Original Investigation

Telecare Collaborative Management of Chronic Pain in Primary Care
A Randomized Clinical Trial

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IMPORTANCE Chronic musculoskeletal pain is among the most prevalent, costly, and disabling medical disorders. However, few clinical trials have examined interventions to improve chronic pain in primary care.

OBJECTIVE To determine the effectiveness of a telecare intervention for chronic pain.

DESIGN, SETTING, AND PARTICIPANTS The Stepped Care to Optimize Pain Care Effectiveness (SCOPE) study was a randomized trial comparing a telephone-delivered collaborative care management intervention vs usual care in 250 patients with chronic (≥3 months) musculoskeletal pain of at least moderate intensity (Brief Pain Inventory [BPI] score ≥5). Patients were enrolled from 5 primary care clinics in a single Veterans Affairs medical center from June 2010 through May 2012, with 12-month follow-up completed by June 2013.

INTERVENTIONS Patients were randomized either to an intervention group (n = 124) or to a usual care group whose members received all pain care as usual from their primary care physicians (n = 126). The intervention group received 12 months of telecare management that coupled automated symptom monitoring with an algorithm-guided stepped care approach to optimizing analgesics.

MAIN OUTCOMES AND MEASURES Primary outcome was the BPI total score, which ranges from 0 ("no pain") to 10 ("pain as bad as you can imagine") and for which a 1-point change is considered clinically important. Secondary pain outcomes included BPI interference and severity, global pain improvement, treatment satisfaction, and use of opioids and other analgesics.

RESULTS Overall, mean (SD) baseline BPI scores in the intervention and control groups were 5.31 (1.81) and 5.12 (1.80), respectively. Compared with usual care, the intervention group had a 1.02-point lower (95% CI, −1.58 to −0.47) BPI score at 12 months (3.57 vs 4.59). Patients in the intervention group were nearly twice as likely to report at least a 30% improvement in their pain score by 12 months (51.7% vs 27.1%; relative risk, 1.9 [95% CI, 1.4 to 2.7]), with a number needed to treat of 4.1 (95% CI, 3.0 to 6.4) for a 30% improvement. Secondary pain outcomes also improved. Few patients in either group required opioid initiation or dose escalation.

CONCLUSIONS AND RELEVANCE Telecare collaborative management increased the proportion of primary care patients with improved chronic musculoskeletal pain. This was accomplished by optimizing nonopioid analgesic medications using a stepped care algorithm and monitoring.

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Pain is the most common symptom reported both in the general population and in primary care,[1] the leading cause of work disability,[2] and a condition that costs the United States more than $600 billion each year in health care and lost productivity.[3] Two-thirds of pain-related outpatient visits are for musculoskeletal pain, accounting for nearly 70 million outpatient visits annually in the United States each year.[4] The Institute of Medicine has highlighted the enormous functional and economic effects of musculoskeletal pain on both the working and the retired population.[5] Low back pain, other musculoskeletal disorders, and neck pain rank first, third, and fourth, respectively, among the 30 leading diseases contributing to years lived with disability in the United States.[6]

Although analgesics account for 10% to 15% of all outpatient prescriptions,[7] their effectiveness for chronic pain is often modest.[8,9] Moreover, the use of opioids in chronic pain is increasingly questioned because of uncertainty about whether harms outweigh benefits.[9] Mandates to assess pain as the "fifth vital sign"[10] in the absence of evidence-based primary care interventions are similar to early depression screening initiatives that failed to improve outcomes[11] until they were supplemented by system-based collaborative care interventions for monitoring and adjusting treatment.[12] Only a few trials enhancing pain management in primary care have been published,[13,14] and these have focused on behavioral interventions rather than optimizing analgesic therapy. Telemedicine strategies for pain care have been proposed but not rigorously tested to date.[15]

This article describes the main outcomes of the Stepped Care to Optimize Pain Care Effectiveness (SCOPE) study. SCOPE is a 12-month randomized controlled effectiveness trial of a collaborative care intervention for primary care patients with chronic musculoskeletal pain. The primary hypothesis was that optimized analgesic management provided through a predominantly telephone-based care management approach would be superior to usual primary care in improving pain outcomes. Secondarily, it was hypothesized that the intervention would improve psychological functioning, health-related quality of life, and patient satisfaction.

Methods

Study Participants

Participants were recruited from June 2010 through May 2012. Patients and physicians in 5 primary care clinics in the Roudebush Veterans Administration Medical Center in Indianapolis participated. Details of the trial protocol have been described.[16]

Patients aged 18 to 65 years were eligible if they had pain that was (1) musculoskeletal, defined as regional (joints, limbs, back, neck) or more generalized (fibromyalgia or chronic widespread pain); (2) moderately severe, defined as a Brief Pain Inventory (BPI) intensity item score of 5 or higher for either "average" or "worst" pain in the past week; and (3) persistent (ie, ≥3 months) despite trying at least 1 analgesic medication. Excluded were individuals who had a pending pain-related disability claim, schizophrenia, bipolar disorder, moderately severe cognitive impairment, active suicidal ideation, current illicit drug use, or a terminal illness.

