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ORIGINAL RESEARCH

Pain Management and Sedation

An interdisciplinary program for familiar faces with chronic pain visiting the emergency department—randomized controlled trial

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Abstract

Objectives: To evaluate the effect of a collaborative interdisciplinary pain assessment program on pain and health-related quality of life among individuals with chronic pain who frequently visit the emergency department (ED).

Methods: Individuals with chronic pain who frequented the ED (ie, ≥8 visits within the previous 12 months) were randomly assigned to a collaborative chronic pain management program or treatment as usual. Primary outcomes were change in physical function and visits to the ED from baseline to 12 months using validated measures. Secondary measures included physical and emotional functioning, insomnia, health-related quality of life, risk of aberrant opioid use, and health care use. Mixed model analyses of variances were used to evaluate intervention effectiveness among the

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whole sample (ie, using intention to treat principles) and individuals who completed more than 50% of follow-up assessments.

Results: One hundred participants were assessed for eligibility and 46 patients were enrolled with 24 being randomized to intervention and 22 to treatment as usual (TAU). Eleven of the 24 patients randomized to the intervention were lost to follow-up and 3 withdrew participation. Two of the 22 patients randomized to TAU were lost to follow-up, and 7 withdrew. Although patients assigned to the intervention improved more rapidly on measures of pain and health related quality of life, both groups had similar improvements overall between baseline to 12 months. Average pain intensity reduction (numeric rating scale [SE]) was 4.63 (0.40) in the intervention and 4.82 (0.53) in the treatment as usual at the 12-month follow-up. A significant group × time interaction was present for risk of aberrant opioid use, with individuals in the intervention group reporting greater improvement in risk of aberrant opioid use by 12-month follow-up.

Conclusion: Participation in an interdisciplinary program may accelerate improvements in pain- and health-related quality of life and reduce risk of aberrant opioid use to manage pain and related distress. Further research is needed to better understand and address barriers to engagement in chronic pain care.

KEYWORDS
case management, chronic pain, emergency department, pain management

1 | INTRODUCTION

1.1 | Background

Chronic pain accounts for 10% to 16% of presenting concerns among patients seeking care in the emergency department (ED).[1,2] Some patients with chronic pain visit the ED frequently. Two studies reported that frequent users of the ED accounted for 21% to 28% of total ED visits.[3,4] A recent Canadian study reported that chronic pain was the primary presenting concern among 37% of patients who visited the ED ≥12 times per year.[5] The ED is not the optimal setting to manage concerns related to chronic pain given its complex nature.[2,5,6] Further, frequent presentations to the ED suggest that patients may not be receiving adequate support through outpatient or community-based services.[7]

1.2 | Importance

Various approaches targeting reduction of ED use have been piloted among patients with chronic pain who had repeated ED visits, including limiting the use of narcotics in the ED,[8] brief behavioral health interventions,[9] and the development of care plans,[10] along with targeted referrals.[11] Interdisciplinary rehabilitation programs[12] show promise for improving chronic pain outcomes and reducing ED visits.[13,14] To date, however, the clinical and health utilization outcomes of such programs are yet to be compared to usual care for patients who frequently visit the ED for chronic pain.

1.3 | Goals of this investigation

We previously completed a feasibility pilot evaluating an interdisciplinary chronic pain management program with 20 frequent users (ie, ≥12 ED visits to the ED within the previous 12-month period) with chronic pain using a single-cohort, pre-post design with this intervention.[15] We demonstrated an 82% reduction in ED visits and clinically meaningful improvements in pain intensity, disability, and psychological distress among program patients over 12 months. This randomized controlled trial (RCT) extends this work and compares the effects of an interdisciplinary chronic pain management program called Familiar Faces Chronic Pain Program (FFCP) to treatment as usual (TAU) in a tertiary care pain clinic on pain and health-related quality of life among frequent users of the ED with chronic pain. We hypothesized that participation in FFCP would improve pain, physical function, emotional function, insomnia, health-related quality of life, and risk of aberrant opioid use among patients with chronic pain while reducing ED visits significantly more than the TAU group.

2 | METHODS

2.1 | Study design and time period

This was a 2-year, phase 2 RCT registered at clinicaltrials.gov (NCT02237391).

2.2 | Study setting and time period

This study was conducted at The Ottawa Hospital, a tertiary academic health sciences center, between June 2015 and March 2016 after approval was obtained from the Ottawa Health Science Network Research Ethics Board (20140575-01H). During the 2015–2016 fiscal year, there were 172,445 ED visits at this center.

2.3 | Population

To be eligible to participate in the study, individuals had to: (1) be at least 18 years of age with 8 or more visits to the ED in the 12-month period before entry into the study, including at least 1 visit in the month preceding study enrollment; (2) have more than 50% of their ED visits because of chronic pain; and (3) be fluent in English or French. Individuals were excluded for the following reasons: (1) presence of a medical condition that could interfere with safe participation in the study based on the medical director's clinical judgment; (2) documented cancer diagnosis; (3) current patients of the hospital's pain clinic; or (4) unable to provide consent.

2.4 | Procedure

Patients were identified by physicians from the ED at the hospital where the study was conducted or through a review of patient medical charts.[5] Patients were informed about the study by a research coordinator and those who provided signed consent to participate were randomly assigned to intervention or control group using a 1:1 allocation schedule determined by a web-based randomization process. Patients in both groups were followed for 1 year. Outcome measures were completed at baseline, 3, 6, 9, and 12 months. Group allocation was concealed from patients and health care professionals not involved in the program until the end of the 1-year period, at which time all patients were debriefed about the study design and offered an opportunity for entry into the interdisciplinary FFCP program. Participants were reimbursed for the cost of parking or alternate mode of transportation (ie, bus fare) and received $20 for each study visit (maximum of 5 visits).

2.5 | Familiar faces chronic pain intervention

The FFCP program consists of an interdisciplinary health care team including a pain specialist, clinical health psychologist, advanced practice nurse, addiction specialist, social worker, and physiotherapist. Other health care professionals were included when necessary (eg, urologist referral for recurrent flank pain; neurologist referral for headaches). Study participants were referred to the initial assessment within 4 weeks of their baseline study visit. The initial assessment was conducted by the team, including the study participant in a round-table format at The Ottawa Hospital Pain Clinic and focused on: (1) pain history; (2) review of pain treatments and coping strategies; (3) review of tests and investigations; and (4) review of previous psychosocial assessments (eg, mood, anxiety, trauma, and beliefs about pain). Patient goals (eg, returning to school or work), needs (eg, financial problems, housing, and support at home), and values (eg, work and family) were queried and integrated into treatment plans. Individualized treatment plans were developed collaboratively with each patient and shared with his/her primary care physician as well as the ED physicians before being uploaded to the hospital's electronic medical record system. Treatment plans detailed chronic pain management recommendations by the FFCP team as well as suggestions for ED staff should the patient visit the ED for their chronic pain.

Study patients were scheduled to be followed clinically in the pain clinic within 1 month of their initial assessment with the appropriate health care professionals, with follow-ups scheduled as appropriate for up to 1 year. In addition, study patients were able to speak to a nurse via phone from Monday to Friday, between the hours of 7:30 am and 3:00 pm.

