RESEARCH ARTICLE

Clinical Presentation of Adults with Traumatic Orthopedic Injuries Enrolled in a Multisite Psychosocial Trial

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Abstract

Objectives: Traumatic orthopedic injuries are a top cause of hospital visits in the U.S. The Toolkit for Optimal Recovery (TOR) is a brief mind-body intervention that targets catastrophic thinking and pain anxiety following orthopedic injury. This study examines the baseline presentation of adults with traumatic orthopedic injuries who were enrolled in our recent multisite feasibility RCT of TOR versus usual care at four geographically distinct Level 1 trauma centers. We also examine whether patient presentation varies by site.

Methods: We recruited 181 adults (M_{age}=44.16, SD=16.5) from four Level I trauma centers located in the northeast (Site A; *N*=63), southwest (Site B; *N*=44), southeast (Site C; *N*=44), and southeast (Site D; *N*=30). At baseline, participants provided information about sociodemographic factors, pain and physical function, and physicians completed the Abbreviated Injury Scale (AIS). Descriptive statistics were used to characterize the sample, and one-way analysis of variance (ANOVA) and Chi-square tests were used to compare variables between sites.

Results: The majority of the sample (88.4%) sustained a fracture, and the mean AIS score was 2.31 (*SD*=0.55). Age, race, sex, gender, occupation, or marital status did not differ across sites (*ps*>.05). Over half (63%) of the sample was treated surgically, and 28.7% endorsed taking narcotic pain medications. More participants at Sites B (75%) and D (96.7%) received surgery than participants at Sites A (41%) and C (61.4%). More participants at Sites D and B reported narcotic usage than participants at Sites C and A. Participants at Site D demonstrated greater functional impairment than participants at the other sites.

Conclusion: Although sites were largely comparable, we did find key differences in surgical management, narcotic use, and functional disability which may have important implications for treatment response. This information will be used to iterate and refine TOR for a future multisite efficacy trial.

Level of evidence: III

Keywords: Orthopedic trauma, Pain, Pain anxiety, Pain catastrophizing, Physical functioning

Introduction

Traumatic orthopedic injuries, including fractures, dislocations, and ruptures, are among the most common causes of hospital visits in the United States.[1] Following appropriate surgical or non-surgical medical management, up to half of all orthopedic trauma patients will develop subsequent chronic pain and dysfunction.[1–3] chronic pain is associated with enormous personal and financial burdens, including reduced well-being and loss of mobility, productivity, and independence. Unhelpful pain-related thoughts and feelings following orthopedic trauma include pain anxiety (e.g., pain-related worry, hypervigilance), pain catastrophizing (e.g.,

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magnifying and ruminating on pain-related thoughts), and activity avoidance, and are associated with the development of chronic pain. Orthopedic trauma occurs in a highly diverse population,[4–6] and patient outcomes following orthopedic injury (such as the development of chronic pain), may differ based on sociodemographic and clinical characteristics.[7] Pain anxiety and catastrophizing are consistently associated with worse orthopedic clinical outcomes, including increased pain[8–11] and decreased function,[12] over and above measures of injury severity.[13,14] Unhelpful pain-related thoughts and feelings are modifiable and present a viable opportunity to prevent chronic pain and dysfunction.

To date, there are no evidence-based interventions targeting unhelpful pain-related thoughts and feelings following traumatic orthopedic injuries. Intervening early after injury to prevent chronic pain, rather than once patients are in a cycle of chronic pain and dysfunction, may reduce excess hospitalizations and subsequent medical costs. Additionally, early interventions can teach patients generalizable skills to manage pain and maximize well-being during rehabilitation. With feedback from multidisciplinary stakeholders,[15–18] we developed the Toolkit for Optimal Recovery (TOR) to help patients return to valued activities and regain physical functioning after traumatic orthopedic injury. Grounded within the Fear Avoidance Model (FAM),[19] TOR targets pain anxiety, pain catastrophizing, and maladaptive pain avoidance.[20,21] The 4-session TOR program includes chronic pain psychoeducation (e.g., myths versus facts, a simplified fear-avoidance model), relaxation, mindfulness (e.g., mindfulness of the breath), adaptive thinking skills (e.g., restructuring unhelpful thoughts about pain), pain acceptance (e.g., understanding the futility of trying to stop or control pain), activity pacing, and value-based activity engagement.