Using electronic medical records available through participating physicians, we identified patients with an *International Classification of Diseases, Ninth Revision* musculoskeletal pain diagnosis (715, 719, 721, 722, 723, 724, 726, 729.0, 729.1, 729.3, 729.5, 738.4, and 738.5) and a primary care visit within the past 12 months. A letter describing SCOPE was mailed to patients on this list, followed by a telephone contact to assess study interest and eligibility. Eligible patients interested in participating were scheduled for an initial study visit during which, after providing written informed consent, they underwent a baseline study interview conducted by a research assistant. The trial was approved by the Indiana University institutional review board and the Roudebush VA Medical Center research review committee.

Randomization

Following the baseline interview, randomized assignment was conducted by the project coordinator to ensure that the 2 research assistants responsible for outcome assessments were blinded to treatment group assignment. Randomization was stratified by patient opioid medication use at baseline (yes or no). To maintain allocation concealment, assignment to treatment group was determined by a computer-generated randomization list with randomly varying block sizes of 4 and 8.

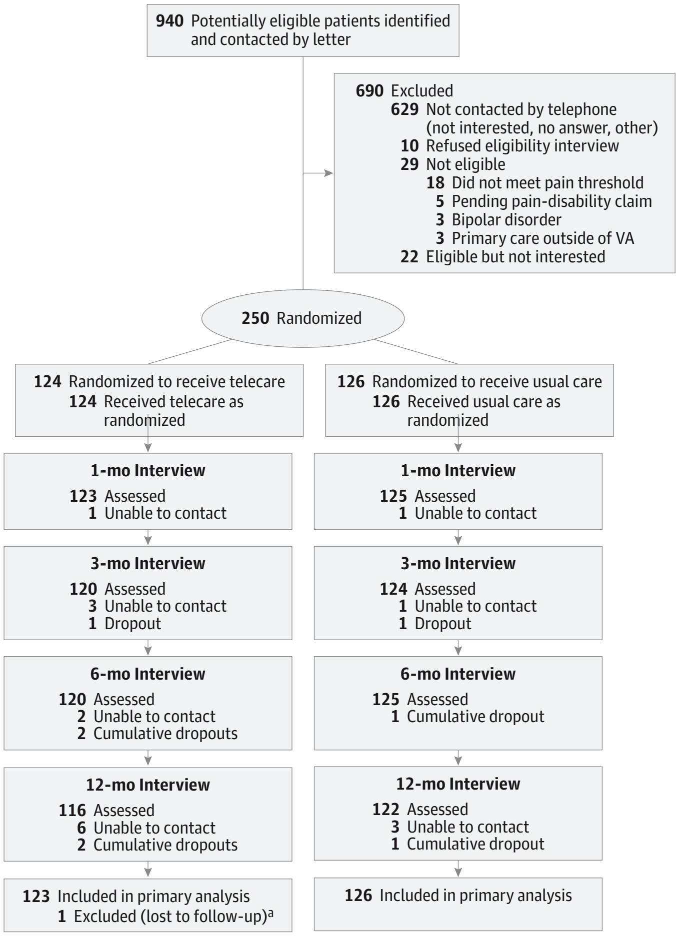
Outcome Measures

Assessments were conducted at baseline and at 1, 3, 6, and 12 months by a research assistant blinded to study group assignment (**Figure**). Pain was assessed using the BPI, which rates the severity of pain on 4 items (current, worst, least, and average pain in past week), and the interference of pain in 7 areas (mood, physical activity, work, social activity, relations with others, sleep, enjoyment of life). The BPI total score is a composite of the pain and interference scores and served as the primary outcome; it has proven sensitive to change in previous trials.[17,18] BPI scale scores range from 0 to 10, with higher scores representing worse pain and a 1-point change considered clinically important.[17,19] The primary outcome was the mean between-group difference in BPI total score during the 12-month trial.

Secondary pain outcomes included between-group comparisons of the (1) difference in response rates (with individual response defined as a 30% or greater decrease in BPI total from baseline to 12 months)[19]; (2) mean BPI interference and BPI severity scale scores; and (3) patient retrospective assessment of change in pain from baseline to 6 months (using a 7-point global rating of change item). Because this anchor-based measure depends on the patient's comparison of pain at present with his or her recollection of pain at the previous assessment, global change was evaluated through 6 months to avoid an unduly long recall period.

Additional demographic and secondary psychological, health-related quality-of-life, and disability outcomes are summarized in **Table 1** and described in detail elsewhere.[16] Because pain treatment and outcomes may vary by race or eth-

Figure. Flow of SCOPE Study



SCOPE indicates Stepped Care to Optimize Pain Care Effectiveness.