The FFCP team of health practitioners held case conferences weekly to review newly admitted patient and patients seen for follow-up that week. Case conferences with ED physicians were held every 6 to 8 weeks, to which primary care professionals were also invited.

The Bottom Line

Frequent emergency department visits among patients with chronic pain rarely result in long-term pain resolution. In this single-center randomized controlled trial, patients allocated to an interdisciplinary intervention saw improvements in chronic pain sooner than those allocated to usual treatment, although both groups saw improvements over time. At 3 months, present pain intensity reported using the 0 to 10 numeric rating scale decreased by an average of 1.04 points in the treatment group compared to 0.27 points in the control group. Sustained engagement in treatment remains an important challenge with this patient population as 23 of 46 participants were lost to follow-up or withdrew.

2.6 | Treatment as usual

Patients randomized to TAU received standard care at the hospital pain clinic. Patients were assigned to a pain specialist physician, assessed, and treated as usual. This could include referrals for other services within or outside the pain clinic as deemed necessary by the physician. At the time of the study, this could include pharmacological and interventional pain management when presenting to the ED, referral for psychological treatment within the pain clinic, referral to other services outside the pain clinic (including chronic pain management programs in the community or in other institutions), or a combination thereof. An interdisciplinary approach was not followed (eg, case conferences were not coordinated or included).

2.7 | Data collection and measures

Data from ED visits during the 12 months before enrollment were collected from the electronic medical records. The following demographic information was collected for all study patients through self-reported questionnaires: age, sex, concurrent medical or mental health conditions, number of ED visits monthly over the last 3 months, preferred language, ethnicity, education level, housing status, number of people in the home, family income, access to primary care professionals, medications prescribed, and insurance coverage.

Taking into account recommendations from the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials,[16,17] outcome measures assessing pain using the Brief Pain Inventory (BPI),[18] emotional functioning using the Pain Catastrophizing Scale (PCS),[19] PTSD Check List for DSM-5 (PCL-5),[20] Generalized Anxiety Disorder Scale (GAD-7),[21] and the Patient Health Questionnaire-9 (PHQ-9),[22] insomnia using the Insomnia Severity Index (ISI),[23] health-related quality of life (HRQOL) using the Quality of Life Questionnaire (EQ-5D),[24] risk of aberrant opioid use using the Screener and Opioid Assessment for Patients with Pain Revised (SOAPP-R)[25] and healthcare utilization using the Pain Economics Questionnaire were obtained during in office visits at baseline, 3, 6, 9, and 12 months

Our primary outcome measures were change in physical function measured using the self-reported BPI-Interference Scale from baseline to 12 months and change in number of ED visits, extracted from medical charts, from 12 months pre- to 12 months post-baseline. The BPI consists of 7 numerical pain interference scales each ranging from 0 (does not interfere) to 10 (completely interferes) in relation to general activity, mood, walking ability, work, relations with other people, sleep, and enjoyment of life. The BPI scores provide more useful information about patient outcome and pain-related disability than pain severity scores alone.

2.8 | Data analysis and screening

Data were analyzed using SPSS (IBM SPSS Statistics 24)[26] after screening for outliers and testing for statistical assumptions. Univariate outliers were identified as values that exceeded a z-score of 3.29 and windsorized.[27] No more than 2 values (4%) were adjusted for any variable. Missing data were handled using multiple imputation[28] with 10 imputations, after confirming that data was missing at random (Little's MCAR $\chi^2(2580) = 647.30$, $P = 0.99$). No multivariate outliers were identified using Mahalanobis distances. Missing data was imputed for intention-to-treat analyses and completers.

2.9 | Demographic and medical characteristics

Demographic and medical characteristics were summarized using frequency and proportions for categorical data, means, and SD for continuous data with a normal distribution, median, and inter-quartile range for variables with a skewed distribution

2.10 | Intervention effectiveness

A series of 2 (group: experimental, control) by 5 (time: 0, 3, 6, 9, and 12 months) mixed model analyses of variances (ANOVAs) were performed to evaluate the effect of intervention on each outcome. Significant group × time interactions were investigated using within subject contrasts to evaluate linear, quadratic, or cubic trends. Analyses were performed for all patients enrolled using intention-to-treat principles.[29] Separate analyses were performed for "completers" (ie, patients who completed ≥3/5 assessment time points, including baseline and 12-month follow-up) to evaluate the use of FFCP when delivered as intended. No adjustments were made to control for inflation of familywise error as a result of conducting multiple statistical tests because of the small sample size.

2.11 | Effect sizes and differentiating statistical and clinical significance

The measure of effect reported is partial eta-square (η_p^2) which measures the ratio of variance associated with an effect divided by the variance associated with that effect plus its associated error using the formula: Partial eta square $= \frac{SSeffect}{SSeffect+SSerror}$. Values of η_p^2 of 0.01, 0.06, and 0.14 correspond with small, medium, and large effect sizes based on benchmarks suggested by Cohen.[30] Values of η_p^2 in relationship to group × time interactions can be interpreted as the approximate proportion of variance accounted for by group allocation in the change observed in the dependent variable across time.

As recommended by the American Statistical Association,[31] rather than rely on statistical significance, attention was paid to effect sizes that met or exceeded recommended minimum effect size representing a "practically" significant effect in the fields of social science and medicine of $\eta_p^2 = 0.04$.[32]

2.12 | Sample size

As a Phase 2 trial, our sample size was determined by logistical restraints. For self-report measures, 18 patients per arm would yield a margin of error of 0.65 SDs (total width of confidence interval = 1.3 on the SD unit scale). For number of ED visits over 3 months, we assumed a SD of 3 based on our preliminary data. Assuming approximate normality, our sample size of 18 patients per arm would yield a margin of error of 2 visits (total width of confidence interval = 4 visits) which is adequate to yield preliminary evidence of change. To account for 20% attrition, we planned to enroll 23 participants per arm (total number of participants = 46).

A post-hoc sensitivity analysis was performed using GPower3.1.9.2[33] to provide a practical assessment of the magnitude of effect size that could be detected with the full and completers sample. Using 2-tailed hypothesis testing with $\alpha = 0.05$, correlation between measurements of 0.30, non-sphericity correlation of 0.50, and power set to 80%, the full sample of 46 patients was sufficiently

sensitive to detect an effect size that met or exceeded $f = 0.25$ ($\eta_p^2 = 0.06$) for a multivariate test of the between-within interaction using mixed model ANOVA, representing a medium effect size by Cohen's standards.[34] The completers sample of 19 patients was sensitive to detect effect sizes that met or exceeded $f = 0.39$ ($\eta_p^2 = 0.13$), representing a medium to large effect size by Cohen's standards.

3 | RESULTS

3.1 | Patient demographics

There were 100 patients informed about the study from May 2015 to February 2016. Forty-six patients enrolled but 4 patients dropped-out before contributing Time 1 (baseline) data and are thus excluded of the analyses. The final sample consisted of 42 patients, including 27 women (64.3%) with a mean age of 42.4 years (SD = 15.46), and 15 men (35.7%), with a mean age of 40.8 years (SD = 12.6) (see Figure 1 for patient flow).