TOR has demonstrated single site feasibility, acceptability, and satisfaction at an urban Level 1 trauma center in the northeast.[21] We recently completed a multisite randomized controlled trial (RCT) to further evaluate feasibility, acceptability, and satisfaction at four Level 1 trauma centers. Given that orthopedic trauma occurs in a highly diverse population and is particularly prevalent and disabling among racial minorities and socioeconomically disadvantaged individuals,[4–6] it is important to understand whether this multisite trial captured a similarly diverse population. Age, race, education, and socioeconomic status can influence openness toward psychological interventions,[22] other clinical characteristics (e.g., psychiatric diagnoses, medication usage, pre-existing chronic pain) have been shown to influence treatment outcomes.[13,23–26] Thus, capturing granular information about the baseline clinical characteristics of individuals with orthopedic injuries may help us better tailor our psychosocial intervention to our target patient population, and to identify factors that can be leveraged to better address varied patient needs. These factors may have important implications for treatment response in this population. Understanding baseline participant presentation, and whether this varies by site, will also provide the groundwork for interpreting the results of the multisite feasibility RCT and allow us to iterate and refine our intervention, if indicated, for future multisite trials. The aims of the current study are to 1) examine the baseline presentation of adults with traumatic orthopedic injuries across the four Level 1 trauma centers and 2) examine differences in baseline factors by study site.

Materials and Methods

Study Design and Setting

Participants were recruited from four Level 1 trauma centers for a multisite feasibility RCT of TOR: Site A (northeast), Site B (southwest), Site C (southeast), and Site D (southeast). Potentially eligible individuals were identified through an electronic medical chart review. If eligible, participants provided verbal consent to screening procedures before enrollment. During the baseline assessment, participants provided sociodemographic information, information about current and prior pain management, physical functioning, and pain-related psychosocial factors. The present analyses include data collected during the baseline assessment. See Vranceanu et al.[20] for a detailed description of the full multisite feasibility RCT study protocol. This multisite study was conducted in accordance with ethical standards. The Institutional Review Board of the primary institution (Site A) approved all study procedures.

Participants

Participants were English-speaking adults who sustained a traumatic orthopedic injury within the last 1-2 months, were cleared by their orthopedic surgeon to participate, and scored ≥20 on the Pain Catastrophizing Scale[27] or ≥40 on the Pain Anxiety Symptoms Scale Short Form 20.[28] Exclusion criteria included: surgery complications or other serious comorbid injuries; diagnosis of a medical condition expected to worsen in the next three months (e.g., malignancy); lifetime history of serious mental illness; current substance use disorder; current suicidal ideation; engaged in mind-body practice (e.g., yoga/mediation) at least once per week for 45 minutes or more within the last three months; and pregnancy. Eligible, interested participants provided informed consent.

Measures

Demographic Questionnaire: Participants completed a demographic questionnaire assessing age, gender, race/ethnicity, marital status, income level, education level, employment status, study site location, prior orthopedic injuries, current psychotropic and pain treatments, and history of psychological and substance use diagnoses.

Pain: Pain at rest and with activity was assessed using the Numerical Rating Scale (NRS).[29] This 2-item measure employs an 11-point Likert scale ranging from (0) no pain to (10) the worst pain imaginable.

Physical Function: Patient perception of physical functioning was assessed using the Patient Reported Outcomes Measurement Information System - Physical Function, version 1.2.8b (PROMIS-PF, v. 1.2.8b).[30] This 8-item measure assesses perception of capability across several different activities using a 5-point Likert scale from (1) unable to do to (5) able to do.

We also utilized the Short Musculoskeletal Function Assessment – Dysfunction Index (SMFA-DI) to assess self-reported physical function.[31] This 34-item measure

assesses physical function and musculoskeletal disability using a five-point Likert scale ranging from (1) not at all difficult to (5) unable to do, with high scores indicative of higher disability.

Pain Catastrophizing: Catastrophic thoughts about pain (i.e., rumination, magnification of the threat value of pain, perceived helplessness) were assessed using the Pain Catastrophizing Scale (PCS).[32] This 13-item measure employs a five-point Likert scale ranging from (0) not at all to (4) all the time, with higher scores indicating greater pain catastrophizing.

