of patients reported taking pain medication after surgery.

A McNemar's test was conducted on the repeated-measures percentages and there was a statistically significant (p=.029) decrease in the proportion of opioid use pre- to post- surgery, though this difference was small (Δ 3.5%).

Table 1.

DEA Scheduled Medication Frequency

DEA Schedule	Pre-Surgical (n = 821)		Post-Surgical (n = 319)	
	n	%	n	%
Schedule 1	1	0.12 %	1	0.31 %
Schedule 2	618	75.27 %	236	73.98%
Schedule 3	11	1.34 %	2	0.63 %
Schedule 4	131	15.96 %	50	15.67 %
Schedule 5	60	7.31%	30	9.40 %

A paired-samples t-test was conducted to compare mean self-reported pain levels pre- and post-surgery. There was a statistically significant and meaningful difference in the mean pain level score reported pre-surgery (M=6.52, SD=1.79) and post-surgery (M=4.39, SD=2.78); t(409)=14.9, $p < .001$, Cohen's d = .74.

Using the 3-6 month prescription pain medication as the dependent variable, hierarchical logistic regression analyses were calculated to determine if the MMPI-2-RF scale scores (Block 4) predicted medication use above and beyond the following: pre-surgical prescription pain medications (Block 1) surgery type (Block 2), and pre-surgical pain levels (Block 3). Regarding the first block of the equation, pre-surgical prescription pain medication use significantly predicted post-surgical prescription pain medication use (β = 13.6, $p < .001$) and accounted for 6.7% of the variability in post-surgical opioid use. After controlling for pre-surgical prescription pain medications, neither of the surgical interventions significantly predicted ongoing opioid use. The additional variability accounted for by pain medication use (.9%) was non-significant. When pre-surgical pain was added to the model, it was also not significantly predictive of post-operative opioid use ($p>.05$) (see Table 2). In the fourth block of the equation, the incremental validity of the scale scores of the MMPI-2-RF in predicting post-surgical prescription pain medication after controlling for pre-surgical prescription pain medication status, pre-surgical baseline pain ratings, and surgery type suggested that higher scale scores on Demoralization (RCd) significantly predicted post-surgical prescription pain medication use ($\beta = 1.295$, $p < .05$).

Table 2.

Hierarchical Logistic Regression for Pre-surgical Medication Associations

Predictors	B	S.E.	p-value	Exp (β)	Cox & Snell R^2
Block 1					.067
Pre-surgical Opioid Rx	2.550	.556	<.001	13.6	
Block 2					.074
Pre-surgical Opioid Rx	2.76	.577	<.001	15.7	
Fusion	-.256	.552	.642	.774	
SCS	-.805	.600	.180	.447	
Block 3					.080
Pre-surgical Opioid Rx	2.78	.581	<.001	16.078	
Fusion	-.315	.558	.572	.730	
SCS	-.879	.603	.145	.415	
Pre-surgical Pain	.184	.128	.152	1.202	
Block 4					.113
Pre-surgical Opioid Rx	2.550	.610	<.001	12.8	
Fusion	-.182	.590	.758	.834	
SCS	-.916	.640	.152	.400	
Pre-surgical Pain	.162	.132	.221	1.18	
RCd	.259	.116	.026	1.295	
RC1	-.043	.065	.509	.958	
RC2	-.091	.108	.399	.913	
RC7	-.016	.100	.870	.984	

A similar hierarchical linear regression approach was utilized to view predictability based on 3-6 month post-surgery self-reported pain level outcomes (Table 3). In terms of the first block of the equation, pre-surgical opioid use significantly predicted higher post-surgical pain-levels ($\beta = .134$, $p < .05$). After controlling for pre-surgical opioid use in the second block of the equation, the spinal fusion intervention was significantly predictive of post-operative pain levels and remained significantly predictive after additionally controlling for pre-surgical pain ($\beta = -.186$, $p < .01$). Similarly, in the third block, pre-surgical pain levels were significantly predictive of 3-6 month post-surgery pain-level reports ($\beta = .186$, $p < .01$)]. After controlling for pre-surgical medication use, surgical intervention type, and pre-surgical pain levels, the higher scale scores on RCd (Demoralization) and RC1 (Somatic Complaints) were significantly predictive of post-operative pain-levels ($\beta = .208$, $p < .05$; $\beta = .142$, $p < .05$, respectively).

