



# A Controlled Pilot Trial of PainTracker Self-Manager, a Web-Based Platform Combined With Patient Coaching, to Support Patients' Self-Management of Chronic Pain

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**Abstract:** The objective of this study was to develop and pilot test a chronic pain empowerment and self-management platform, derived from acceptance and commitment therapy, in a pain specialty setting. A controlled, sequential, nonrandomized study design was used to accommodate intervention development and to test the efficacy of the PainTracker Self-Manager (PTSM) intervention (Web-based educational modules and outcome tracking combined with tailored patient coaching sessions and provider guidance). Generalized estimating equations evaluated changes over time (baseline, 3 months, 6 months) in pain self-efficacy (primary outcome), chronic pain acceptance (activity engagement and pain willingness), perceived efficacy in patient-provider interactions, pain intensity and interference, and overall satisfaction with pain treatment (secondary outcomes) between intervention (n = 48) and usual care control groups (n = 51). The full study sample (N = 99) showed greater improvements over time (significant Group × Time interactions) in pain self-efficacy and satisfaction with pain treatment. Among study completers (n = 82), greater improvement in activity engagement as well as pain intensity and interference were also observed. These preliminary findings support the efficacy of the PTSM intervention in a pain specialty setting. Further research is needed to refine and expand the PTSM intervention and to test it in a randomized trial in primary care settings.

**Perspective:** We developed a Web-based patient empowerment platform that combined acceptance and commitment therapy-based educational modules and tailored coaching sessions with longitudinal tracking of treatments and patient-reported outcomes, named PTSM. Pilot controlled trial results provide preliminary support for its efficacy in improving pain self-efficacy, activity engagement, pain intensity and interference, and satisfaction with pain treatment.

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**Key words:** Acceptance and commitment therapy, patient-reported outcomes, patient empowerment, health coaching.

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Patient engagement in self-management is a crucial unsolved problem in chronic pain treatment. As opioid therapy becomes less central to chronic pain care, patients and providers will need practical tools that promote patient empowerment and engagement more than ever before. Many of the patient empowerment innovations of chronic disease management have yet to be developed and disseminated for chronic pain care. The National Pain Strategy calls repeatedly for multimodal interdisciplinary care for chronic pain.<sup>36</sup> If this care is to be available outside of academic and other tertiary care medical centers, it must be supported by a range of health information technology tools to help coordinate and direct this practice, including reliable patient reported outcome assessments, self-management interventions, shared decision-making tools, population health reporting, and provider guidelines and alerts. This article describes the development and testing of a newly developed Web-based self-management tool joined with a computerized patient reported outcome assessment of chronic pain and patient coaching to support patients' self-management of chronic pain.

PainTracker, a Web-based multidimensional treatment and outcome tracking tool, is currently deployed at the University of Washington (UW) Center for Pain Relief (CPR).<sup>31</sup> PainTracker provides clinicians and patients a more complete sense of the patient's experience of chronic pain and response to treatment over time than does a traditional 0 to 10 pain numeric rating scale. Through longitudinal assessments of sleep, mood, and functional status, it serves as a patient assessment as well as education tool, broadening patients' sense of their pain problem and what is necessary for recovery. However, PainTracker does not explicitly engage patients as partners in the treatment process.

We sought to extend PainTracker into a self-management support tool using concepts and methods from acceptance and commitment therapy (ACT). The effectiveness of ACT for chronic pain has been investigated in a variety of settings, in various age groups (eg, adolescents, adults, older adults), pain conditions, and levels of intensity (eg, interdisciplinary and unidisciplinary, see reviews<sup>22,42</sup>). ACT is a flexible model of intervention, which can be understood as having 3 core components: 1) increasing patient's awareness of ongoing experiences, 2) increasing openness to experiences, and 3) promoting increased levels of participation in activities they value. The ultimate goal of ACT is increased engagement in values-based activities, even with the ongoing experience of pain.<sup>10,11</sup> ACT has been successfully delivered using technology such as smartphone apps,<sup>1</sup> telephone,<sup>4</sup> and a Web site.<sup>3</sup> ACT's mechanism of change has been directly linked to outcomes in 1 of these technologically delivered ACT interventions.<sup>37</sup>

By extending PainTracker into PainTracker Self-Manager (PTSM), we hoped to engage patients in the assessment as well as management of their pain problem. The new tool was designed to support coaching of patients by a primary care nurse or social worker, such as those already engaged in team-based care of chronic illnesses like diabetes and depression.<sup>14</sup> The objectives of this pilot

study were to: 1) develop PTSM, a patient empowerment and self-management support tool to engage and support patients in self-management using strategies largely derived from ACT, and 2) provide a pilot test of the efficacy of the PTSM platform in combination with patient coaching to improve the primary outcome of chronic pain self-efficacy and secondary outcomes of chronic pain acceptance (activity engagement and pain willingness), perceived efficacy in patient-provider interactions, pain intensity and interference, and overall satisfaction with pain treatment.