Pain Anxiety: Pain-related anxiety was assessed using the Pain Anxiety Symptoms Scale Short Form 20 (PASS-20).[28] This 20-item measure assesses factors of pain-related anxiety (i.e., cognitive, fear, escape/avoidance, physiological) on a six-point Likert scale ranging from (0) never to (5) always, with higher scores indicating greater pain-related anxiety.

Clinical Pain Characteristics: Post-injury rehabilitation was assessed using the question "Have you engaged in physiotherapy (physical therapy or occupational therapy) in the past week? (Yes/no)". Participants also reported if they had received surgical management of their injury (yes/no). History of pain was assessed by asking "In the past year prior to your current injury, did you have any serious pain or pain that required medical attention? (Yes/no)". If they endorsed a history of pain, they were asked a follow-up question assessing chronicity, "Was this pain longer than three months? (Yes/no)".

Injury Severity: Injury severity was reported by the physician using the Abbreviated Injury Scale (AIS).[33] This measure classifies each injury by body region on a six-point scale ranging from (1) minor to (6) maximal. AIS scores were assessed by orthopedic surgeons following enrollment.

Statistical Approach

We conducted all analyses in R Version 4.2.1[34] using RStudio.[35] To characterize the sample for Aim 1, we reported descriptive statistics for the demographic and clinical variables. For Aim 2, we conducted a series of one-way analysis of variance (ANOVA) for continuous variables and Chi-square test of independence for categorical variables by site. We report the effect sizes for ANOVA and Chi-square test of independence using partial eta squared and Cramer's V, respectively. Two-tailed $p<0.05$ were considered statistically significant. Effect sizes were reported as Cramer's V for categorical variables (0 indicating no effect, >.25 indicating a large effect) and η_p^2 for continuous variables interpreted as small (.01), medium (.06), and large (>.14).[36,37]

Results

Demographic Characteristics

Participants included 181 adults (M_{age}=44.2, SD=16.5) across the four study sites (Site A: N=63, Site B: N=44, Site C: N=44, Site D: N=30). 68.5% of participants identified as female (N=124), and 13.8% identified as Hispanic or Latino/Latina (N=25). Participants were primarily White individuals (76.2%) and just under half (49.2%) endorsed being employed full-time. In terms of psychological characteristics, 34.3% of participants endorsed depression diagnoses (N=62), 35.4% endorsed anxiety diagnoses (N=64), and 8.3% endorsed PTSD diagnoses (N=15). All demographic data and participant characteristics for the total sample are included in [Table 1].

Table 1. Sociodemographic Characteristics

		Study Site				
	Total (N=181)	**Site A** (N=63)	**Site B** (N=44)	**Site C** (N=44)	**Site D** (N=30)	***p*-value**
Age	M (SD) 44.2 (16.5)	M (SD) 46.8 (17.8)	M (SD) 42.9 (15.2)	M (SD) 43.6 (15.7)	M (SD) 41.3 (16.6)	0.42
	N (%)	N (%)	N (%)	N (%)	N (%)	
Sex						
Male	57 (31.5%)	17 (27.0%)	13 (29.5%)	14 (31.8%)	13 (43.3%)	0.45
Female	124 (68.5%)	46 (73.0%)	31 (70.464)	30 (68.2%)	17 (56.7%)	
Gender						
Man	56 (30.9%)	16 (25.4%)	13 (29.5%)	15 (34.1%)	12 (40.0%)	
Woman	119 (65.7%)	44 (69.8%)	30 (68.2%)	29 (65.9%)	16 (53.3%)	0.60
Genderqueer/gender fluid/nonbinary	5 (2.8%)	2 (3.2%)	1 (2.3%)	0 (0.0%)	2 (6.7%)	
Prefer not to say	1 (0.6%)	1 (1.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Race						
American Indian Alaska Native	1 (0.6%)	0 (0.0%)	0 (0.0%)	1 (2.3%)	0 (0.0%)	
Asian	9 (5.0%)	7 (11.1%)	0 (0.0%)	1 (2.3%)	1 (3.3%)	
Black/African American	14 (7.7%)	5 (7.9%)	4 (9.1%)	1 (2.3%)	4 (13.3%)	0.07
More Than One Race	11 (6.1%)	2 (3.2%)	3 (6.8%)	3 (6.8%)	3 (10.0%)	
White	138 (76.2%)	47 (74.6%)	32 (72.7%)	38 (84.4%)	21 (70.0%)	
Choose Not to Answer	8 (4.4%)	2 (3.2%)	5 (11.4%)	0 (0.0%)	1 (3.3%)	