Eleven patients of the 24 patients randomized to FFCP were lost to follow-up and 3 withdrew participation. Two of the 22 patients randomized to TAU were lost to follow-up, and 7 withdrew. The intervention and control groups did not differ significantly on any demographic or clinical outcome variables (Table 1). The mean across intervention and control groups BPI worst pain score (M = 7.6, SD = 2.0) and pain interference score (M = 6.6, SD = 2.3) indicated that patients reported severe pain levels causing moderate interference in physical function. Eighty-four (%) of patients had at least moderate levels of anxiety (GAD scores ≥10) and 66% had at least moderate levels of depression (PHQ-9 scores ≥10). All study patients had at least 8 ED visits before the 12-month study period, for a total of 626 ED visits (median = 13) visits with at least 75% of visits attributed to a pain complaint.

3.2 | Intervention effectiveness using intention-to-treat principles

Results of analyses obtained from intention-to-treat principles are depicted in Table 2. Significant main effects of time (baseline to 12 months) were observed for all variables with the exception of the BPI reported worst and average pain. Significant improvements were observed in BPI reported least pain, present pain, pain interference, health-related quality of life, pain catastrophizing, insomnia, emotional function (ie, pain catastrophizing and symptoms of anxiety, depressed mood, and post-traumatic stress), risk of aberrant opioid medication taking behaviors, and healthcare utilization (ie, self-reported and objective; see Table 3).

A significant group × time interaction was observed for present pain intensity with a cubic contrast ($F[1,40] = 4.19$, SE = 3.27, $P = 0.047$) and a medium effect size ($\eta_p^2 = 0.10$), indicating 3 significant between-group changes in slope across the trial. As depicted in Figure 2, patients assigned to FFCP experienced greater improvement in present pain between baseline and 3 months ($M_{Diff} = -1.04$, SE = 0.72) than control ($M_{Diff} = -0.27$, SE = 0.78), followed by worsening between 3 and 9 months ($M_{Diff} = 0.49$, SE = 0.42) than control ($M_{Diff} = -1.59$, SE = 0.51), and followed by improvement between 9 and 12 months ($M_{Diff} = -0.63$, SE = 0.52) than control ($M_{Diff} = 0.17$, SE = 0.68). Both groups reported similar levels of present pain at 12-month assessment.

A significant group × time interaction was observed for risk of aberrant opioid use with a cubic contrast ($F[1,40] = 14.81$, SE = 37.22, $P = 0.023$) and a large effect size ($\eta_p^2 = 0.27$), indicating 3 significant between-group changes in slope across the trial. Patients assigned to the FFCP group reported a significantly greater reduction in SOAPP score from baseline to 12 months ($M_{Diff} = -10.43$, SE = 2.35) than control ($M_{Diff} = -2.86$, SE = 2.91, $F[1,40] = 4.38$, SE = 70.96 [$P = 0.04$]). As depicted in Figure 3, this change was not linear, but characterized by a rapid reduction over the first 6 months, a rebound between months 6 and 9, and a reduction between months 9 and 12. The end result was an overall improvement in risk of aberrant opioid use at 12 months among patients assigned to FFCP relative to control.

No group × time interactions were observed for self-reported worst pain, least pain, average pain, pain interference, health-related quality of life, emotional function (ie, pain catastrophizing or symptoms of anxiety, depression, and posttraumatic stress), insomnia, or healthcare utilization (see Tables 2 and 3). It is important to note that few effect sizes met recommendations for effect sizes that represent minimally "practically" significant effects.

Patients assigned to FFCP reported slightly greater global impression of change at 3 months ($M_{Diff} = 0.76$, SE = 0.40, $P = 0.06$) relative to control (PGIC). No between-group differences were observed at 6 months ($M_{Diff} = 0.44$, SE = 0.49, $P = 0.38$), 9 months ($M_{Diff} = 0.16$, SE = 0.54, $P = 0.98$), or 12 months ($M_{Diff} = 0.25$, SE = 0.47, $P = 0.60$).

3.3 | Intervention effectiveness among patients classified as completers

Results of analyses obtained from patients identified as "completers" are depicted in Table 4. The intervention and control arms included 11 and 8 completers, respectively. Significant main effects of time were observed for all variables with the exception of symptoms of generalized anxiety. Significant improvements were observed in BPI reported worst pain, least pain, average pain, present pain, and pain interference (physical function), health-related quality of life, pain catastrophizing, insomnia, emotional function (ie, symptoms of depressed mood, or post-traumatic stress), risk of aberrant opioid medication taking behaviors, and healthcare utilization (ie, self-reported and objective).

A significant group × time interaction was observed for present pain intensity with a cubic contrast ($F[1,17] = 8.12$, SE = 1.11, $P = 0.01$) and a large effect size ($\eta_p^2 = 0.32$), indicating 3 significant between-group changes in slope across the trial. Results were comparable to the intention-to-treat analysis (see Figure 2).

A significant group × time interaction was observed for risk of aberrant opioid use with a cubic contrast ($F[1,17] = 4.66$, SE = 31.27, $P = 0.045$) and a large effect size ($\eta_p^2 = 0.22$), indicating 3 significant

TABLE 1 Study patient demographics

Characteristic	Total		
	Full sample	Intervention	Control
	Mean (SE)	Mean (SE)	Mean (SE)
Age, y	41.90 (2.26)	42.09 (2.79)	41.67 (3.80)
Sex (female), No.	27	14	13
Age			
19-29	12	4	6
30-39	9	8	1
40-49	16	7	7
50+	9	5	4
Ethnicity			
Caucasian	37	20	15
African-American	3	1	1
Latino or Hispanic	1	1	
First Nations	1		1
Other	3	2	1
Marital status			
Single	22	10	9
Married/common law	17	11	6
Divorced (or legally separated)	6	3	3
Employment status			
Unemployed	8	5	2
Social assistance	17	10	6
Full time	9	4	4
Part time	1		1
Retired	4	2	2
Other	6	3	3
Family income			
<$10,000	11	4	6
$10,000-$24,999	20	10	8
$25,000-$39,999	4	3	1
$55,000-$69,999	2	2	0
$70,000-$84,999	4	4	0
$85,000-$99,999	2	0	2
$150,000 or more	2	1	1
Education			
<Grade 8	3	2	1
Grade 12	11	8	2
College/university	30	14	14
Other	1		1
Smoker Status			
Current	12	7	4
Former (>1 y)	13	7	5
Never	20	10	9
No. of drinks (per wk)			
0	38	21	16
1	3	2	1
2	4	1	1