## Methods

### *Patients and Setting*

Study participants (N = 99) were patients seeking care for various chronic pain conditions at the UW CPR between April 2016 and March 2017. The target population for the study was patients who had received an initial treatment planning visit, but who were still early in their course of treatment. Therefore, to be eligible for this study, patients were required to have visited the UW CPR at least once, but not more than 5 times. The control subjects were recruited between April 2016 and September 2016 while the intervention was being developed. The intervention subjects were recruited between September 2016 and March 2017. This sequential, nonrandomized design was chosen because of the limited budget and time available for the development and testing of our intervention.

### *Measures*

Demographic and clinical data were extracted from UW CPR electronic medical records. Demographic data collected at enrollment included age, sex, race, ethnicity, and insurance type. Clinical data collected on control and intervention subjects included pain diagnoses, previous and current interventional treatments and therapies for pain, as well as current pain and related medications (opioids, anticonvulsants, antidepressants, anxiolytics, antihistamines, and nonsteroidal anti-inflammatory drugs).

The Pain Self-Efficacy Questionnaire<sup>24,25</sup> is a 10-item survey that assesses patients' pain self-efficacy, or confidence in their ability to cope with their pain and continue activities of daily living (eg, "I can cope with my pain in most situations."). Items are scored on a 7-point scale from 0 "not at all confident" to 10 "completely confident." Higher scores denote higher pain self-efficacy. The questionnaire is widely used across various chronic pain conditions and has strong psychometric properties.<sup>25</sup> Scores range from 0 to 60. This was prespecified as our primary outcome measure.

The Chronic Pain Acceptance Questionnaire<sup>40</sup> was used to evaluate chronic pain acceptance. This 20-item survey is composed of 2 factors: 1) "activity engagement": engagement in life activities with pain (11 items), and 2) "pain willingness": willingness to experience pain without trying to engage in unhelpful attempts to control it (9 items). Patients were asked to rate the truth of each item

as it applied to them (eg, "My life is going well, even though I have chronic pain."). Items are scored on 7-point scale from 0 "never true" to 6 "always true." Higher scores denote greater levels of pain acceptance. Scores on the "activity engagement" subscale range from 0 to 66; scores on the "pain willingness" subscale range from 0 to 54). The Chronic Pain Acceptance Questionnaire has good psychometric properties<sup>28</sup> as well as evidence of clinical utility.<sup>40</sup>

The Perceived Efficacy in Patient-Physician Interactions<sup>21</sup> is a 5-item survey measuring confidence in obtaining medical information and attention to their medical concerns from physicians. Items are scored on a 5-point Likert scale from 1 "not at all confident" to 5 "very confident." The Perceived Efficacy in Patient-Physician Interactions has established validity and reliability in older adults<sup>21</sup> and patients with osteoarthritis.<sup>35</sup>

Pain and pain interference were evaluated using the 3-item Pain Intensity and Interference With Enjoyment of Life and General Activity (PEG).<sup>16</sup> Pain intensity was rated on an 11-point numeric rating scale, from 0 "no pain" to 10 "pain as bad as you can imagine." For interference items, patients indicated how much pain interfered with enjoyment of life and with general activity from 0 "does not interfere" to 10 "completely interferes." The PEG total score is the mean of these 3 items, where higher values denote a higher level of pain intensity and interference. The PEG has established reliability and validity in a community and veteran populations with chronic pain and has shown responsiveness to improvement similar to the Brief Pain Inventory.<sup>15</sup> The PEG was completed as part of the participant's regular clinical care. Assessments within 2 months of the primary PTSM outcome assessment were used for these analyses.

To evaluate satisfaction with pain treatment, participants were asked to choose the number between 0 "extremely dissatisfied" and 10 "extremely satisfied" that best reflected how satisfied they are with the results of their pain treatment, in general.

## Study Procedures

Consecutive new patients who attended the UW CPR between April 2016 and March 2017 completed a collection of pain-relevant patient-reported outcome questionnaires using PainTracker to facilitate comprehensive multidimensional pain care. All new patients were asked to complete the online questionnaires 1 week before their scheduled appointment. Those who were scheduled for a follow-up appointment at UW CPR and completed the follow-up PainTracker assessment were presented with a question determining interest in the PTSM study. If patients were interested in learning about the study, they were directed to an online information statement outlining the purposes and procedures of the study and given the opportunity to enroll. Patients who chose to not consent at the time were given the options to decide at a later time or obtain more information regarding the study. These patients were then sent a follow-up e-mail by the research team. Intervention and control

subjects were compensated with a \$100 gift card for completion of all outcome measures.