Table 1. Continued						
Ethnicity						
Hispanic	25 (13.8%)	5 (7.9%)	15 (34.1%)	2 (4.5%)	3 (10.0%)	0.001*
Non-Hispanic	151 (83.4%)	56 (88.9%)	27 (61.4%)	41 (93.2%)	27 (90.0%)	
Choose Not to Answer	5 (2.8%)	2 (3.2%)	2 (4.5%)	1 (2.3%)	0 (0.0%)	
Education						
Less than high school	1 (0.6%)	0 (0.0%)	1 (2.3%)	0 (0.0%)	0 (0.0%)	0.003*
Completed high school, GED	47 (26.0%)	22 (34.9%)	9 (20.5%)	10 (22.7%)	6 (20.0%)	
Some college/Associates	42 (23.2%)	7 (11.1%)	6 (13.6%)	13 (29.5%)	16 (53.3%)	
Completed 4 years of college	37 (20.4%)	17 (27.0%)	12 (27.3%)	6 (13.6%)	2 (6.7%)	
Graduate/professional degree	7 (3.9%)	2 (3.2%)	2 (4.5%)	1 (2.3%)	2 (6.7%)	
Choose Not to Answer	47 (26.0%)	15 (23.8%)	14 (31.8%)	14 (31.8%)	4 (13.3%)	
Employment						
Employed full-time	89 (49.2%)	31 (49.2%)	24 (54.5%)	20 (45.5%)	14 (46.7%)	0.70
Employed part-time	24 (13.3%)	6 (9.5%)	7 (15.9%)	6 (13.6%)	5 (16.7%)	
School full or part-time	6 (3.3%)	4 (6.3%)	0 (0.0%)	2 (4.5%)	0 (0.0%)	
Keeping House/Housemaker	3 (1.7%)	1 (1.6%)	1 (2.3%)	1 (2.3%)	0 (0.0%)	
Other	10 (5.5%)	4 (6.3%)	3 (6.8%)	2 (4.5%)	1 (3.3%)	
Retired	17 (9.4%)	9 (14.3%)	2 (4.5%)	4 (9.1%)	2 (6.7%)	
Unemployed	26 (14.4%)	5 (7.9%)	5 (11.4%)	9 (20.5%)	7 (23.3%)	
Choose Not to Answer	6 (3.3%)	3 (4.8%)	2 (4.5%)	0 (0.0%)	1 (3.3%)	
Income						
Less than $10,000	26 (14.4%)	6 (9.5%)	6 (13.6%)	6 (13.6%)	8 (26.7%)	0.04*
$10,000 to less than $15,000	10 (5.5%)	4 (6.3%)	3 (6.8%)	2 (4.5%)	1 (3.3%)	
$15,000 to less than $20,000	4 (2.2%)	0 (0.0%)	0 (0.0%)	3 (6.8%)	1 (3.3%)	
$20,000 to less than $25,000	10 (5.5%)	2 (3.2%)	2 (4.5%)	6 (13.6%)	0 (0.0%)	
$25,000 to less than $35,000	14 (7.7%)	4 (6.3%)	6 (13.6%)	2 (4.5%)	2 (6.7%)	
$35,000 to less than $50,000	24 (13.3%)	10 (15.9%)	2 (4.5%)	9 (20.5%)	3 (10.0%)	
$50,000 to less than $75,000	18 (9.9%)	3 (4.8%)	7 (15.9%)	5 (11.4%)	3 (10.0%)	
$75,000 or more	51 (28.1%)	23 (36.5%)	13 (29.5%)	9 (20.5%)	6 (20.0%)	
Choose Not to Answer	24 (13.2%)	11 (17.5%)	5 (11.4%)	2 (4.5%)	6 (20.0%)	
Psychological Characteristics						
Depression	62 (34.3%)	23 (36.5%)	14 (31.8%)	13 (29.5%)	12 (40%)	0.77
Anxiety	64 (35.4%)	26 (41.3%)	11 (25%)	19 (43.2%)	8 (26.7%)	0.16
PTSD	15 (8.3%)	7 (11.1%)	3 (6.8%)	1 (2.3%)	4 (13.3%)	0.28

