Original Research Article

Opioid Use Patterns and Association with Pain Severity and Mental Health Functioning in Chronic Pain Patients

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Abstract

Objective. The objective of this study was to explore the relationship between patterns of opioid use, pain severity, and pain-related mental health in chronic pain patients prescribed opioids.

Design. The study was designed as a one-time patient interview with structured pain and opioid use assessments.

Setting. The study was set in a tertiary care medical center in the United States Department of Veterans Affairs.

Patients. Study participants were primary care patients with a pain condition for greater than 6 months who received at least one prescription for an opioid in the prior 12 months.

Outcome Measures. The Prescription Drug Use Questionnaire was used to assess patterns of opioid use. The Pain Outcomes Questionnaire was used to assess pain-related functioning.

Results. Symptomatic use of opioid medication (e.g., taking an opioid in response to increased pain) was more common than scheduled (i.e., taking an opioid at regular times) or strategic use of opioid medication (e.g., taking an opioid specifically to engage in activities). Symptomatic use of opioids was associated with poorer pain-related mental health, after controlling for pain duration and pain-related physical functioning. Use of opioids in a scheduled pattern was associated with better pain-related mental health. Patients rarely reported that they used opioids strategically to facilitate functional activities.

Conclusions. The patterns in which patients use their opioid medications are associated with their psychological functioning. This is consistent with theory regarding the potential impact of reinforcing effects of opioid medication on functional outcomes. Interventions to encourage strategic or scheduled opioid use warrant investigation as methods to improve pain outcomes with opioids.

Key Words. Opioid Therapy; Pain-related Mental Health; Pain Severity; Patterns of Opioid Use; Pain Outcomes

Introduction

Opioid therapy for chronic nonmalignant pain is common but controversial [1]. Estimates indicate that as many as 90% of chronic pain patients in pain management settings have been prescribed opioid medication [2]. However, there is concern regarding the efficacy of opioids in management of chronic pain [3,4], potential for hyperalgesia [5–7], unclear sustained benefit over time [8], and ineffective pain relief especially at high doses [4,9,10]. There is also growing concern about the potential for misuse, abuse, and accidental overdose [11–14]. Current guidelines recommend a balanced approach when using opioid therapy for pain management, encouraging careful selection of patients based on
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likelihood of risks and benefits and ongoing monitoring for efficacy, side effects, and problematic use behaviors [12,15]. Improving our ability to identify patients likely to have negative outcomes from opioid therapy based on individual characteristics or risk factors (i.e., past drug abuse history or mental health diagnosis) [16] is important. In addition to individual characteristics, how opioid medication is prescribed and used may also contribute to the safety and efficacy of chronic opioid therapy [17]. The pattern and timing of how patients use their opioid medication may impact patient outcomes. While there is some evidence that timing and patterns of use are important, little work has examined, from the patient perspective, how opioids are used and associations with outcomes. This study describes chronic pain patients’ self-reported patterns for using opioids based on detailed interviews and how those patterns of use related to outcomes in these patients.

Clinicians typically prescribe opioids for use in three main patterns:

1. Symptomatic: opioids are to be taken in response to symptoms perceived as negative (i.e., pain severity exceeds a threshold or tolerance level);
2. Scheduled: opioids are to be taken consistently at set times during the day regardless of current pain or life challenges; and
3. Strategic: opioids are to be taken prior to potentially painful tasks (e.g., before physical therapy or before work) to enable functioning.

Patients may choose to follow clinician instructions to use opioids in any of the three patterns mentioned earlier or patients may choose to self-manage their medications and use them in a symptomatic, scheduled, or strategic manner regardless of clinician instructions [18]. Looking beyond individual characteristics that may contribute to negative outcomes in pain patients using opioids (i.e., drug abuse history), we hypothesize that patients develop different patterns of opioid use and that these differing behavioral patterns of prescription opioid use may be associated with differing pain, mood, and mental functioning outcomes based on their different effects on reward circuits and learning.