A controlled, sequential, nonrandomized study design was used. During the first 6 months of the enrollment period, assessment procedures for the control group were conducted. The control group received treatment as usual in the CPR, with no restrictions on treatment received, including medications, procedures, and sessions with pain psychology, pain psychiatry, and social work that provided support for pain self-management. While control subjects were being assessed, the Web-based PTSM platform for the intervention phase of the study was developed by the multidisciplinary research team, which included investigators from psychiatry, internal medicine, psychology, nursing, social work, computer science, and graphic design. During the second 6 months of the study enrollment period, patients were enrolled in the intervention group. Control as well as intervention subjects were followed for 6 months. There was no restriction on treatments received in either group. The study procedures were reviewed and approved by the institutional review board at UW.

## Intervention

The intervention included exposure, at the patient's discretion, to a Web-based patient empowerment platform on the basis of ACT principles, as well as phone and text coaching from the research clinicians (P.S.D. and C.T., trained in nursing and social work, respectively). The flow of the study is shown in Fig 1. The PTSM interactive educational modules covered the following topics: module A: "Introduction to PainTracker" is a brief, noninteractive informational module that was presented to the intervention as well as control patients as an introduction to the first PainTracker assessment. Module B: "What is Pain?" explained that pain is important, unpredictable, and complex. It emphasized that all pain is real and important. It also emphasized that pain may get better and worse for unclear reasons. It did not focus on the difference between acute and chronic pain. Education on the complexity of pain used concepts of "injury" versus "alarm," and incorporated some ideas from *Explain Pain* by Butler and Moseley.<sup>5,23</sup> Module C: "Life Navigation System," assisted patients with clarifying values and developing an action plan to improve 1 selected life area (ie, free time, relationships, health and self-care, or work and education). This module was adapted from a treatment manual written by Vowles and Sorrell<sup>38</sup> and incorporated the Values Bullseye exercise of Lundgren and colleagues.<sup>19</sup> Module D: "Get Rhythm," focused on pacing, mindful breathing, and sleep rhythms. These 3 areas were selected for skill development because they are often core components of behavioral treatments for chronic pain and because of their relevance with the values focus of the intervention. Participants were encouraged to bring some regular rhythm into their lives, particularly as related to engagement in valued living. Module E: "Life Goes On," the final module, focused on scheduling value-based activities and managing pain flares over the longer term. These themes were chosen to

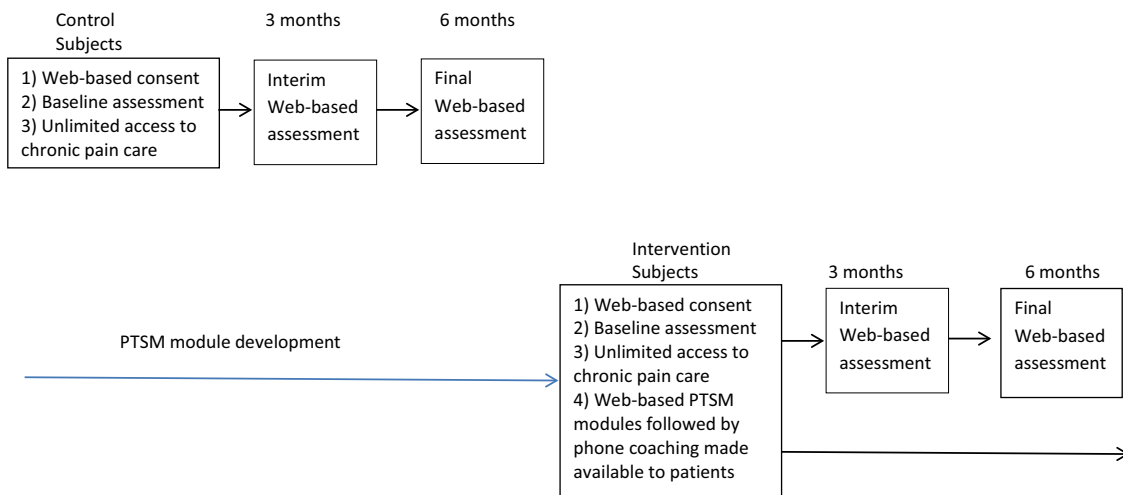


Figure 1. PTSM study flow chart.

emphasize the importance of engagement in value-based activities for sustained recovery.<sup>2</sup> Intervention participants were given access to all modules at the outset of the study. They were not forced to complete them on a schedule or in order. The coaches strived to have at least 1 coaching session after the completion of each module. The coaches estimate that patients spent 30 to 40 minutes on each module that they viewed. Module A was especially short and Module B was especially long. Total estimated time for module viewing was 120 to 160 minutes. More precise tracking of viewing time was not possible because of patients' ability to leave the modules open while they attend to other things.