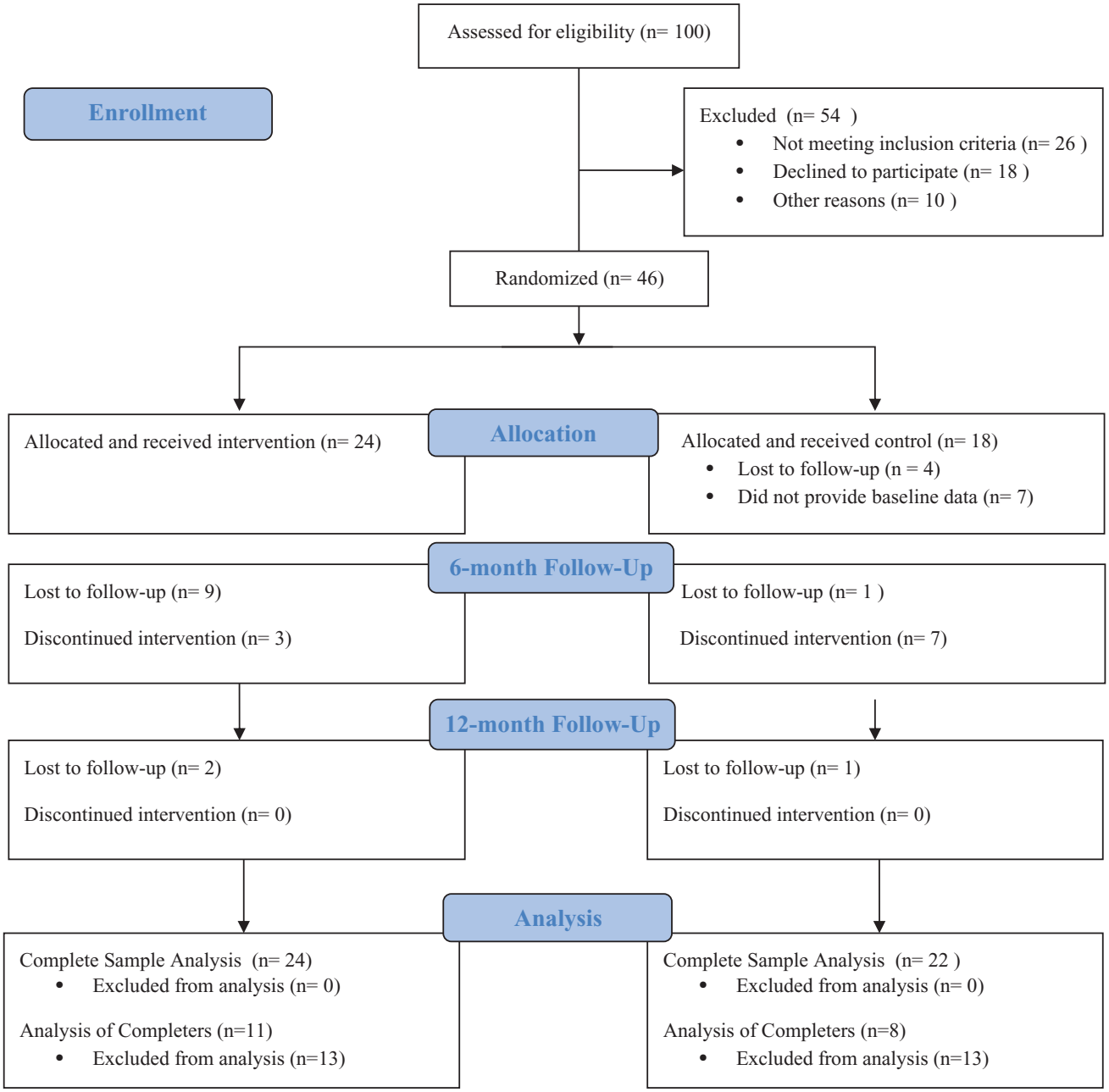

FIGURE 1 Consort diagram

between-group changes in slope across the trial. Results were comparable to the intention-to-treat analysis (see Figure 3).

A non-significant group × time interaction was observed for pain interference despite a large effect size (see Table 4). Given the magnitude of the effect, follow-up analyses were conducted. Contrast analysis revealed a significant cubic trend (F[1,17] = 7.92, SE = 1.20, P = 0.01) and a large effect size (η_p^2 = 0.32), indicating 3 significant between-group changes in slope across the trial. As can be seen in Figure 4, this effect was driven by a rapid improvement in pain interference among patients allocated to FFCP between baseline and 3 months (M_{Diff} = −2.52, SE = 0.70) than control (M_{Diff} = −1.50, SE = 0.63) that gradually harmonized to comparable reports of pain interference at 12 months among patients allocated to FFCP (M = 4.87, SE = 0.69) and control (M = 5.17, SE = 0.99).

Group × time analyses for self-reported ED visits within the previous 3 months was close to reaching statistical significance, with a large effect size (see Table 4). Contrast analysis revealed a non-significant cubic trend (F[1, 17] = 2.48, SE = 0.72, P = 0.08) and a large effect size (η_p^2 = 0.17). As can be seen in Figure 5, this effect was driven by a continued decrease in ED visits among patients allocated to FFCP between baseline and 9 months (M_{Diff} = −2.56, SE = 0.82), relative to control (M_{Diff} = −1.78, SE = 0.71), followed by an improvement in patients allocated to control between 9 and 12 months (M_{Diff} = −1.21, SE = 0.41), relative to FFCP (M_{Diff} = 0.18, SE = 0.25). Both groups

TABLE 2 Results of 5 (time: 0, 3, 6, 9, and 12 months) by 2 (group: experimental, control) ANOVAs performed using intention-to-treat principles

Variable	$F(\eta_p^2)$ time	*M* (SE) baseline	*M* (SE) 12 months	$F(\eta_p^2)$ condition	$F(\eta_p^2)$ condition × time
BPI					
Worst pain	1.60 (0.05)	7.60 (0.30)	6.77 (0.32)	0.03 (0.00)	0.88 (0.02)
Least pain	7.24 (0.15)**	4.64 (0.47)	2.26 (0.27)	0.09 (0.00)	0.60 (0.02)
Average pain	2.80 (0.09)	6.10 (0.34)	5.19 (0.28)	0.14 (0.00)	0.68 (0.02)
Present pain	3.20 (0.07)*	6.32 (0.39)	4.88 (0.38)	0.50 (0.01)	2.93 (0.07)*
Interference	3.68 (0.08)*	6.59 (0.36)	5.20 (0.30)	0.25 (0.01)	0.98 (0.02)
EQ5D	3.13 (0.07)*	0.65 (0.02)	0.67 (0.02)	1.47 (0.04)	1.11 (0.04)
EQ5D VAS	523.93 (0.76)**	48.68 (3.56)	61.75 (1.74)	0.11 (0.00)	0.64 (0.01)
Pain catastrophizing	16.31 (0.30)**	32.38 (2.07)	17.70 (1.55)	1.00 (0.03)	0.76 (0.01)
GAD-7 anxiety	3.22 (0.07)*	12.62 (1.16)	9.75 (0.67)	1.11 (0.03)	1.38 (0.02)
PHQ-9 depression	5.14 (0.12)**	15.95 (1.11)	11.13 (0.85)	0.97 (0.02)	1.55 (0.04)
ISI, insomnia	8.45 (0.18)**	14.69 (1.14)	10.48 (0.81)	0.57 (0.01)	0.52 (0.02)
SOAPP	4.68 (0.11)**	22.10 (1.70)	15.59 (1.11)	1.96 (0.05)	4.59 (0.12)**
PCL5	10.51 (0.18)**	28.33 (3.21)	23.93 (1.77)	1.12 (0.03)	0.85 (0.02)
Self-report ED visits past 3 months	20.55 (0.37)**	3.70 (0.34)	0.62 (0.10)	1.53 (0.04)	1.33 (0.03)
Objective ED visits past 12 months	13.09 (0.25)**	14.90 (1.47)	10.64 (1.49)	0.65 (0.02)	2.53 (0.06)
Self-reported healthcare utilization past 3 months	16.06 (0.30)**	8.08 (0.68)	2.31 (0.25)	0.43 (0.01)	0.52 (0.01)

Abbreviations: ANOVA, analyses of variances; BPI, Brief Pain Inventory; EQ5D, EuroQol-5D; GAD-7, Generalized Anxiety Disorder-7; ISI, Insomnia Severity Index; PHQ-9, Patient Health Questionnaire-9; PCL-5, PTSD Checklist for DSM-5; SOAPP, Screener and Opioid Assessment for Patients with Pain; VAS, Visual Analogue Scale.
N = 42 (22 experimental, 18 control). *$P < 0.05$; **$P < 0.01$.