[a] Had no follow-up assessments after baseline and therefore not included in the primary analysis, since at least 1 follow-up data point is required for mixed-effects model repeated-measures analysis.

nicity, the latter were identified by the patient from preselected options. Data on analgesics dispensed and health care use during the 12 months for each patient in the trial were extracted from the electronic medical records. Pain-specific cointerventions were elicited by patient report at the 6- and 12-month outcome assessments. Pain-specific treatment satisfaction was assessed in both groups; intervention-specific satisfaction was assessed in the intervention group.

Intervention

The intervention included 2 major components: automated symptom monitoring and optimized analgesic management by a team consisting of a nurse care manager and physician pain specialist. These components were carried out in collaboration with the primary care physician.

Automated Symptom Monitoring

Patients in the intervention group underwent automated symptom monitoring (ASM), either by interactive voice-recorded telephone calls or by Internet, depending on their preferences. Reports from ASM were scheduled weekly for the first month, every other week for months 2 and 3, and monthly for months 4 through 12. The 15-item ASM measure included 7 symptom items: 3 pain items from the PEG instrument, 2 anxiety items from the GAD-2 (2-Item Generalized Anxiety Disorder Questionnaire), and 2 depression items from the PHQ-2 (Patient Health Questionnaire 2).[20,21] The other 8 items asked about how difficult pain made it to carry out usual activities; degree of relief from pain medications; global change in pain (worse, same, better) and, if better, the degree of improvement; analgesic adverse effects, adherence, and whether a medication change was desired; and a request for the nurse to call.

Care Management

All patients randomized to the intervention group had 1 in-person meeting with the nurse care manager to collect a detailed pain history as well as current and past pain treatments. After staffing with the physician pain specialist at a weekly case management conference, a treatment plan was developed. The nurse discussed this initial treatment plan with the patient during a follow-up call, typically occurring in the first week. Intervention calls were scheduled per protocol at 1 and 3 months. All other nurse contacts were prompted by responses on the ASM trend reports, with calls triggered by inadequate improvement in pain, medication nonadherence or

Table 1. Baseline Characteristics of 250 Participants Enrolled in the SCOPE Study

Characteristic	Intervention (n = 124)	Usual Care (n = 126)
Demographic, No. (%)		
Age, mean (SD), y	55.0 (9.0)	55.3 (7.9)
Men	109 (87.9)	98 (77.8)
White race	89 (71.8)	103 (81.8)
Married	98 (79.0)	87 (69.1)
Education >high school	94 (75.8)	91 (72.2)
Employed	76 (61.3)	84 (66.7)
Income adequate by self-report	107 (86.3)	118 (93.7)
Major depression, No. (%)	33 (26.6)	27 (21.4)
Posttraumatic stress disorder, No. (%)	22 (17.2)	21 (16.7)
Comorbid medical diseases, mean (SD), No.	2.0 (1.2)	2.1 (1.4)
Pain sites, mean (SD), No.	5.3 (3.0)	4.6 (3.0)
Duration of pain, y, No. (%)		
≤5	37 (29.8)	36 (28.6)
6-10	24 (19.4)	24 (19.1)
>10	63 (50.8)	66 (52.4)
Current pain treatments, No. (%)		
Any prescribed pain medication	87 (70.2)	87 (69.0)
Opioid medication	42 (33.9)	42 (33.3)
Over-the-counter medications	56 (45.2)	57 (45.2)
Nonpharmacological treatments	48 (38.7)	62 (49.2)
No pain treatments	8 (6.5)	10 (7.9)
Pain scale scores, mean (SD)		
BPI pain (range, 0-10 [worst])		
Total	5.31 (1.81)	5.12 (1.80)
Severity	5.27 (1.74)	5.00 (1.71)
Interference	5.35 (2.20)	5.24 (2.27)
ASES pain self-efficacy (range, 1-10 [best])	6.3 (2.1)	6.3 (2.2)
CSQ pain catastrophizing (range, 0-36 [worst])	11.2 (8.1)	11.2 (8.6)
Percent relief from pain treatments (range, 0-100 [best])	52.8 (23.2)	52.3 (25.0)
Psychological scale scores, mean (SD)		
PHQ-9 depression (range, 0-27 [worst])	9.2 (6.2)	9.0 (6.4)
GAD-7 anxiety (range, 0-21 [worst])	6.1 (5.6)	5.7 (5.7)
PHQ-14 somatization (range, 0-28 [worst])	10.2 (4.6)	10.6 (4.5)
SF-36 mental health (range, 0-100 [best])	70.9 (21.8)	69.1 (21.7)
AUDIT-C alcohol use (range, 0-12 [worst])[a]	2.2 (2.3)	1.8 (2.0)
Health-related quality of life scores, mean (SD)		
SF-12 (norm = 50)		
Physical component summary	35.4 (9.2)	35.5 (9.1)
Mental component summary	48.7 (12.1)	47.9 (12.6)
SF-36 (range, 0-100 [best])		
General health perceptions	51.4 (29.3)	51.0 (28.9)
Social functioning	66.7 (26.8)	66.8 (27.8)
Vitality	40.5 (22.5)	40.7 (22.8)
PROMIS (range, 40-20 [worst])		
Fatigue	12.7 (4.4)	12.2 (4.2)
Sleep	12.6 (4.3)	12.8 (4.3)
Health-related disability days in past 4 wk, mean (SD)	9.3 (8.4)	8.8 (8.7)
Pain-specific disability days in past 4 wk, mean (SD)[a]	8.2 (8.1)	7.8 (8.5)