Embedded in each of the interactive modules were open-ended and multiple choice questions and tasks, such as "Of all the things that have happened to you since your pain started, what concerns you the most?" or "Create your own action plan." The responses to these module questions were visible to the coaches and were used to guide and tailor the coaching sessions to the individual patient. Coaching sessions occurred in person (14%), over the phone (85%), or by e-mail and text (1%), on an average of 4 occasions ( $SD = 1.6$ ) depending on participant preference and availability, with a mean duration of 20 minutes ( $SD = 8.6$ , range = 2-50 minutes per session). After each individual coaching session, participants were sent an e-mail summary of the recommendations discussed. At study completion, a final note was sent with a summary of key self-management strategies, and encouragement to continue to incorporate them into daily life.

The patient coach's general approach within each coaching session was to use open, active listening strategies to establish therapeutic rapport. Coaching sessions were focused on incorporating and engaging participants in the PTSM study educational content. Module content was reviewed and questions or concerns were addressed. Participants were asked to identify 1 to 2 simple and achievable goals on the basis of suggestions in the module, and were guided to identify specific strategies to meet the goal. Efforts were made to redirect

conversations from excessive review of pain complaints to values, functioning, goal-setting, and self-care. Questions regarding specific diagnoses or medical therapies were directed to the UW CPR provider. Each week, the team met to discuss 1 or 2 challenging cases, and to provide the research clinicians with supervision. Suggestions for strategies to promote engagement in the study educational content were provided by pain psychiatry and psychology (M.S., K.E.V., R.V.). Brief summaries of the coaching session and customized suggestions for engagement of the patient in pain self-management were provided to the patient's UW CPR provider at their next clinic visit on a printed sheet placed on top of the patient's clinical chart.

### Data Analysis

Data were analyzed using SPSS version 25 (IBM Corp, Armonk, NY). Descriptive statistics and frequency distributions were calculated for sample characteristics. Independent samples t-tests for continuous variables and  $\chi^2$  tests for categorical variables were used to evaluate for differences in demographic and clinical characteristics between the control and intervention groups. Adjustments were not made for missing data. A  $P$  value of  $<.05$  was considered statistically significant.

Generalized estimating equations (GEE) were used to evaluate the effect of the intervention on primary (pain self-efficacy) and secondary (chronic pain acceptance, perceived efficacy in patient-provider interactions, pain intensity and interference, satisfaction with pain treatment) outcomes. GEE is an extension of generalized linear models that allows for the analysis of repeated measures with unknown covariance structure. GEE uses any and all available data that participants provide, even if follow-up data are missing (ie, intent-to-treat analysis). For all models, the main effect of group and time, and the Group  $\times$  Time interaction were evaluated. For this pilot study, Wald  $\chi^2$  statistics with  $P$  values  $<.05$  for overall model effects were considered statistically significant. For models with significant Group  $\times$  Time interactions, the

main effects of group or time were not reported. For models with only a significant main effect of time, models were rerun without the interaction term to obtain the true main effect. GEE models for the entire study sample and for only those who provided outcome data at all study time points (baseline, 3 months, 6 months) were evaluated.

## Results

### Sample Characteristics

A total of 99 participants were enrolled in the study, 49 in the intervention group and 51 control group participants. Table 1 shows the demographic characteristics of the 2 groups. The groups did not differ significantly on any variables assessed. Participants were, on average, 46 years old (SD = 14.1, range = 18-76 years); predominantly female (78%), white (70%), and non-Hispanic (70%). Just over half of participants were partnered (54%) and unemployed (59%). Table 2 shows the clinical characteristics of the control and intervention groups. The groups did not differ significantly on any variables assessed. The most common pain diagnoses were low back pain, sacrum, hip, or radicular pain (40%), followed by chronic widespread pain (36%). The average duration of

pain was 10 years (SD = 10.3, range = 1-65 years). Most participants had undergone some kind of interventional pain treatment (eg, epidural steroid injection, 69%) or other pain therapies (such as physical therapy, massage, chiropractic care, acupuncture, psychotherapy, and hypnosis, 97%). In addition, 65% of the total sample were taking anticonvulsant medication for their pain (eg, gabapentin, pregabalin), 68% were taking antidepressant medication, and 34% were taking opioids. For those taking opioids with available data (n = 29), the average morphine equivalent dose was 55 mg (SD = 50.5, range = .2-156).

There was no significant difference in the proportion of participants who provided complete data (baseline, 3 months, 6 months) between the control (88%, n = 45) and intervention (77%, n = 37) groups. In addition, no significant difference in demographic characteristics or outcome measures were observed between participants who did (82%, n = 82) and did not (17%, n = 17) provide complete data. Compared with noncompleters, a smaller proportion of completers had received steroid injections (30% vs 59%,  $P = .048$ ) and a larger proportion of completers were currently taking anxiolytic medication (26% vs 0%,  $P = .020$ ). Otherwise, no significant differences in clinical characteristics between completers and noncompleters were observed.