Table 3.

Hierarchical Linear Regression for Post-Surgical Pain-Level Associations

Predictors	B	S.E.	p-value	(β)	R^2	R^2_{Change}
Block 1					.015	.02
Pre-surgical Opioid Rx	1.428	.560	.011	.134		
Block 2					.035	.02
Pre-surgical Opioid Rx	1.528	.555	.006	.144		
Fusion	-0.997	.324	.003	-.186		
SCS	-0.703	.373	.060	-.117		
Block 3					.142	.12
Pre-surgical Opioid Rx	1.267	.525	.016	.119		
Fusion	-1.102	.306	<.001	-.210		
SCS	-0.743	.352	.036	-.123		
Pre-surgical Pain	.486	.072	<.001	.332		
Block 4					.215	.12
Pre-surgical Opioid Rx	.818	.510	.110	.077		
Fusion	-.782	.299	.009	-.149		
SCS	-.495	.344	.152	-.082		
Pre-surgical Pain	.438	.070	<.001	.298		
RCd	.106	.045	.020	.208		
RC1	.082	.033	.013	.142		
RC2	.001	.056	.990	.001		
RC7	-.014	.048	.767	-.022		

CHAPTER IV:

DISCUSSION

The post-surgical use of prescription medication, such as opioids, is a crucial topic that continues to be addressed as the United States healthcare system evaluates the negative outcomes of chronic opioid among the American population. The results from this study have added and expanded to the literature regarding the association of spine surgery, psychosocial risk factors, and opioid use. In this research study, initial findings determined that, although small, there was a significant reduction in opioid medication use post-surgically when compared to pre-surgical use. It was also determined that there was a significant difference between pain levels being reported pre- and post-surgery, suggesting that undergoing a surgical intervention for back pain may be associated with decreased pain levels. However, unlike previous findings in the literature on this topic, no significant differences or associations were observed among patients' ongoing use of opioids and specific surgical interventions (i.e. Fusion, SCS, etc.). In terms of higher scale scores from the MMPI-2-RF, pre-surgical Demoralization (RCd) incrementally and significantly predicted future opioid use and pain post-surgery. In addition, Somatic Complaints (RC1) also incrementally and significantly predicted higher levels of reported pain after surgery.

Observationally speaking, the initial hypothesis was supported by the findings in that there was a reduction in postoperative opioid use; however, the overall difference was much smaller than expected. Once the medications were dichotomized (prescription vs. non-prescription strength), the findings showed that there was only about a 3.5% decrease in opioid use between self-reported medication use pre-and post- surgery. Although the type of surgical intervention appeared not to predict post-surgical opioid use, the data provides support for studies suggesting that interventions, such as undergoing a spinal fusion, may provide overall pain relief (Oakley & Prager, 2002). It is important to note that studies examining longer term outcomes (up to one year) suggest patients continue postoperative use of narcotics (Yoshihara, 2015). The current study suggests that shortly after surgery, many patients continue to take prescription strength narcotics despite reporting reductions in the amount of pain they feel. This is a somewhat unexpected finding. Atlas et al. (2000), reported that patients undergoing spine surgery not only reported diminishing pain-levels, but also decreased postoperative opioid use for pain treatment. Similarly, Oakley &Prager (2002) previously reported that there is both a decrease in opioid use and pain after patients underwent a SCS. Although it is unknown why the course of continued narcotic pain use persisted in the current sample despite reductions in pain levels after surgery, future follow-up studies should consider a broader range of variables beyond self-reported pain, such as adherence to physical therapy and measures regarding functional abilities (sitting, bending, standing, range of motion, etc).