Abbreviations: ASES, Arthritis Self-Efficacy Scale; AUDIT-C, Alcohol Use Disorders Identification Test; BPI, Brief Pain Inventory; CSQ, Coping Strategies Questionnaire; GAD-7, 7-Item Generalized Anxiety Disorder Questioannaire; PHQ-9/14, Patient Health Questionnaire 9/14; PROMIS, Patient Reported Outcomes Measurement Information System; SCOPE, Stepped Care to Optimize Pain Care Efectiveness; SF-12/36, 12/36-Item Short Form Health Survey.

[a] Because these variables are skewed (SD >mean), the median (interquartile range) is also provided, which for the AUDIT-C is 1 (0-4) in the intervention group and 1 (0-3) in the control group and for pain-specific disability days is 7 (1-14) in the intervention group and 5 (0-14) in the control group.

adverse effects, a patient's desire to change medication, or a request for the nurse to call. Nonopioid analgesic prescriptions were routinely written by the physician specialist. For opioid analgesics, primary care physicians were given the option of prescribing or of authorizing prescribing by the study team.

Analgesic Algorithm

The stepped care analgesic optimization algorithm used in SCOPE[16] was based on a systematic literature synthesis of pharmacological therapy for chronic pain.[22] The 6 major categories of analgesics included (1) simple analgesics (acetaminophen and nonsteroidal anti-inflammatory drugs); (2) tricyclic antidepressants (amitriptyline and nortriptyline) and cyclobenzaprine (which has a chemical structure quite similar to that of amitriptyline); (3) tramadol; (4) gabapentoids (gabapentin and pregabalin); (5) topical analgesics; and (6) opioids. Patients who began receiving opioids during the trial or who required an escalation in the baseline dose of their opioids signed a written opioid agreement and provided a baseline urine drug screen.

Three criteria, assessed by ASM and during nurse calls, prompted adjustments in type or dose of analgesic medication: less than 30% improvement in the PEG pain score; global improvement not at least moderate or better; or a patient desire for a change in treatment.[19] Analgesics were prescribed by either the study physician or the primary care physician, depending on the latter's preference.

Usual Care

Patients randomized to usual care continued to receive care for their chronic musculoskeletal pain from their primary care physician. There was no attempt by study personnel to influence clinical management unless an emergency arose (eg, suicidal ideation as detected on a baseline or follow-up outcome assessment interview).

Statistical Analysis

We determined that 100 patients were needed per group to detect a between-group treatment difference of 0.4 SD in the BPI total score (representing a small to moderate treatment effect[19]), presuming a 2-sided $\alpha \le .05$ and 80% power. Allowing for up to 20% attrition, the enrollment target was set at 250 patients.

Groups were compared at baseline using analysis of variance for continuous variables and χ^2 for categorical variables. Between-group differences in outcomes during the 12 months of the trial were compared using mixed-effects model repeated-measures analysis, adjusting for baseline value of the outcome and time.[23,24] BPI total pain response (>30% decrease) was analyzed using a repeated-measures logistic model. Logistic regression modeling showed that the missing-at-random assumption for mixed-effects model repeated-measures analysis was satisfied. As a sensitivity analysis, multiple imputation analysis was also performed. Health care and analgesic use data were compared using negative binomial regression analysis and Wilcoxon rank sum scores. The effect size for a continuous outcome was the between-group difference divided by the pooled SD. The number needed to treat for a binary outcome was 1 divided by the absolute difference between groups. For secondary outcomes, $P < .001$ was required using Bonferroni correction for multiple comparisons (ie, .05 divided by 50, since there were fewer than 50 secondary comparisons). Analyses were performed using SAS version 9.3 (SAS Institute Inc).

Results

Study Participants

The Figure summarizes the participant flow in SCOPE. Follow-up rates were excellent, with outcome assessments completed by 99% of participants at 1 month, by 98% at 3 and 6 months, and by 95% at 12 months. Of the 250 participants enrolled, randomization resulted in intervention (n = 124) and usual care control (n = 126) groups balanced in terms of baseline characteristics (Table 1). The mean BPI total score was 5.2 (at least moderately severe pain), and participants reported a mean of 8 pain-specific disability days (defined as having to reduce their activity by at least 50%) in the past 4 weeks. Moreover, most patients had pain in multiple sites present for many years and previously treated with a median of 5 pain medicines from 4 different analgesic classes.