**Table 1. Demographic Characteristics of Study Sample (N = 99)**

CHARACTERISTIC	CONTROL GROUP (N = 51)	INTERVENTION GROUP (N = 48)	COMPARISON OF CONTROL AND INTERVENTION GROUP PARTICIPANTS
Mean age (SD), years	47.2 (14.0)	45.3 (14.3)	$t = .68, P = .496$
Gender			
Female	74.5 (38)	81.3 (39)	FE = .475
Male	25.5 (13)	18.8 (9)	
Racial category			
American Indian/Alaskan Native	2.0 (1)	2.1 (1)	$\chi^2 = 5.09, P = .405$
Asian	3.9 (2)	2.1 (1)	
Black/African American	3.9 (2)	2.1 (1)	
White	76.5 (39)	62.5 (30)	
Other	.0 (0)	2.1 (1)	
Unknown	13.7 (7)	29.2 (14)	
Ethnicity			
Hispanic/Latino	5.9 (3)	4.2 (2)	$\chi^2 = 3.25, P = .197$
Not Hispanic/Latino	76.5 (39)	62.5 (30)	
Unknown	17.6 (9)	33.3 (16)	
Partner status			
Married/partnered	47.1 (24)	62.5 (30)	$\chi^2 = 3.29, P = .193$
Single	51.0 (26)	33.3 (16)	
Unknown	2.0 (1)	4.2 (2)	
Employment status			
Employed	25.5 (13)	35.4 (17)	$\chi^2 = 1.16, P = .561$
Unemployed	62.7 (32)	54.2 (26)	
Unknown	11.8 (6)	10.4 (5)	
Insurance Coverage			
Private insurance	27.5 (14)	39.6 (19)	FE, $P = .210$
Medicare	31.4 (35)	16.7 (8)	FE, $P = .104$
Medicaid	35.3 (18)	39.6 (19)	FE, $P = .683$
Dual-insured	5.9 (3)	4.2 (2)	FE, $P = 1.000$
Other	2.0 (1)	2.1 (1)	FE, $P = 1.000$

Abbreviation: FE, Fisher exact.

NOTE. Data are presented as n (%) except where otherwise noted.

**Table 2. Clinical Characteristics of Study Sample (N = 99)**

CHARACTERISTIC	CONTROL GROUP (N = 51)	INTERVENTION GROUP (N = 48)	COMPARISON OF CONTROL AND INTERVENTION GROUP PARTICIPANTS
Mean pain duration (SD), years	9.7 (8.6)	10.0 (12.1)	$t = -.14, P = .890$
Pain diagnosis or diagnoses			
Headache, facial pain	21.6 (11)	29.2 (14)	FE, $P = .489$
Neck pain, thoracic pain, whiplash	21.6 (11)	29.2 (14)	FE, $P = .489$
Low back pain, sacrum, hip, radicular pain	37.3 (19)	43.8 (21)	FE, $P = .544$
Pelvic, gynecological, genitourinary pain	5.9 (3)	12.5 (6)	FE, $P = .309$
Focal extremity pain	17.6 (9)	16.7 (8)	FE, $P = 1.000$
Neuropathic pain	13.7 (7)	29.2 (14)	FE, $P = .085$
Widespread pain, fibromyalgia syndrome	41.2 (21)	31.3 (15)	FE, $P = .403$
Other	13.7 (7)	6.3 (3)	FE, $P = .320$
Interventional pain treatments			
Trigger point injection	13.7 (7)	2.1 (1)	FE, $P = .060$
Steroid injection	33.3 (17)	37.5 (18)	FE, $P = .680$
Nerve block	13.7 (7)	14.6 (7)	FE, $P = 1.000$
Radiofrequency ablation	.0 (0)	2.1 (1)	FE, $P = .485$
Surgery	23.5 (12)	27.1 (13)	FE, $P = .818$
Other	25.5 (13)	18.8 (9)	FE, $P = .475$
None	27.5 (14)	33.3 (16)	FE, $P = .662$
Therapies for pain			
Psychiatry/psychology/social work	29.4 (15)	31.3 (15)	FE, $P = 1.000$
Physical therapy	62.7 (32)	66.7 (32)	FE, $P = .834$
Biofeedback	3.9 (2)	2.1 (1)	FE, $P = 1.000$
Occupational therapy	3.9 (2)	2.1 (1)	FE, $P = 1.000$
Massage therapy	9.8 (5)	22.9 (11)	FE, $P = .103$
Acupuncture	9.8 (5)	18.8 (9)	FE, $P = .254$
Yoga	3.9 (2)	10.4 (5)	FE, $P = .259$
Relaxation/mindfulness/meditation	11.8 (6)	4.2 (2)	FE, $P = .270$
Other	29.4 (15)	35.4 (17)	FE, $P = .668$
None	5.9 (3)	.0 (0)	FE, $P = .243$
Current pain medications			
Opioids	33.3 (17)	35.4 (17)	FE, $P = .836$
MED (SD) if receiving opioids and available	65.7 mg (51.9)	46.5 mg (49.2)	$t = 1.02, P = .319$
Anticonvulsants (eg, gabapentin)	72.5 (37)	54.2 (26)	FE, $P = .064$

Abbreviation: MED, morphine equivalent dose.