*Indicates statistically significant p<0.05

Baseline Characteristics

Most participants sustained a fracture as their primary injury type (88.4%). The mean AIS score was 2.3 ± 0.6. 63% of participants required surgical management of their injury. Participants reported experiencing minimal pain at rest (NRS; 3.8 ± 2.4), though reported moderate pain with activity (NRS; 6.0 ± 2.5). 60.2% of participants endorsed taking non-narcotic (i.e. non-prescription) pain medications the week of their baseline appointment, and 28.7% endorsed taking narcotic (i.e. prescription) pain medications during the same period. 31.5% of participants were engaged in physiotherapy at the baseline assessment (i.e. physical therapy and/or occupational therapy). 23.8% of participants (N=43) endorsed experiencing "serious pain or pain that required medical attention" in the year prior to their injury, and 62.8% of these individuals (N=27) indicated the pain lasted >3 months.

Participants endorsed experiencing moderate pain-related anxiety (55.4 ± 15.9) and moderate levels of pain catastrophizing (23.2 ± 10.8), which was expected due to the inclusion criteria for the present study requiring PCS≥20 and/or PASS≥40. Participants also endorsed physical functioning on the PROMIS-PF two standard deviations below the adult population mean (30.3 ± 6.9), and moderate physical dysfunction on the SMFA-Dysfunction Index (46.7 ± 15.0). Further injury and post-injury management characteristics data can be found in [Table 2].

Site Differences in Baseline Characteristics

We observed significant differences in participant characteristics by site [Table 1]. More participants identified as Hispanic or Latino/Latina at Site B (southwest) than the other three sites (34.1% Site B vs 7.94% Site A, 4.55% Site C, 10% Site D; $X^2(6, N=181) = 22.59$, $p=.001$, $V=.25$. Education differed between sites, $X^2(15, N=181) = 34.62$, $p=.003$, with participants at Site D (southeast) reporting lower levels of education than the other sites (53.3% reporting "Some college/Associates degree; $p=.001$, $V=.25$). Additionally, there was a significant difference in income between sites $X^2(24, N=181) = 37.79$, $p=.04$, $V=.26$, with participants at Site D reporting lower income (26.7% of the sample reporting an income of less than $10,000) than the other three sites (p=.003). Participant age did not differ across sites, nor did

race, sex, gender, occupation, or marital status (ps≥.05). Further, there were no differences between baseline psychological characteristics between sites (ps≥.05), indicating that incidences of depression, anxiety, PTSD, and other mental health diagnoses were similar.