Pain Outcomes

Compared with the usual care group, patients in the intervention group had significantly greater improvement in their BPI total score during the 12-month trial as well as greater improvement in BPI severity and interference scale scores (**Table 2**). The more than 1-point improvement in BPI total score at 12 months is clinically important[19] and represents a moderate treatment effect size of 0.57. Between-group differences at 12 months were also significant for BPI total, BPI interference, and BPI severity using multiple-imputation analyses. BPI outcomes did not differ by patient age, sex, race, socioeconomic status, education, clinic, or mode of automated monitoring. Patients in the intervention group were nearly twice as likely to report at least a 30% improvement from their baseline pain score by 12 months (51.7% vs 27.1%; relative risk [RR], 1.91 [95% CI, 1.36 to 2.69]). The number needed to treat for a 30% improvement was 4.1 (95% CI, 3.0 to 6.4).

Patients in the intervention group were also significantly more likely to report global pain improvement (55.8% vs 31.2%; RR, 1.8 [95% CI, 1.3 to 2.4]) and only half as likely to report worsening pain (19.2% vs 36.0%; RR, 0.5 [95% CI, 0.3 to 0.8]) by 6 months (eFigure in the Supplement). The number needed to treat for global improvement at 6 months was 4.0 (95% CI, 2.9 to 6.2). Patients in the intervention group were also more likely to rate as good to excellent the medication prescribed for their pain (73.9% vs 50.9%, RR, 1.5 [95% CI, 1.2 to 1.8]) as well as the overall treatment of their pain (76.7% vs 51.6%; RR, 1.5 [95% CI, 1.2 to 1.8]).

Secondary Health-Related Quality of Life Outcomes

Although patients in the intervention group reported greater improvement in depression, anxiety, somatization, sleep, so-

Table 2. Pain Outcomes in SCOPE Trial Participants

BPI Clinical Outcome (Score Range, 0-10)	Intervention (n =124)[a]	Usual Care (n = 126)[a]	Measure (95% CI)	Overall P Value[b]
Primary pain outcome				
Total pain score, mean (SD)			Time-Specific Between-Group Difference	
Baseline	5.31 (1.81)	5.12 (1.80)	0.19 (−0.26 to 0.64)	<.001
1 mo	4.72 (1.97)	4.75 (1.88)	−0.02 (−0.50 to 0.46)	
3 mo	4.29 (2.15)	4.79 (1.95)	−0.50 (−1.02 to 0.02)	
6 mo	4.12 (2.43)	4.47 (2.17)	−0.34 (−0.93 to 0.23)	
12 mo	3.57 (2.22)	4.59 (2.13)	−1.02 (−1.58 to −0.47)	
Secondary pain outcomes				
Total pain score responder, No. (%)[c]			Relative Risk	
1 mo (123/125)	27 (22.0)	19 (15.2)	1.44 (0.85 to 2.46)	<.001
3 mo (120/124)	44 (36.7)	23 (18.6)	1.98 (1.28 to 3.06)	
6 mo (120/125)	50 (41.7)	31 (24.8)	1.68 (1.16 to 2.44)	
12 mo (116/122)	60 (51.7)	33 (27.1)	1.91 (1.36 to 2.69)	
Pain severity, mean (SD)			Time-Specific Between-Group Difference	
Baseline	5.27 (1.74)	5.00 (1.71)	0.26 (−0.17 to 0.69)	<.001
1 mo	5.01 (1.88)	4.75 (1.76)	0.26 (−0.20 to 0.71)	
3 mo	4.53 (2.16)	4.92 (1.89)	−0.40 (−0.91 to 0.11)	
6 mo	4.21 (2.33)	4.60 (2.00)	−0.40 (−0.94 to 0.15)	
12 mo	3.80 (2.21)	4.80 (1.97)	−1.00 (−1.53 to −0.46)	
Pain interference, mean (SD)			Time-Specific Between-Group Difference	
Baseline	5.35 (2.20)	5.24 (2.27)	0.11 (−0.45 to 0.67)	<.001
1 mo	4.44 (2.35)	4.74 (2.39)	−0.30 (−0.89 to 0.29)	
3 mo	4.04 (2.45)	4.65 (2.32)	−0.60 (−1.21 to 0.00)	
6 mo	4.03 (2.84)	4.33 (2.61)	−0.29 (−0.98 to 0.39)	
12 mo	3.34 (2.55)	4.38 (2.61)	−1.05 (−1.71 to −0.39)	

Abbreviations: BPI, the Brief Pain Inventory; SCOPE, Stepped Care to Optimize Pain Care Efectiveness.