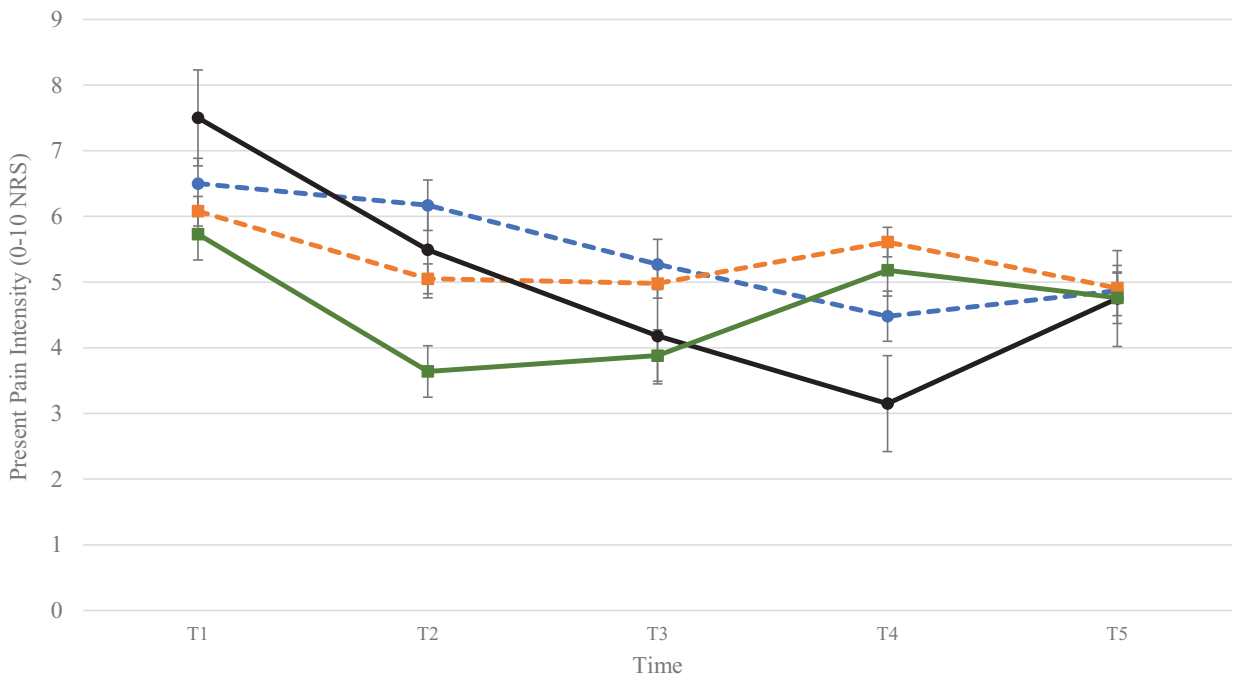

FIGURE 2 Change in present pain intensity from baseline (T1) to 3 (T2), 6 (T3), 9 (T4), and 12 months (T5). The experimental group is denoted by the marker and the control group by the marker. The dashed line depicts the intention-to-treat sample, and the solid line depicts the completers sample. Error bars represent SEM

TABLE 3 Descriptive statistics among the intention-to-treat sample

	Time 1 mean (SE)		Time 2 mean (SE)		Time 3 mean (SE)		Time 4 mean (SE)		Time 5 mean (SE)	
Variable	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control
BPI										
Worst pain	7.58 (0.40)	7.65 (0.46)	6.76 (0.53)	7.17 (0.68)	6.67 (0.46)	7.02 (0.63)	7.05 (0.44)	6.38 (0.71)	6.71 (0.41)	6.96 (0.52)
Least pain	4.63 (0.61)	4.73 (0.74)	3.68 (0.51)	4.17 (0.70)	3.96 (0.45)	4.23 (0.44)	3.44 (0.49)	2.90 (0.47)	2.71 (0.42)	2.50 (0.45)
Average pain	6.21 (0.39)	6.02 (0.59)	5.31 (0.49)	5.68 (0.63)	5.17 (0.43)	5.09 (0.47)	4.88 (0.50)	4.62 (0.57)	4.63 (0.40)	4.82 (0.53)
Present pain	6.08 (0.51)	6.50 (0.60)	5.05 (0.53)	6.17 (0.64)	4.98 (0.54)	5.27 (0.54)	5.61 (0.48)	4.48 (0.66)	4.91 (0.50)	4.87 (0.64)
Interference	6.67 (0.45)	6.46 (0.56)	5.25 (0.54)	6.05 (0.62)	5.03 (0.47)	5.49 (0.60)	5.51 (0.54)	5.40 (0.68)	5.09 (0.42)	5.16 (0.59)
EQ5D	0.67 (0.03)	0.63 (0.02)	0.70 (0.03)	0.65 (0.04)	0.71 (0.05)	0.68 (0.05)	0.70 (0.04)	0.70 (0.05)	0.72 (0.03)	0.66 (0.03)
EQ5D VAS	46.92 (4.24)	49.60 (6.01)	55.43 (3.09)	49.53 (4.13)	57.57 (2.59)	55.15 (2.09)	58.7 (3.28)	56.78 (5.61)	61.65 (2.02)	61.92 (3.25)
Pain catastrophizing	31.88 (2.64)	32.60 (3.23)	27.72 (2.48)	31.68 (2.72)	26.16 (2.65)	30.20 (2.22)	23.91 (2.03)	25.43 (2.75)	15.59 (1.78)	19.84 (2.97)
GAD-7 anxiety	12.96 (1.51)	12.04 (1.76)	10.02 (0.99)	11.17 (1.42)	12.07 (1.08)	13.42 (1.44)	11.04 (0.91)	11.44 (1.32)	8.33 (0.88)	11.45 (1.25)
PHQ-9 depression	14.46 (1.36)	14.66 (1.92)	11.71 (0.95)	14.41 (1.57)	11.74 (0.79)	13.10 (1.16)	13.37 (1.09)	12.85 (1.21)	9.19 (1.01)	11.25 (1.53)
ISI, insomnia	17.00 (1.54)	14.80 (1.53)	15.96 (1.38)	15.58 (1.03)	14.53 (1.13)	14.16 (1.07)	13.90 (1.21)	14.08 (1.54)	11.20 (1.06)	11.20 (1.57)
SOAPP	23.08 (2.34)	21.01 (2.39)	15.26 (1.13)	22.47 (2.49)	17.28 (1.40)	19.38 (2.19)	20.14 (1.76)	20.65 (1.47)	12.65 (1.23)	18.15 (2.16)
PCL5	26.04 (3.59)	30.52 (5.69)	23.61 (2.53)	31.09 (3.63)	31.19 (2.49)	37.41 (3.27)	22.08 (1.68)	24.46 (3.86)	23.63 (2.64)	23.88 (2.57)
Self-report ED visits past 3 months	3.29 (0.44)	4.05 (0.54)	0.86 (0.20)	0.95 (0.28)	0.72 (0.24)	0.74 (0.23)	0.77 (0.20)	1.13 (0.26)	0.68 (0.14)	0.58 (0.18)
Objective ED visits past 12 months	14.74 (1.75)	15.06 (2.46)							8.61 (1.54)	12.67 (2.73)
Self-reported healthcare utilization past 3 months	7.69 (0.90)	8.62 (0.98)	2.82 (0.64)	3.29 (0.64)	2.14 (0.38)	2.74 (0.63)	2.03 (0.33)	2.62 (0.40)	2.34 (0.41)	2.43 (0.40)