Table 2. Injury and Post-Injury Management Characteristics

	Total (N = 181)	Site A (N = 63)	Site B (N = 44)	Site C (N = 44)	Site D (N = 30)	p-value
	N (%)	N (%)	N (%)	N (%)	N (%)	
Injury Type						
Fracture	160 (88.4%)	55 (87.3%)	38 (86.4%)	38 (86.4%)	29 (96.7%)	0.72
Dislocation	3 (1.7%)	0 (0.0%)	0 (0.0%)	3 (6.8%)	0 (0.0%)	
Rupture	3 (1.7%)	1 (1.6%)	2 (4.5%)	0 (0.0%)	0 (0.0%)	
Multiple	11 (6.1%)	4 (6.3%)	3 (6.8%)	3 (6.8%)	1 (3.3%)	
Not Identified	4 (2.2%)	3 (4.8%)	1 (2.3%)	0 (0.0%)	0 (0.0%)	
Past Week Non-Narcotics						
Yes	109 (60.2%)	36 (57.1%)	23 (52.3%)	30 (68.2%)	20 (66.7%)	0.38
No	72 (39.8%)	27 (42.9%)	21 (47.7%)	14 (31.8%)	10 (33.3%)	
Past-Week Narcotics						
Yes	52 (28.7%)	11 (17.5%)	18 (40.9%)	7 (15.9%)	16 (53.3%)	< 0.001*
No	129 (71.3%)	52 (82.5%)	26 (59.1%)	37 (84.1%)	14 (46.7%)	
Physiotherapy						
Yes	57 (31.5%)	28 (44.4%)	9 (20.5%)	8 (18.2%)	12 (40.0%)	0.007*
No	124 (68.5%)	35 (55.6%)	35 (79.5%)	36 (81.8%)	18 (60.0%)	
Surgery						
Yes	114 (63.0%)	25 (39.7%)	33 (75.0%)	27 (61.4%)	29 (96.7%)	< 0.001*
No	65 (35.9%)	36 (57.1%)	11 (25.0%)	17 (38.6%)	1 (3.3%)	
No Answer	2 (1.1%)	2 (3.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Past Year Serious Pain						
Yes	43 (23.8%)	24 (38.1%)	6 (13.6%)	7 (15.9%)	6 (20.0%)	0.01*
No	138 (76.2%)	39 (61.9%)	38 (86.4%)	37 (84.1%)	24 (80.0%)	
Past Year Chronic Pain						
Yes	27 (14.9%)	15 (23.8%)	4 (9.1%)	4 (9.1%)	4 (13.3%)	0.07
No	16 (8.8%)	9 (14.3%)	2 (4.5%)	3 (6.8%)	2 (6.7%)	
No Answer	138 (76.2%)	39 (61.9%)	38 (86.4%)	37 (84.1%)	24 (80.0%)	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	
Injury Severity (AIS)	2.3 (0.6)	2.5 (0.7)	2.3 (0.5)	2.1 (0.3)	2.5 (0.5)	< 0.001*
Pain at Rest (NRS)	3.8 (2.4)	3.1 (2.1)	4.2 (2.5)	3.6 (2.1)	4.8 (2.7)	0.007*
Pain with Activity (NRS)	6.0 (2.5)	5.1 (2.5)	6.5 (2.3)	6.1 (2.3)	7.0 (2.7)	0.002*
Pain Catastrophizing (PCS)	23.2 (10.8)	20.8 (10.5)	23.1 (11.0)	23.1 (10.3)	28.3 (10.5)	0.02*
Pain-Related Anxiety (PASS)	55.4 (16.0)	54.4 (15.1)	55.3 (13.8)	54.2 (18.2)	59.2 (16.7)	0.53
Physical Function (PROMIS)	30.3 (6.9)	30.8 (7.3)	31.3 (7.1)	30.8 (6.4)	27.3 (5.5)	0.07
Physical Function (SMFA-DI)	46.7 (15.0)	44.6 (14.9)	44.3 (15.5)	45.4 (14.4)	56.4 (12.0)	0.001*

Note. Abbreviated Injury Scale (AIS); NRS = Numeric Rating Scale; PCS = Pain Catastrophizing Scale; PASS = Pain Anxiety Symptoms Scale

Several injury and post-injury management variables were significantly different between the sites [Table 2]. Site A (2.5 ± 0.7) and Site D (2.5 ± 0.5) had higher AIS scores than Site C (2.1 ± 0.3), F (3, 175) =6.36, p<.001, η_p^2=.10. Additionally, more participants at Sites B (75%) and D (96.7%) received surgery following their injury than at Site A (41.0%) and Site C (61.4%), X^2(3, N=181) =30.24, p<.001, V=.41 [Figure 1]. More participants at Site D (53.3%) and Site B (40.9%) reported narcotic usage in the week prior to enrollment than at Site C (15.9%) and Site A (17.5%), X^2(3, N=181)=19.50, p<.001, V=.33. More participants at Site A (44.4%) and Site D (40.0%) reported engaging in physiotherapy following their injury than at Site C (18.2%) and Site B (20.5%), X^2(3,

N=181)=12.00, *p*=.007, V=.26. In total, 23.8% of participants (*N*=43) across all sites reported experiencing serious pain in the year prior to enrollment, with participants at Site A (38.1%) reporting the highest rates (Site B: 13.6%, Site C: 15.9%, Site D: 20.0%; X^2(*3, N*=181) =11.37, *p*=.010, V=.25). Of those with previous serious pain, 62.8% (*N*=27) reported this pain was chronic (lasting longer than three months). Sites did not differ in the number of participants endorsing chronic pain in the year prior to enrollment (*p*=.07). Additionally, participants across all sites did not differ in their usage of non-narcotic pain medications (*p*=.38).