[a] The number of participants assessed at follow-up was 248 (123 intervention, 125 control) at 1 month, 244 (122 and 122) at 3 months, 245 (120 and 125) at 6 months, and 238 (116 and 122) at 12 months.

[b] From mixed-effects model repeated-measures analysis, used to compare group differences during the 12 months, adjusting for time effect and for baseline value of outcome variable. Follow-up assessments were conducted at 4 points: 1, 3, 6, and 12 months.

[c] Defined as 30% or greater decrease in BPI total score from baseline. Repeated-measures logistic modeling performed for this outcome.

cial functioning, and physical component summary scores, only depression reached the significance threshold for secondary outcomes of $P < .001$ (**Table 3**). The groups did not differ significantly in vitality/fatigue, mental component summary scores, or self-reported disability days.

Intervention Adherence and Satisfaction

The intervention group was about equally divided between patients who chose to receive automated symptom monitoring (ASM) by interactive voice response (51%) or Internet (49%). Patients in the intervention group had a mean of 12.7 (median, 12) nurse telephone contacts and a mean of 13.5 (median, 15) ASM contacts during the 12-month period. Of the 108 patients in the intervention group who completed an end-of-study satisfaction survey, 95% rated the nurse calls as "very or moderately helpful," 92% rated ASM as "easy," and 76% rated ASM as "very or moderately helpful."

Analgesic Use, Health Care Use, and Pain-Specific Co-interventions

Analgesic and health care use for patients during their 12 months in the trial was determined from electronic health record data (**Table 4**). Treatment groups were similar at baseline in terms of analgesic use. During the 12-month trial, patients in the intervention group received a greater number of analgesics for more months and at a higher mean dose. Treatment groups did not differ in their opioid use at baseline, during the trial, or at the end of the trial. Of the 166 patients in the overall sample who were not taking opioids at the start of the trial, opioids were initiated in only 6 (3.6%). Moreover, the median daily dose (morphine-equivalent dose, 54 mg) among patients taking opioids was identical at the beginning and end of the trial.

Treatment groups did not differ in use of health care services, including outpatient visits, emergency department visits, and hospitalizations, during the 12-month trial. Patient-reported pain-specific co-interventions were similar except for more pain medication changes reported by patients in the intervention group and more chiropractic and massage therapy use by those in the usual care group (eTable in the Supplement). In the intervention group, the estimated time spent per patient during the 12 months was 3 to 4 hours by the study nurse and 1 hour by the study physician.

Discussion

The SCOPE trial has several key findings. First, the collaborative telecare management intervention produced clinically meaningful improvements in pain, with a moderate treatment effect size (0.57), a greater rate of improvement

(56% vs 31%), and a number needed to treat of 4 for pain response. Second, this was accompanied by greater patient satisfaction with pain treatment. Third, although one-third of patients were taking opioid therapy at baseline, few patients in either group were started on opioids or had escalations in their opioid dose. Fourth, patients in the usual care group were more likely to experience worsening of pain by 6 months compared with those in the intervention group

Table 3. Secondary Health-Related Quality of Life Outcomes in SCOPE Trial Participants