As mentioned before regarding surgical interventions, spinal fusion predicted lower pain levels when compared to other surgical results. This was a surprising finding as other research (e.g., Black & Sarwer,2013), indicates that more destructive surgeries, in which the body tissue undergoes severe damage, are associated with poorer outcomes in spine surgery and poor levels of pain management among spine surgery patients. Additionally, this finding also counters previous literature that determined SCS yielded a decrease in pain-levels and post-operative opioid use due to the gate control theory (Deer et al., 2016; Melzack & Wall, 1965; Oakley & Prager, 2002). Current study findings may suggest post-operative opioid use for pain management use is more so psychologically based than physiologically based (in terms of perceived levels of pain). For instance, patients may think they need an opioid prescription to function when in fact the surgical results are already providing pain relief. This is supported by the predictability of decreased post-surgical pain-levels seen in patients who underwent spinal fusion, as well as increased post-surgical pain-levels in those who reported pre-surgical pain and higher scale scores on RCd and RC1.

Interestingly, the best predictor of postoperative opioid use was preoperative opioid use. These conclusions support previous findings from Armaghani and colleagues (2014) who found that preoperative opioid use was a negative predictor of a decrease of postoperative opioid use. This may suggest that the importance of being able to predict postoperative opioid use lies more in the use of preoperative narcotics and not on the individual surgical intervention being conducted. It would be ideal to provide patients with pain management or chronic pain needs with psychosocial information about other pain management skills (den Boer, Oostendorp, Beems, Munneke, & Evers, 2006). It would be suggested to, in congruence with their medical health professional, provide assistance in tapering their opioid use prior to a scheduled and decided upon surgical intervention. During the carefully calculated change, it would be important to introduce and teach better pain management skills, such as Cognitive-Behavior Therapy for chronic pain in order to provide the patient with the best multidisciplinary care for their pain needs (Munich, Wang, Slindee, Kraemer, & Yeh, 2019; Rolving et al., 2016).

In terms of utilizing psychosocial risk factors as predictors for postoperative opioid use, the findings in this study partially support the previous literature regarding higher scale scores of RCd, RC1, RC2, and RC7 from the MMPI-2-RF. Higher scale scores of RCd, RC1, and RC2 have previously been associated with reduced outcomes for pain management and reduction, and the findings in this study also yielded similar associations or predictive values (Ben-Porath, 2012; Block, Marek, Ben-Porath, & Kukal, 2015; Epker & Block, 2014; Marek, Block, Ben-Porath, 2015). For instance, higher RC1 scale scores predicted higher pain levels above and beyond pre-surgical pain levels, pre-surgical opioid use, and evasiveness of surgical intervention. Past work has examined RC1 in either isolation or while controlling for pre-surgical pain levels. Patients who score high on RC1 in this setting likely report preoccupation with their health and pain, are more prone to developing physical symptoms in response to stress, and likely reject psychological interpretations of their somatic complaints (Ben-Porath & Tellegen, 2011). Thus, patients who are seeking postoperative medication for pain may be more prone to somaticizing.

In a similar manner, higher RCd scale scores predicted increased pain levels and post-operative opioid use, supporting present-day literature findings regarding its' significance (Marek, Block, & Ben-Porath, 2017). Those who had higher scale scores on the RCd had a predictive association with transferable or increased opioid use after their spine surgery (Marek, Block, & Ben-Porath, 2015). Higher RCd scale scores also significantly predicted higher post-operative pain levels, supporting findings illustrating the negative impact of unhappiness and dissatisfaction in medical (specifically post-surgical) settings (Ben-Porath, 2012; Marek, Block, & Ben-Porath, 2017). The data provides continued support for the findings demonstrating that RCd is a strong predictor for overall post-surgery outcomes, and in this case provides a more narrow view focused on a patient's postoperative medication use (Marek, Block, & Ben-Porath, 2015).

The following limitations regarding this study are discussed to determine better future steps in which to continue to expand the literature on the topic of spine surgery outcomes, psychosocial risk factors, and opioid use. First, the data were analyzed retrospectively and during a short postoperative period of time. Therefore, research examining longer-term outcomes (e.g. one-year, two-years, etc.) should be examined in the future, owing to the trend that most providers may not begin to decrease prescription opioids until further out from surgery. Secondly, the information regarding medication use was obtained via self-report. For future studies, it would be ideal to obtain or view a patient's medication record to obtain concrete information. Third, in regard to the previous limitation, it would be ideal to record not only the narcotic prescribed, but also the dose in which they were prescribed via milligram equivalent of morphine in order to determine accurate and comparable opioid use; as well as how much is being prescribed (or over prescribed) and what doses are actually being taken. Finally, in order to provide a more reliable view of surgical application, it would be ideal to obtain information regarding previous spine surgical interventions in order to determine where the patient was in their treatment path. Potentially, researchers could determine if previous surgical interventions and the concept of FBSS could be affecting the surgical outcomes, psychosocial risk factors, and postoperative narcotic use of these patients.