Regarding pain-related psychosocial factors, participants at Site D (28.3 ± 10.5) demonstrated significantly higher PCS scores than participants at Site A (20.8 ± 10.5, *F* (3, 177) =3.44, *p*=.018, η_p^2=.06). Further, participants at Site D had significantly higher SMFA-DI scores (56.4 ± 12.0) than participants at the other sites (*F* (3, 177) =5.40, *p*=.001, η_p^2=.08), indicating higher levels of functional impairment at baseline (Site A: 44.6 ± 14.9; Site B: 44.3 ± 15.5; Site C: 45.4 ± 14.4). Neither the PROMIS-PF scores (*p*=.07) or PASS scores (*p*=.53) differed by site.

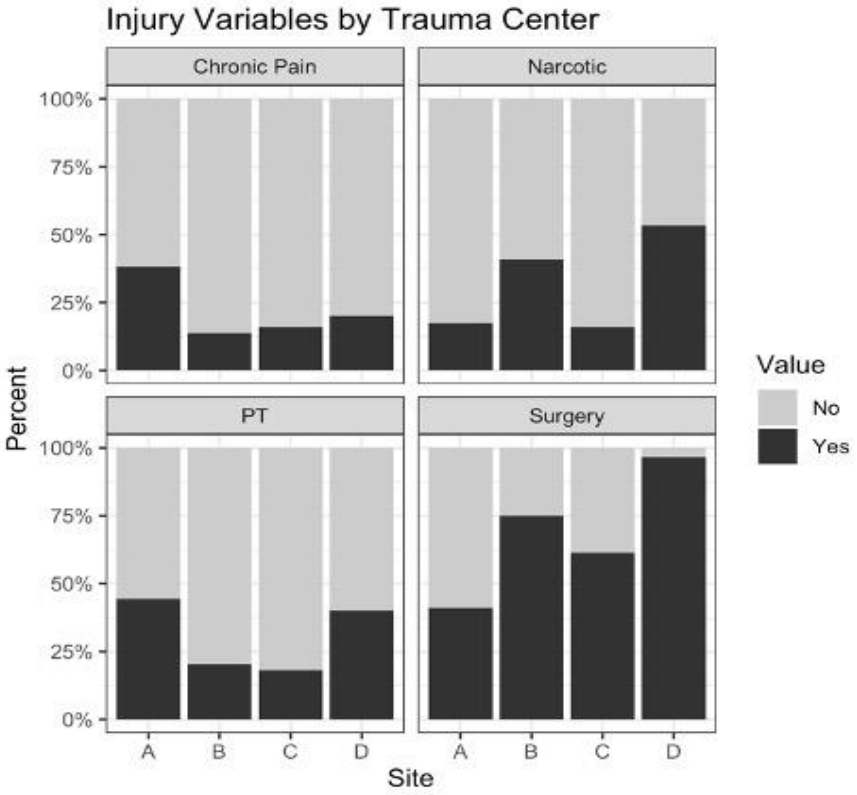

Figure 1. Injury variables of chronic pain (serious pain in the last year that lasted longer than three months), narcotic use, physiotherapy attendance, and surgical management by site

Discussion

Despite the known influence of psychosocial factors on pain and functional outcomes following orthopedic injuries,[38] no evidence-based interventions directly addressing catastrophic thinking about pain and pain-related anxiety are available. The present study sought to characterize the sociodemographic and clinical characteristics of individuals with orthopedic trauma enrolled in a multisite psychosocial trial. Identifying these baseline characteristics may help us better identify and address patient needs and elucidate factors that may have important implications for treatment response in this population. Given that unhelpful pain-related thoughts and feelings are a primary predictor of clinical outcomes (e.g., the development of chronic pain) following traumatic orthopedic injuries,[38] novel interventions tailored to address the specific needs of this population are needed. The 4-session TOR program was developed to fill this gap by providing patients with skills to encourage them to return to valued activities and regain physical function following traumatic orthopedic injury. TOR has demonstrated single-site feasibility, acceptability, and satisfaction,[21] and we recently completed a multisite feasibility RCT of the TOR program. Our previous work highlighted the need to recruit a more racially and ethnically diverse sample from geographically diverse regions of the U.S.,[21] and the present study sought to explore differences in patient characteristics, which may be associated with subsequent TOR treatment response, between each of the four Level 1 trauma centers.