Clinical Outcome	Mean (SD) Intervention (n = 124)[a]	Mean (SD) Usual Care (n = 126)[a]	Time-Specific Between-Group Difference (95% CI)	Overall P Value[b]
PHQ-9 depression (range, 0-27)				
Baseline	9.2 (6.2)	9.0 (6.4)	0.2 (−1.4 to 1.7)	<.001
3 mo	6.6 (5.5)	8.3 (6.0)	−1.6 (−3.1 to −0.2)	
12 mo	6.1 (5.6)	7.8 (6.6)	−1.8 (−3.4 to −0.2)	
GAD-7 anxiety (range, 0-21)[c]				
Baseline	6.1 (5.6)	5.7 (5.7)	0.4 (−1.0 to 1.8)	.04
3 mo	4.3 (4.5)	4.8 (5.1)	−0.5 (−1.7 to 0.7)	
12 mo	3.7 (4.4)	4.4 (4.7)	−0.7 (−1.9 to 0.5)	
PHQ-14 somatization (range, 0-28)				
Baseline	10.2 (4.6)	10.6 (4.5)	−0.4 (−1.5 to 0.8)	.002
3 mo	8.4 (4.4)	9.9 (4.6)	−1.5 (−2.7 to −0.4)	
12 mo	8.2 (4.4)	9.4 (4.5)	−1.3 (−2.4 to −0.1)	
SF-12 (range, 0-100)				
Physical component summary				
Baseline	35.4 (9.2)	35.5 (9.1)	−0.1 (−2.4 to 2.1)	.02
3 mo	37.2 (10.1)	36.4 (9.4)	0.8 (−1.6 to 3.3)	
12 mo	39.3 (10.1)	36.8 (9.7)	2.5 (0.0 to 5.0)	
Mental component summary				
Baseline	48.7 (12.1)	47.9 (12.6)	0.9 (−2.2 to 3.9)	.34
3 mo	49.9 (11.3)	47.4 (11.6)	2.5 (−0.4 to 5.4)	
12 mo	48.4 (11.9)	48.2 (12.5)	0.2 (−2.9 to 3.3)	
SF-36 (range, 0-100)				
Social functioning				
Baseline	66.7 (26.8)	66.8 (27.8)	0.0 (−6.8 to 6.8)	.03
3 mo	71.3 (27.7)	66.0 (28.2)	5.2 (−1.8 to 12.3)	
12 mo	72.6 (26.6)	67.3 (27.4)	5.3 (−1.6 to 12.2)	
Vitality, follow-up				
Baseline	40.5 (22.5)	40.7 (22.8)	−0.2 (−5.8 to 5.4)	.09
3 mo	44.3 (24.3)	40.3 (21.0)	4.0 (−1.7 to 9.7)	
12 mo	44.8 (24.4)	42.6 (23.1)	2.2 (−3.9 to 8.2)	
Mental health, follow-up				
Baseline	70.9 (21.8)	69.1 (21.7)	1.8 (−3.6 to 7.2)	.26
3 mo	72.8 (19.6)	68.8 (20.4)	4.0 (−1.1 to 9.0)	
12 mo	72.2 (20.5)	70.3 (21.9)	1.9 (−3.5 to 7.3)	
PROMIS (range, 4-20)				
Sleep				
Baseline	12.6 (4.3)	12.8 (4.3)	−0.1 (−1.2 to 0.9)	.01
3 mo	11.7 (4.3)	12.7 (4.2)	−1.0 (−2.1 to 0.2)	
12 mo	11.5 (4.1)	12.5 (4.0)	−1.0 (−2.0 to 0.0)	
Fatigue, follow-up				
Baseline	12.7 (4.4)	12.2 (4.2)	0.5 (−0.6 to 1.6)	.05
3 mo	11.4 (4.5)	11.8 (4.5)	−0.4 (−1.5 to 0.7)	
12 mo	11.5 (4.4)	11.8 (4.4)	−.0.3 (−1.4 to 0.8)	
Disability days past 4 wk (range, 0-28)				
Baseline	9.3 (8.4)	8.8 (8.7)	0.5 (−1.6 to 2.7)	.34
3 mo	9.0 (8.8)	9.0 (8.4)	0.0 (−2.2 to 2.2)	
6 mo	8.8 (8.5)	9.6 (8.8)	−0.7 (−2.9 to 1.5)	
12 mo	8.1 (7.9)	9.5 (8.8)	−1.3 (−3.5 to 0.8)	

Abbreviations: GAD-7, 7-Item Generalized Anxiety Disorder Questioannaire; PHQ-9/14, Patient Health Questionnaire 9/14; PROMIS, Patient Reported Outcomes Measurement Information System; SCOPE, Stepped Care to Optimize Pain Care Efectiveness; SF-12/36, 12/36-Item Short Form Health Survey.

[a] The number of participants assessed was 250 at baseline (126 intervention, 124 control), 244 at 3 months (122 intervention, 122 control), and 238 at 12 months (118 intervention, 120 control).

[b] From mixed-effects model repeated-measures analysis, used to compare group differences during the 12 months, adjusting for time effect and for baseline value of outcome variable. Follow-up assessments were conducted at 3 and 12 months for all outcomes in this table except disability days which was assessed at 1, 3, 6, and 12 months.

[c] Because the GAD-7 is skewed (SD >mean) at some points, the median (interquartile range) is also provided, which for the intervention vs control group is 5 (1-9) vs 4 (1-9) at baseline, 3 (1-6.5) vs 3.5 (0-7) at 3 months, and 2 (0-6) vs 3 (1-7) at 12 months.

Table 4. Twelve-Month Analgesic and Health Care Use From Electronic Health Records