Conclusion

Overall, the findings from this study have provided support for the use of presurgical evaluations, and suggested the importance of not only obtaining current information from the patients about their emotional and physical status but also recording historical information regarding their previous narcotic use. The data also serve as additional and specific support for the importance of administering and MMPI-2-RF and the information that may be predicted or associated with crucial scales, such as RCd (Demoralization) and RC1 (Somatic Complaints). The interaction of surgery, psychosocial risk factors, and historical medication use allows for a wider, predictive view of surgical outcomes among patients undergoing spine surgery interventions.

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APPENDIX A:

PAIN AND SPINE SURGERY EVALUATION SURVEY (PASSS)

Pain and Spine Surgery Evaluation Survey (PASSS)
Questions about your expectations for surgery

Name: __________________________ **Date: _______________________**

What do you think are the odds that you will achieve successful surgery results?

__ 0% - 25%
__ 25% - 50%
__ 50% - 75%
__ 75% - 100%

What is your current average pain level (circle the number)?

0	1	2	3	4	5	6	7	8	9	10
(no pain)					(moderate)					(severe)

With successful surgery results, what average level of pain do you expect (circle the number)?

0	1	2	3	4	5	6	7	8	9	10
(no pain)					(moderate)					(severe)

How much does pain currently interfere with your lifestyle (circle the number)?

0	1	2	3	4	5	6	7	8	9	10
(no pain)					(moderate)					(severe)

With successful surgery results, how much will pain interfere with your lifestyle (circle the number)?

0	1	2	3	4	5	6	7	8	9	10
(not at all)					(moderately)					(severely)

With successful surgery results, how much do you expect to need pain medicine

__ Never
__ Less than once per week
__ Two – Three times per week
__ Once per day
__ More than once per day

With successful surgery results, will you return to your job

__Definitely not
__Probably not
__Unsure
__Probably will
__Definitely will
__Not applicable (I do not work outside the home)

Please indicate how strongly you feel each of the following: (Place √ in circle)

	Not at all	**A little**	**Somewhat**	**A lot**	**Extremely**
Depressed	**O**	**O**	**O**	**O**	**O**

Nervous or Tense	O	O	O	O	O
Angry	O	O	O	O	O
Irritable	O	O	O	O	O
Happy	O	O	O	O	O
Energetic	O	O	O	O	O
Fearful	O	O	O	O	O
Worried	O	O	O	O	O

Have you had surgery yet?

__Yes

Approximate Date of Surgery ________________

__No

What is your current average pain level (circle the number)?

0 1 2 3 4 5 6 7 8 9 10

(no pain) (moderate) (worst imaginable)

How much does pain currently interfere with your lifestyle (circle the number)?

0 1 2 3 4 5 6 7 8 9 10

(no pain) (moderate) (severe)

How well did the outcome of surgery meet your expectations?

0 1 2 3 4 5 6 7 8 9 10

(not at all) (moderate) (perfectly)

How satisfied are you with the surgery, overall?

0 1 2 3 4 5 6 7 8 9 10

(not at all) (moderate) (perfectly)

Please indicate how strongly you feel each of the following: (Place √ in circle)

	Not at all	**A little**	**Somewhat**	**A lot**	**Extremely**
Depressed	O	O	O	O	O
Nervous or Tense	O	O	O	O	O
Angry	O	O	O	O	O
Irritable	O	O	O	O	O
Happy	O	O	O	O	O
Energetic	O	O	O	O	O
Fearful	O	O	O	O	O
Worried	O	O	O	O	O

Please indicate your current work status

__Working full time outside the home

__Working part time or restricted duty outside the home

__Working at home (including Homemaker)

__Disabled

__Other

What medications are you taking FOR YOUR PAIN:

Type: ______________________ Dose and Freq: ______________________

Type: ______________________ Dose and Freq: ______________________

Type: ______________________ Dose and Freq: ______________________

Office Use Only

ID ___________________ Follow-up period: ______________________