Overall, participants were primarily White, middle-aged, non-Hispanic, and female. A sample with greater variability in race, ethnicity, and sex is desirable when testing the

feasibility and efficacy of new interventions to infer potential generalizability. Traumatic orthopedic injuries are particularly disabling among racial minorities,[4,5] and race can influence openness toward psychological interventions[22] which is important to consider when evaluating the future efficacy of TOR. To increase the feasibility of recruiting a more diverse sample, the future TOR trials will include Level 1 trauma centers with larger populations of racially and ethnically diverse patients, and a concerted effort will be made to enroll a more sex-balanced sample. Consistent with inclusion criteria, all participants reported moderate pain-related anxiety and/or pain catastrophizing, demonstrating the feasibility of recruiting a sample with the target mechanism for TOR at each of the four study sites. Additional participant characteristics including psychiatric diagnoses, medication usage, and pre-existing chronic pain can negatively influence injury recovery and response to TOR.[13,23–26] Our results are consistent with other orthopedic literature, with over one third of participants endorsing depression and/or anxiety,[9] over a quarter taking narcotic pain medications,[25] and one in every six participants reporting chronic pain in the last year.[39] Attending physiotherapy also plays a critical role in physical recovery from traumatic orthopedic injury. In the present study, less than one third of participants were attending physiotherapy at the time of enrollment – one to two months following their traumatic orthopedic injury – despite the fact that 63% of participants had undergone surgery. This is lower than an expected 70% of cases with physiotherapy referrals.[40] Low physiotherapy attendance highlights the need for additional recovery support providing further justification for TOR.

Several important differences emerged between study sites. Participants at Site D presented with a greater clinical burden, including higher pain catastrophizing and lower physical function scores, as well as lower education and income levels. These disparities at Site D may indicate a greater need for efficacious treatments to prevent chronic pain and disability. There were also noteworthy differences in medical management based on site. For example, while nearly all participants at Site D received surgery for their injury, less than half received surgery at Site A, demonstrating a divergence in management of equivalently severe injuries. For the same or worse injury severity than the other sites, Site A had the lowest rate of surgery, the highest rate of physiotherapy, and low rates of opioid use, while also having the highest rate of prior serious pain. This suggests that usual care at Site A may consider factors beyond injury severity (e.g., history of serious pain) to dictate treatment course, resulting in greater utilization of physiotherapy and lower rates of opioids and surgical management.

Future work will examine whether these geographic variations in baseline participant characteristics will impact the feasibility, acceptability, or satisfaction of the TOR program. The increased clinical need (i.e., higher pain catastrophizing and lower physical function) and contributing socioeconomic factors (i.e., lower education and income levels) identified at Site D are important to consider when analyzing the multisite feasibility data and planning for future multisite efficacy trials, as these patients may have additional barriers to care (e.g., financial concerns, difficulty getting to medical appointments) that could impact their treatment engagement and response. Subsequent longitudinal examinations of the TOR multisite feasibility study may assess if these varied patient groups responded differently, and if injury severity moderates the relationship between pain-related anxiety/catastrophizing and physical function.

Limitations

While we included four geographically diverse sites, we did not include U.S. sites located in the Midwest or West Coast. Future multisite trials of TOR will further increase geographic diversity to examine the feasibility and acceptability in diverse and lower-resourced clinics. Site D began recruitment later than the other 3 sites and enrolled fewer participants as a result. This discrepancy in participant volume should be considered when interpreting the results. Additionally, 68.5% of the participants identified as female. As help-seeking behaviors and pain processing differ between sexes,[41–44] the primarily female sample may have had an impact on the results. Future studies will aim to recruit a sex-balanced sample by utilizing more targeted recruitment methods (e.g., medical record review, diversifying recruitment locations, and amending study materials to cater to specific populations).

Conclusion

We reported on the baseline characteristics and geographic site variation for a multisite feasibility RCT of the TOR program, which is designed to help patients with elevated pain anxiety or catastrophizing return to valued activities and regain physical function following traumatic orthopedic injury. Participants were predominantly White and female and exhibited lower levels of physiotherapy attendance than expected. We found that sites were largely comparable, with key differences in narcotic use, physiotherapy attendance, and physical function, which may have important implications for treatment response. This baseline information will be used to interpret the results of the multisite feasibility RCT, iterate and refine the TOR intervention, and conduct a future multisite efficacy clinical trial.

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Authors Contribution:

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