Abbreviations: BPI, Brief Pain Inventory; EQ5D, EuroQol-5D; GAD-7, Generalized Anxiety Disorder-7; ISI, Insomnia Severity Index; PHQ-9, Patient Health Questionnaire-9; PCL-5, PTSD Checklist for DSM-5; SOAPP, Screener and Opioid Assessment for Patients with Pain; VAS, Visual Analogue Scale.

N = 42 (22 experimental, 18 control). $^{*}P < 0.05$; $^{**}P < 0.01$.

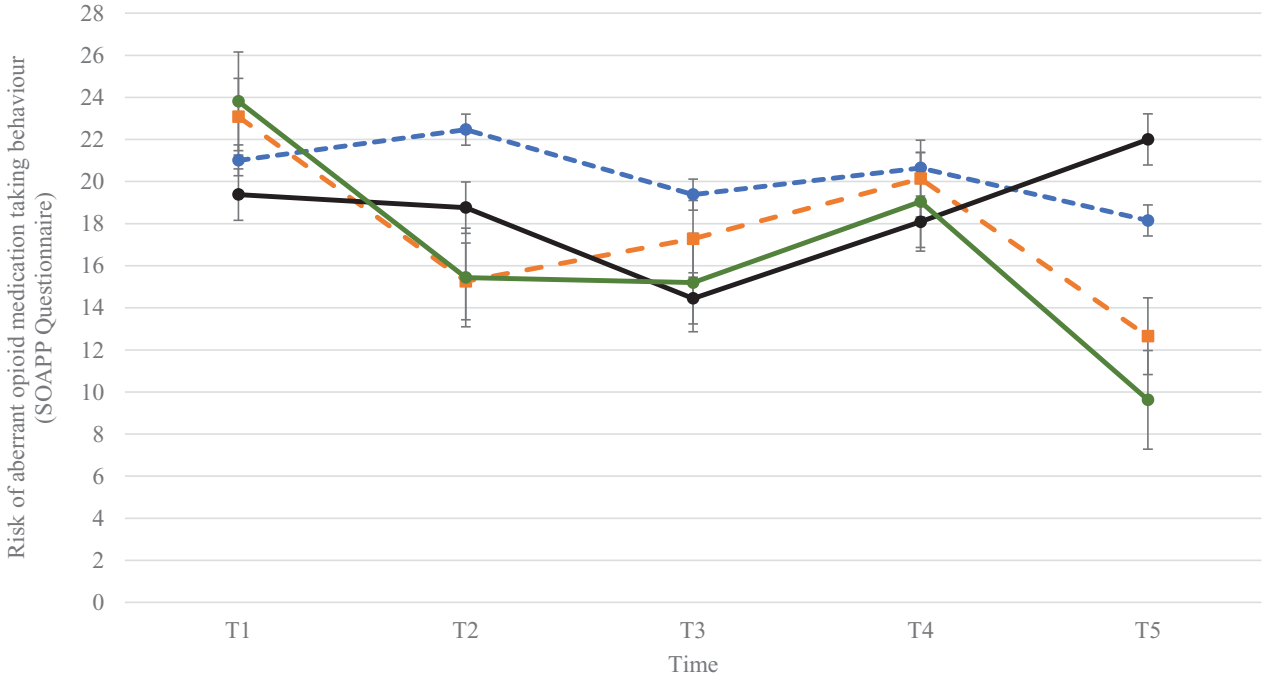

FIGURE 3 Change in risk of aberrant opioid use from baseline (T1) to 3 (T2), 6 (T3), 9 (T4), and 12 months (T5). The experimental group is denoted by the marker and the control group by the marker. The dashed line depicts the intention-to-treat sample, and the solid line depicts the completers sample. Error bars represent SEM

TABLE 4 Results of 5 (time: 0, 3, 6, 9, 12 months) by 2 (group: experimental, control) ANOVAs performed using completers

Variable	$F(\eta_p^2)$ time	*M* (SE) baseline	*M* (SE) 12 months	$F(\eta_p^2)$ condition	$F(\eta_p^2)$ condition × time
BPI					
Worst pain	4.26 (0.22)*	7.88 (0.31)	6.75 (0.53)	0.03 (0.00)	1.66 (0.07)
Least pain	4.95 (0.29)**	4.87 (0.68)	2.46 (0.51)	1.07 (0.06)	1.92 (0.10)
Average pain	5.05 (0.24)**	6.11 (0.50)	4.78 (0.50)	0.08 (0.00)	0.98 (0.04)
Present pain	6.14 (0.24)**	6.61 (0.41)	4.83 (0.69)	0.25 (0.01)	3.95 (0.17)*
Interference	4.37 (0.22)*	6.40 (0.43)	5.02 (0.58)	0.42 (0.02)	2.67 (0.12)‡
EQ5D	4.54 (0.18)*	0.63 (0.02)	0.69 (0.02)	0.81 (0.05)	0.86 (0.07)
EQ5D VAS	98.97 (0.75)**	51.54 (5.49)	62.14 (3.87)	0.19 (0.01)	0.48 (0.03)
Pain catastrophizing	9.45 (0.25)**	30.51 (3.12)	17.53 (3.38)	0.63 (0.04)	0.41 (0.03)
GAD-7 anxiety	0.88 (0.07)	12.55 (1.54)	9.69 (1.34)	0.29 (0.02)	1.97 (0.09)
PHQ-9 depression	3.58 (0.19)*	14.76 (1.61)	10.11 (1.75)	0.59 (0.03)	1.12 (0.05)
ISI, insomnia	3.68 (0.21)*	15.41 (1.31)	10.83 (1.74)	0.36 (0.02)	2.00 (0.09)
SOAPP	2.15 (0.15)	21.60 (2.30)	15.81 (2.07)	0.46 (0.03)	3.86 (0.17)*
PCL5	3.74 (0.18)*	27.74 (3.79)	22.08 (3.76)	0.02 (0.00)	0.71 (0.03)
Self-report ED visits past 3 months	7.81 (0.31)**	3.14 (0.50)	0.45 (0.14)	4.89 (0.22)*	2.95 (0.13)‡
Objective ED visits past 12 months	6.42 (0.27)*	15.87 (2.25)	11.97 (2.17)	5.04 (0.23)*	2.19 (0.11)
Self-reported healthcare utilization past 3 months	5.16 (0.27)**	7.20 (0.92)	2.11 (0.39)	2.93 (0.15)	0.90 (0.05)

Abbreviations: ANOVA, analyses of variances; BPI, Brief Pain Inventory; EQ5D, EuroQol-5D; GAD-7, Generalized Anxiety Disorder-7; ISI, Insomnia Severity Index; PHQ-9, Patient Health Questionnaire-9; PCL-5, PTSD Checklist for DSM-5; SOAPP, Screener and Opioid Assessment for Patients with Pain; VAS, Visual Analogue Scale.