NOTE. Data are presented as n (%) except where otherwise noted.

### Intent-to-Treat Analyses: GEE Modeling

Table 3 depicts the results of the GEE modeling, which includes all available data and affords the opportunity to evaluate Group  $\times$  Time interactions. Results are shown separately for the total intent-to-treat sample and the sample that provided complete data for baseline, 3-month, and 6-months assessments. For the total sample, statistically significant Group  $\times$  Time interactions were observed for the primary outcome, pain self-efficacy, as well as satisfaction with pain treatment. For the sample with complete data, significant Group  $\times$  Time interactions were observed for pain self-efficacy, activity engagement, pain intensity and interference (PEG total score), and satisfaction with pain treatment. The GEE model's estimated marginal means (and corresponding standard errors) for the complete data sample for the outcomes with significant Group  $\times$  Time interactions are shown in Fig 2.

### Discussion

The results of this pilot study provide preliminary evidence that a Web-based ACT-derived education and

assessment tool for chronic pain, PTSM, in combination with nurse or social worker phone coaching, is effective at improving pain self-efficacy, activity engagement, pain intensity and interference, and treatment satisfaction in specialty clinic patients with chronic pain. Patients in the intervention group who completed all outcome assessments showed greater improvements in these outcomes over time, compared with the usual care control group. This group provided us more statistical power to find differences because they completed all outcome assessments. They were also likely more engaged in the treatment process and more likely to show a positive effect. Pain willingness and perceived efficacy in patient-provider interactions tended to improve over time in the intervention as well as control groups. Back pain, widespread pain, headache, and neck pain were the most common pain problems, with a mean duration of 10 years. The intervention and control groups were not randomized, but did not differ on any demographic or treatment-related characteristics, suggesting low risk of bias from the sequential recruitment method. One-third of the sample was receiving opioids. Two-thirds of the sample was receiving antidepressants.

**Table 3. Test of Model Effects from Unadjusted and Adjusted (Partner Status, Any Pain Therapy), Using GEE, for Primary and Secondary Outcome Variables**

OUTCOME	TOTAL SAMPLE (N = 99)			SAMPLE WITH COMPLETE DATA (N = 82)		
	WALD $\chi^2$	DF	P	WALD $\chi^2$	DF	P
Chronic pain self-efficacy*						
Group $\times$ Time	<b>7.51</b>	<b>2</b>	<b>.023</b>	<b>7.93</b>	<b>2</b>	<b>.019</b>
Chronic pain acceptance						
Activity Engagement						
Group	<b>2.1</b>	<b>1</b>	<b>.152</b>			
Time	<b>33.4</b>	<b>2</b>	<b>&lt;.001</b>			
Group $\times$ Time	5.37	2	.068	<b>6.76</b>	<b>2</b>	<b>.034</b>
Pain willingness						
Group	.43	1	.514	1.27	1	.261
Time	<b>10.08</b>	<b>2</b>	<b>.006</b>	<b>10.33</b>	<b>2</b>	<b>.006</b>
Group $\times$ Time	3.51	2	.173	3.57	2	.167
Perceived efficacy in patient-provider interactions						
Group	2.74	1	.098	2.42	1	.120
Time	<b>7.29</b>	<b>2</b>	<b>.026</b>	5.92	2	.052
Group $\times$ Time	3.47	2	.176	3.88	2	.143
Pain intensity and interference (PEG)						
Group	.99	1	.320			
Time	<b>8.74</b>	<b>2</b>	<b>.013</b>			
Group $\times$ Time	4.56	2	.102	<b>6.06</b>	<b>2</b>	<b>.048</b>
Satisfaction with pain treatment						
Group $\times$ Time	<b>6.09</b>	<b>2</b>	<b>.048</b>	<b>15.92</b>	<b>2</b>	<b>&lt;.001</b>

Results in bold if significant at  $p < 0.05$ .