Variable	Intervention (n =124) Mean (SD)	Intervention (n =124) Median (IQR)	Usual Care (n = 126) Mean (SD)	Usual Care (n = 126) Median (IQR)	P Value[a]
Analgesics					
Baseline, No.	0.6 (1.0)	0 (0-1)	0.5 (0.8)	0 (0-1)	.22
During trial, No.	3.0 (1.7)	3 (2-4)	1.6 (1.5)	1 (0-3)	<.001
Baseline maximum dose, %[b]	15.4 (28.3)	0 (0-24)	15.6 (30.5)	0 (0-16)	.85
End of trial maximum dose, %[b]	24.6 (34.8)	0 (0-48)	12.6 (29.6)	0 (0-0)	<.001
Analgesic months[c]	10.0 (7.8)	8 (4-13)	5.1 (6.5)	3 (0-7)	<.001
Opioid months[c]	2.0 (4.1)	0 (0-2)	1.6 (3.9)	0 (0-2)	.27
Health care use, No.					
Outpatient visits, total	11.9 (12.1)	8 (4-17)	11.6 (12.5)	7.5 (4-16)	.82
Primary care					
Physician	2.4 (1.7)	2 (1-3)	2.4 (1.9)	2 (1-3)	.72
Other	1.1 (2.6)	0 (0-1)	0.9 (1.0)	1 (0-1)	.52
Specialty					
Medical	1.6 (3.0)	1 (0-2)	2.0 (3.3)	0.5 (0-3)	.36
Surgical	1.3 (2.4)	0 (0-1)	0.9 (2.1)	0 (0-1)	.12
Mental health	2.0 (4.4)	0 (0-2.5)	2.1 (5.1)	0 (0-1)	.94
Other	3.5 (5.4)	2 (0-4)	3.4 (5.4)	1 (0-4)	.92
Emergency department visits	0.4 (1.0)	0 (0-0)	0.3 (0.8)	0 (0-0)	.45
Hospitalizations	0.08 (0.3)	0 (0-0)	0.02 (0.2)	0 (0-0)	.07
Hospital length of stay, d	0.28 (1.3)	0 (0-0)	0.09 (0.8)	0 (0-0)	.23

Abbreviation: IQR, interquartile range.

[a] Negative binomial distribution regression analysis was used to test between-group differences for all variables except for % maximum dose and analgesic/opioid months, which were compared using Wilcoxon rank sum scores.

[b] The average of the maximum doses for all analgesics. Thus, a patient taking 75% of the maximum dose of analgesic A, 50% of the maximum dose of analgesic B, and 25% of the maximum dose of analgesic C would have an average maximum dose of 50%.

[c] Analgesic months is the sum of the number of months taking each discrete analgesic during the 12-month trial. Thus, a patient taking analgesic A for 6 months, analgesic B for 3 months, and analgesic C for 12 months would have 21 analgesic months. Opioid months is the number of months taking any opioid during the 12-month trial (which thus can range from 0 to 12).

(36% vs 19%), demonstrating a greater risk of deterioration in the absence of systematic approaches to optimizing pain therapy.

The intervention was effective, even though most trial participants reported pain that had been present for many years, that involved multiple sites, and that had been unsuccessfully treated with numerous analgesics. However, chronic pain involving multiple sites is more the norm than the exception among prevalent cases of pain in primary care.[25,26] The improvement in pain with minimal opioid initiation or dose escalation is noteworthy, given increasing concerns about the consequences of long-term opioid use.[9,27,28] The results of SCOPE, coupled with findings from a previous trial conducted among patients with cancer,[23] show that algorithm-guided optimization of analgesic therapy can be efficiently delivered through a predominantly telephone and Internet-based approach. SCOPE has added importance because noncancer pain is often marked by chronicity, prior treatment failures, and a desire to minimize opioid use.

SCOPE focused primarily on optimizing analgesic therapy for pain. Cognitive-behavioral therapy, pain self-management, and other nonpharmacological interventions have also proven effective for chronic pain, as has the treatment of comorbid depression and anxiety.[13,14,29-31] Thus, combining an algorithmic approach to optimizing pain medications with 1 or more other evidence-based treatments might produce even greater pain improvement in some patients. Additionally, monitoring the response of pain to treatment and incorporating measurement with patient preferences when adjusting therapy were key components of SCOPE; as with depression[32] and other patient-reported outcomes, measurement-based treatment modifications are essential. Indeed, a "treat to target" approach, rather than reliance on a specific type of treatment, maximizes tailoring of therapy to the individual patient with pain.

Our study has several limitations. First, the sample consists of veterans from a single center. Nonetheless, the sample had more women and a higher socioeconomic status than earlier veteran samples, thus enhancing generalizability. Second, many patients had pain for years that involved at least several bodily sites. However, this means the trial may provide a conservative estimate of intervention effectiveness in patients with pain of more recent origin or localized to a single site. Third, the comparator group was usual care rather than an attention control; thus, the relative effects of optimizing analgesics, automated monitoring, and nurse contacts cannot be unbundled. Fourth, we did not have data on medications prescribed outside of the Veterans Affairs system. Fifth, the trial did not include a formal cost analysis.

Conclusions

Telecare collaborative management substantially increased the proportion of primary care patients with improved chronic musculoskeletal pain. This was accomplished by optimizing nonopioid analgesic medications using a stepped care algorithm and monitoring.

ARTICLE INFORMATION

Author Contributions: Drs Kroenke and Yu had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Krebs, Bair.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Kroenke, Wu.
Critical revision of the manuscript for important intellectual content: All authors
Statistical analysis: Krebs, Wu, Yu, Bair.
Administrative, technical, or material support: Kroenke, Krebs, Chumbler, Bair.
Study supervision: Yu.

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