N = 19 (11 experimental, 8 control). ‡$P < 0.10$; *$P < 0.05$; **$P < 0.01$.

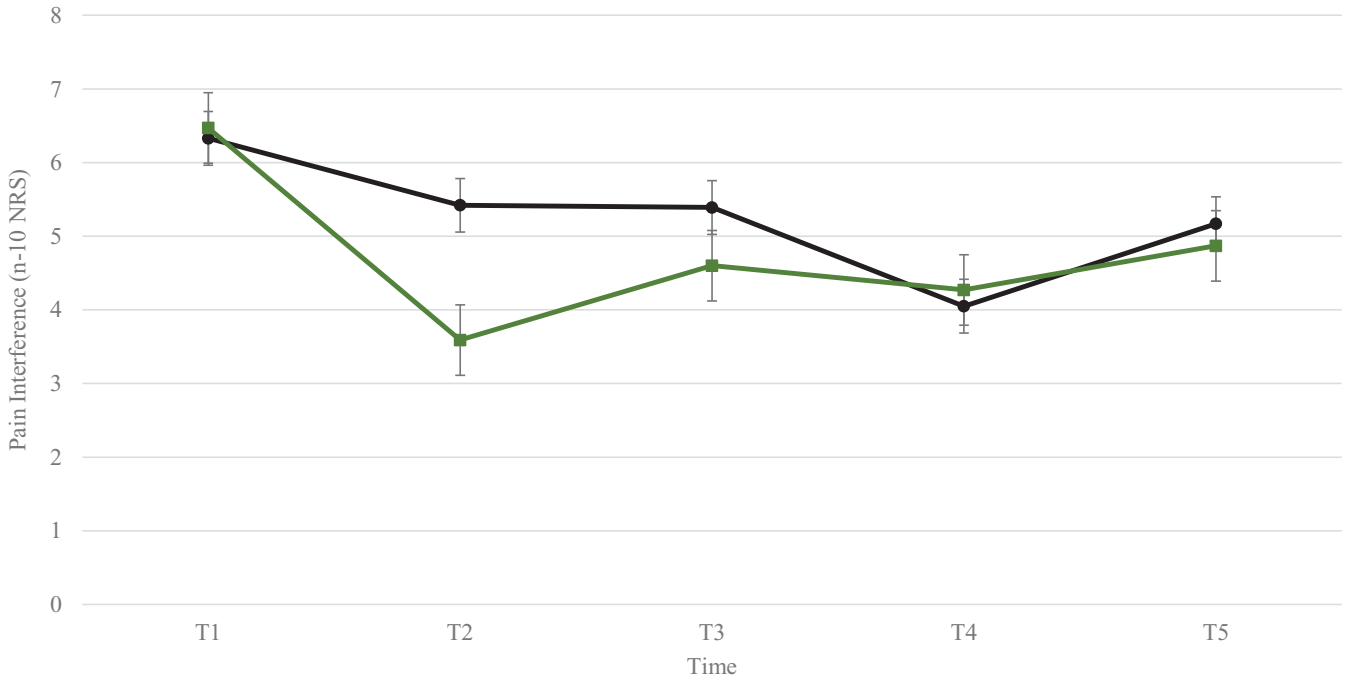

FIGURE 4 Change in pain interference from baseline (T1) to 3 (T2), 6 (T3), 9 (T4), and 12 months (T5). The experimental group is denoted by the marker and the control group by the marker. Error bars represent SEM

reported similar reductions and levels of ED visits at 12-month assessment.

No group × time interactions were observed for worst pain, least pain, average pain, health-related quality of life, insomnia, emotional function (ie, pain catastrophizing or symptoms of anxiety, depressed mood, or posttraumatic stress), or some indices of healthcare utilization, refer to Table 4. It is important to note that small to medium effect sizes were observed that exceed recommendations for effect sizes that represent minimally "practically" significant effects, and all effects favored the experimental condition. This suggests that meaningful effects may exist that would be detected with a larger sample size.

Patients allocated to FFCP reported marginally statistically greater global impression of change at 3 months (M_{Diff} = 1.04, SE = 0.63, P = 0.09) and significant greater global impression of change at 6 months (M_{Diff} = 0.87, SE = 0.39, P = 0.04), relative to control. No between-group differences were observed at 9 months (M_{Diff} = 0.17, SE = 0.70, P = 0.81) or 12 months (M_{Diff} = 0.40, SE = 0.77, P = 0.60).

4 | LIMITATIONS

The 3 most significant limitations of this study are: (1) challenges in engaging patients in the study, reflected by the high number of patients who refused to meet with the team for an initial discussion about a potential entry into the pain clinic; (2) significant attrition; and (3) the potential contamination of the control condition. A total of 100 patients with more than 12 visits to the ED for CP were contacted for the study but only 42 of patients completed the intake process (ie, attended baseline appointment and completed baseline questionnaires). Over the course of the study, we lost over 50% of our initial group of participants. Finally, over the 1-year period that participants were involved with the study, control participants are likely to have been able to access additional care through their pain clinic physician's resources outside of the FFCP program (eg, referral to mindfulness-based stress management programs or intensive chronic pain management program at our local rehabilitation institute).

5 | DISCUSSION

This study compared an interdisciplinary chronic pain management program to pain clinic TAU among individuals with chronic pain that presented to the ED on at least 8 occasions over a 1-year period. Our hypothesis that participation in an interdisciplinary program would lead to lower pain-related interference at 1-year post-program in comparison to TAU was not supported. Overall, patients in both groups reported comparable levels of improvement in pain, physical function, emotional function, insomnia, health-related quality of life, and ED visits at 1-year follow-up. Patients allocated to FFCP demonstrated improvement more rapidly (ie, within the first 3 months) than control patients who improved gradually across 12 months. However, an exception to this trend was observed because the risk of opioid aberrant use was significantly reduced in the intervention arm, compared to control.