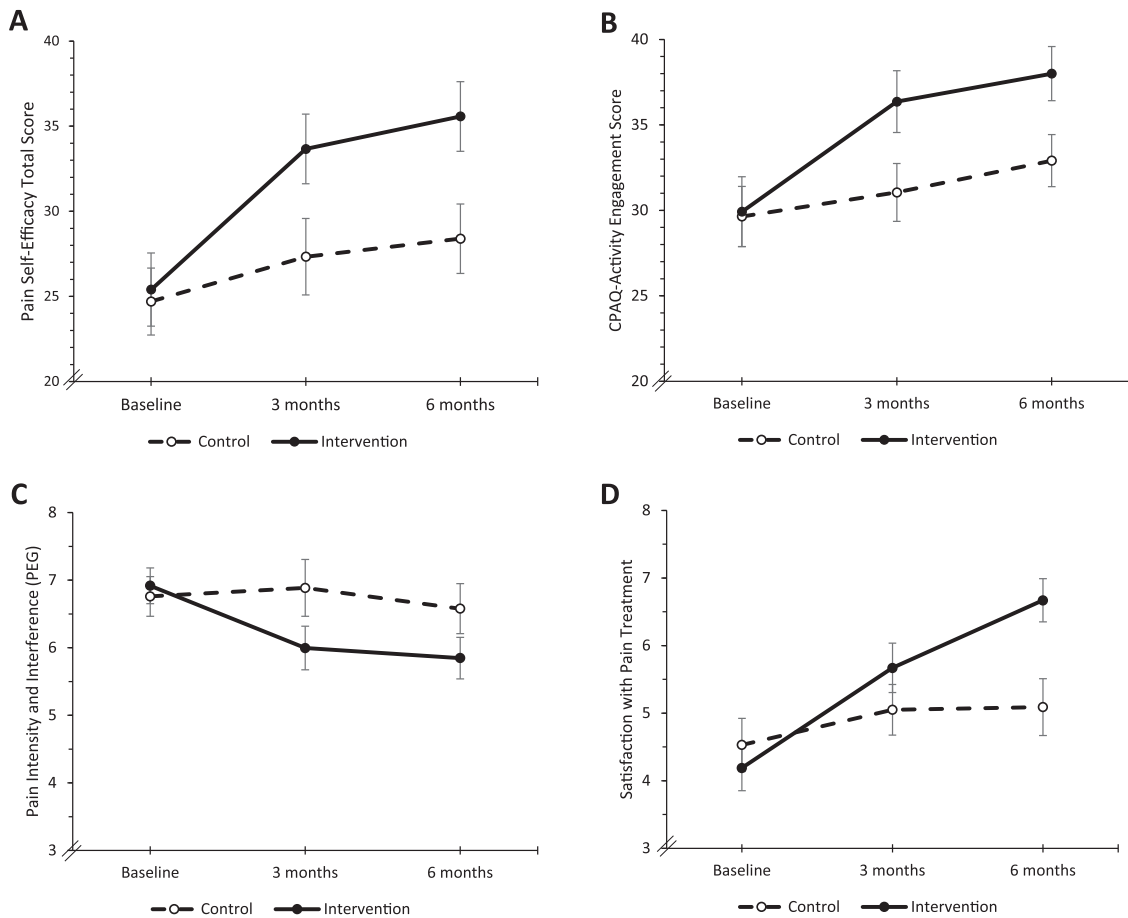
\*Primary outcome variable.

Our study suggests that the PTSM Web platform in combination with patient coaching might effectively support self-management and empowerment of patients with chronic pain. Our pilot study was conducted in a specialty pain clinic population with more chronic and severe pain than would be typical in primary care. Further testing is needed to show that the PTSM platform with coaching is effective in primary care. The PTSM Web platform was used in combination with nurse and social worker coaching through phone and text contact with patients. Nurses and social workers are commonly available in primary care settings, whereas pain psychologists are not.<sup>7</sup> Primary care nurses and social workers are now often used as care managers within disease management programs (eg, for depression and diabetes).<sup>9,43</sup> The PTSM platform may help these primary care team members support self-management for patients with chronic pain as well.

Although these data from our pilot study are preliminary and must be confirmed in a larger primary care study, they do support the effectiveness of a brief intervention that may be cost-effective and easily disseminated. The treatment modules can be delivered remotely to anyone with internet access, as long as there is a server to host the materials and to store the short-answer and multiple choice questions asked within each of the 4 modules. This study employed a nurse and social worker to make individual contact with each participant on at least 2 occasions, with the duration of contact time typically 10 to 20 minutes. Although not specifically assessed in this study, the cost-effectiveness of this intervention

appears to be good. If future studies in primary care clinics continue to suggest that the PTSM is effective, then there is the potential for broad dissemination and utilization of the PTSM platform to support self-management by patients with chronic pain.