These results suggest that usual care within the study setting is effective. At the time the study was conducted, TAU in this clinic included a consultation, along with follow-up with a pain specialist

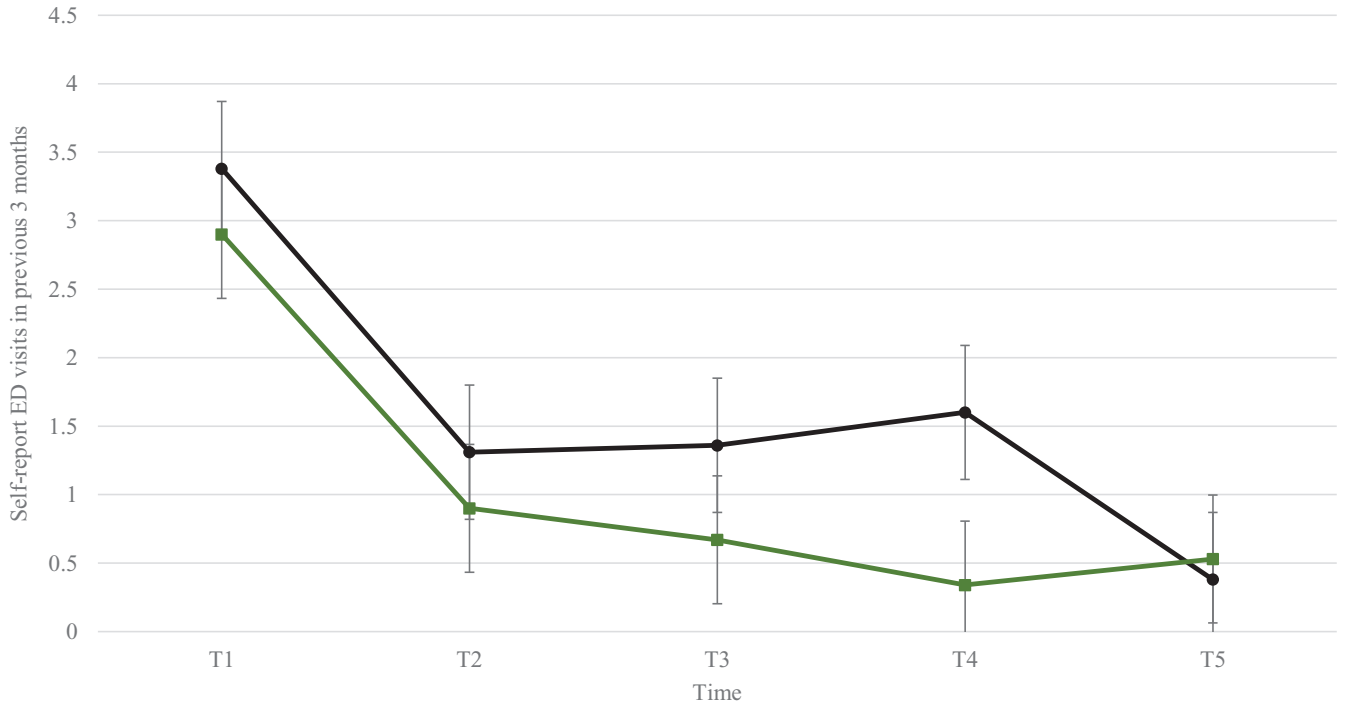

FIGURE 5 Change in self-reported emergency department visits in the previous 3 months from baseline (T1) to 3 (T2), 6 (T3), 9 (T4), and 12 months (T5). The experimental group is denoted by the marker and the control group by the marker. Error bars represent SEM

when appropriate, as well as referrals to psychological services or to other programs within the hospital and community. Physicians in the TAU group were aware of the study and may have identified patients in the TAU group despite our efforts to blind care professionals; both of these factors may have contributed to change in the way physicians treated patients who had repeatedly visited the ED, thereby changing the control condition. Services offered and utilization beyond ED visits were not tracked objectively, but it is possible that after a few months into our clinic, TAU resembled our intervention for many patients. This may explain why the TAU group improved at a slower rate early in the study, as they waited for services readily available to intervention participants. This points out the importance of improving access to interprofessional care that is well-coordinated, a priority identified by patients and clinicians in a priority-setting partnership exercise conducted in Canada.[35]

We did not find any difference in the number of ED visits between the intervention and control groups. Outcome measures, such as ED visits, vary substantially from year to year,[36] and the observed results may reflect such year-to-year variation. Importantly, substantive improvements over time were found for aberrant opioid use among the intervention group as compared to the control group. As the rate of apparent opioid-related overdoses continue to rise, the need for improved access to treatment has been highlighted by the government of Canada.[37] Given the number of individuals that present to the ED for chronic pain, this represents an opportunity to connect individuals with multidisciplinary services that can reduce the risk of aberrant opioid use.

It is worth highlighting the high number of patients who refused to meet with the team or dropped out. In a separate study, we observed that many patients who repeatedly visit the ED experienced negative or invalidating interactions with the healthcare system at some point along their illness trajectory.[6] Prospective patients were informed that they would be meeting with a team to review their history and current pain management and to develop a treatment plan. This may have elicited some fears, such as opioid tapering among prospective patients.[38] Furthermore, the retention rate of individuals in both groups was lower than expected. At 6-month follow-up, 9 (38%) individuals did not continue with the FFCP group. We were not able to ascertain reasons for dropping out, but we hypothesize that a discrepancy between the team's approach and the patient's readiness for change in their pain management plan may explain a portion of the attrition observed. It is also possible that some patients were at higher risk of drop out from the study. Recent literature has suggested that having a daytime job, having young children, and being diagnosed with depression may predict dropout from treatment.[39] Two-thirds of our participant reported moderate depression at baseline.

It is important to note that this trial was powered to detect medium to large effects. Although a notable portion of the sample was lost to follow-up, the similar pattern of results observed using intention to treat and per-protocol principles fuel our confidence in our results. We identified several small to medium effects were identified, specifically among completers, but these were not consistently observed in favor of the FFCP group. This requires further investigation.

In summary, in this study of patients with chronic pain who visit the ED frequently, patients receiving an interdisciplinary pain assessment program intervention reported pain reduction sooner as compared to patients in the usual treatment group; however, final differences in measures of pain interference were not significant. Both groups experienced significant improvements in pain, physical function, emotional function, insomnia, health-related quality of life, and healthcare utilization over time, regardless of being allocated to usual care or the interdisciplinary pain group. Risk of opioid aberrancies was significantly reduced in the group receiving interprofessional care, which may have implications for longer term health and service utilization outcomes. Our team is now investigating barriers to engagement with chronic pain care among patients with complex needs to visit the ED with the goal of improving access and clinical outcomes.

AUTHOR CONTRIBUTIONS

Study design: PP, CS, and YS. Acquisition of data: PP, YS, HR, E-LK, and VJ. Analysis and interpretation of data: JAR, HN, PP, and YS. Drafting of the manuscript: YS, PP, DR, and JAR. Critical revision of the manuscript: YS, PP, DR, JAR, VJ, ET, E-LK, LS, HN, CS, and GH. Statistical expertise: JAR and PP. Acquisition of funding: PP and CS. Shergill and Poulin take the final responsibility for the paper as a whole.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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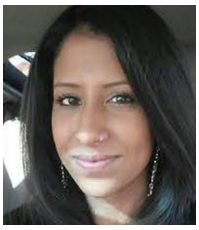

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