The US National Pain Strategy states, "Self-management programs can improve quality of life and are an important component of acute and chronic pain prevention and management."<sup>36</sup> A wide variety of interventions to support chronic pain self-management have been tested.<sup>17,29</sup> These have addressed many different types of chronic pain.<sup>18</sup> In-person self-management courses have been thoroughly studied, but are not widely available.<sup>6</sup> Among technology-supported self-management interventions, telephone, interactive voice response, and internet interventions have all shown efficacy, with none clearly superior to the others.<sup>12</sup> A recent randomized trial of an internet-delivered intervention showed significant reductions of pain intensity and interference, perceived disability, catastrophizing, and fear.<sup>30</sup> However, this was conducted entirely online with volunteers, who are generally less ill than clinic patients, and in isolation from clinical care. Another recent trial investigated an internet intervention in combination with multimodal pain rehabilitation in primary care. The additional use of the internet intervention produced more significant reductions in pain catastrophizing, but not pain intensity or self-efficacy.<sup>26</sup> Our Web-based ACT-derived intervention combined with nurse or social worker coaching was able to increase empowerment outcomes like pain self-efficacy, as well as clinical outcomes like pain



**Figure 2.** Estimated marginal means and standard errors plotted at each measurement time point for GEE models that showed significant Group  $\times$  Time interactions. Change over time in (A) pain self-efficacy, (B) activity engagement, (C) pain intensity and interference, and (D) satisfaction with pain treatment differed significantly with respect to group assignment. Y-axes were truncated to adequately visualize the change over time between the 2 groups. Abbreviations: CPAQ, Chronic Pain Acceptance Questionnaire.

intensity and interference in the sample that provided complete data.

The PTSM intervention built on UW's current PainTracker treatment and outcome tracking tool, which provides risk stratification and graphical feedback on treatment outcomes to providers as well as patients. Although PainTracker is primarily an assessment tool, it also functions as an educational tool, directing providers as well as patients to target a multidimensional set of treatment outcomes beyond pain intensity.<sup>33</sup> Contrary to the expectation of many patients, analyses of PainTracker data currently under way suggest that pain reduction is often a trailing indicator, rather than a leading indicator, of improvement in chronic pain. Multidisciplinary pain rehabilitation programs and cognitive-behavioral treatments of chronic pain also often produce earlier and more marked reductions in pain-related disability than pain intensity.<sup>13,20</sup> PTSM builds on PainTracker by further shifting patient attention away from reductions in pain intensity and toward re-engagement with valued life activities.

The primary implementation challenge of the PTSM intervention was engaging patients in dialogue via phone, e-mail, or text messaging. Study participants had been dealing with chronic pain for a decade on average and

were quite deactivated. This deactivation often extended beyond physical and social deactivation to a disengagement from personal goals and values. Clarifying patient values with the Values Bullseye exercise appeared to be an important first step in patient empowerment. Other studies have also reported benefit from personal goal setting in patients with chronic pain.<sup>8</sup> Studies have also shown a strong relationship between treatment-related increases in valued activities and improvements in pain-related functioning.<sup>27,39,41</sup> We have recently argued that patient action may properly function as a means as well as an end in chronic pain care.<sup>34</sup> This is consistent with an approach to chronic illness care that respects the patient as the primary agent of health and health care.<sup>32</sup>

Our study has a number of important limitations. First, this was a relatively small pilot study conducted in a single specialty pain center. It may not be possible to generalize our results to the full population of patients with chronic pain treated in specialty and primary care settings. Second, our study was not a randomized trial. Because of time and budget constraints, our control and intervention groups were recruited in sequence, one after the other. Although the groups appeared similar in demographic, clinical, and treatment characteristics, potential



for bias due to sequential recruitment exists. Third, our multidisciplinary team, including the patient coaches, had many years of experience treating patients with chronic pain. It is not clear that a less experienced team would have made PTSM effective. Fourth, the control and intervention groups were not matched for time and attention. The effectiveness of the PTSM platform might be because of the increased time and attention provided by the patient coaches. Fifth, clinic providers received written summaries of patient goals and concerns at the time of the patient's clinic visits. Although these providers indicated that these summaries were helpful and that the PTSM intervention benefitted their patients, it is not clear how providers used this information during their clinic interaction.

Further research is needed to optimize and test the effectiveness and cost-effectiveness of the PTSM platform in the primary care setting. Patients often expressed that the message of the "What is pain?" module was that their pain was "all in their head," despite deliberate efforts

on our part to avoid this perception. Further work is needed to overcome this barrier. Integrating objective measures of patient activity (eg, activity monitors, like FitBit [San Francisco, CA]), may potentially enhance PTSM engagement and efficacy. We need to develop a more detailed manual for the patient coaches, describing common obstacles encountered and strategies to overcome these. We need to provide more effective guidance to clinic providers so they can become more effective partners in the effort to promote patient self-management.

## Conclusions

These findings provide preliminary evidence that the PTSM platform, in combination with coaching, can support patient empowerment and self-management among patients with various chronic pain problems attending a specialty pain clinic. Further research is needed to refine content, incorporate observed activity measures, and test effectiveness in the primary care setting.

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