Current theory suggests that how patients use prescription opioids may alter pain and affect functional outcomes by differentially driving reward and punishment learning (e.g., [19,20]). While theory suggests that use patterns may affect pain and behavioral outcomes, there are gaps in the empirical literature. Specifically, there is little information about patients’ perceptions of how they use their opioid (i.e., symptomatically, strategically, or scheduled) and how those patterns of use relate to patient outcomes. The current study had two specific aims: 1) to first describe opioid use patterns reported by chronic pain patients seen in primary care, and 2) to explore associations between use patterns, pain severity, and pain-related mental health in a sample of patients with chronic pain of heterogeneous origin who recently received opioids. Although similar processes may also affect pain-related physical functioning, we felt that the current sample was not adequate to test this hypothesis given the diversity of chronic pain conditions experienced by the participants.

Methods

Participants

The current study used existing data collected as part of a study to identify risk factors for misuse of opioid medications. Participants were 191 United States Veterans receiving care at the Veterans Affairs Palo Alto Health Care System (VAPAACS). Inclusion criteria for the study were receipt of an opioid prescription in the 12 months prior to recruitment and ability to provide written informed consent. Participants could be taking short-acting or long-acting medications. Participants were recruited through primary care providers at several locations within the VAPAACS including Palo Alto, Menlo Park, Livermore, San Jose, Monterey, Modesto, Stockton, and Sonora. Participants are 92% male, 62.5 years old on average, and 27% self-identified as non-White. This is broadly reflective of the population served by the VAPAACS.

Procedure

Data from the VA regional Corporate Data Warehouse identified approximately 9,000 people who were eligible for the study based on receiving at least one opioid prescription in the prior 12 months. Of these ~9,000 eligible, 3,065 potential participants were randomly selected for recruitment based on oversampling procedures to identify those more likely to have problematic opioid use. Oversampling procedures enriched for potential participants who had an emergency room visit in the prior 12 months, a history of mental health and/or substance abuse diagnoses, or at least one visit to the VA pain clinic. Primary care providers were given a list of eligible participants from their panels and were encouraged to invite them to participate by sending a letter informing the potential participant of study eligibility. Letters were sent to 1,359 potential participants. Of the potential participants, 18% responded to the letter (N = 227). Thirty-six of these individuals did not complete the study (e.g., due to failure to return consent documents). The final sample consisted of 191 patients.

A comparison between participating patients (N = 191) and eligible patients (approximately 9,000) found only small differences between the groups by average age (62.5 among participants vs 63.8 among eligible patients) and percent female (28% of participants vs 7% of eligible patients), indicating that our sample is generally representative of the eligible veteran population. Participants did have a somewhat higher average number of prescriptions (6.6 vs 5.6 prescriptions in the 12 months prior to sample identification) and mental health diagnoses (5.0 vs 3.3 mental health diagnoses), consistent with the oversampling methods.
Two study staff completed all clinical interviews: the second author (169 interviews) and a research assistant (22 interviews). Approximately 80% of participants were interviewed by phone and 20% in person; each participant received a $40 gift certificate for their time. Using only two study staff to conduct the assessments enhanced reliability, internal consistency, and stability in their administration. Both interviewers have substantial experience conducting structured assessments, semi-structured interviews, and working with qualitative data. In addition, they met periodically during the data collection period to ensure consistency in the administration of the interviews and interpretations of specific questions and items on assessment tools. When questions arose about how to interpret responses to specific assessment questions they consulted with the third author (the principal investigator).

Of the full sample of 191 participants, 33 participants reported that they had acute pain, defined as pain less than 6 months. These 33 participants were excluded as the analyses in this article focus on chronic pain. One participant had missing data for all pain ratings and was therefore excluded. Our final sample included 157 participants who indicated that they had a pain condition for more than 6 months. These participants reported chronic pain conditions that ranged from extremely severe and chronic (e.g., shrapnel throughout the body), to moderate and chronic (e.g., arthritis, neuropathy from diabetes). Almost all participants reported pain in multiple sites, with the back most frequently reported as the site of “worst pain.” Eighty-seven percent of participants reported having tried non-opioid pain management options.

Measures
Participants completed a battery of assessments that included validated measures of opioid misuse, assessments of physical factors and functioning, medication use, substance use assessments, and mental health assessments. Data collection occurred between November 2007 and November 2008. Detailed notes were taken during each interview about participants’ responses to allow qualitative data analysis. Responses to the Prescription Drug Use Questionnaire (PDUQ) and the Pain Outcomes Questionnaire (POQ) were used for this study to code patterns of opioid use and measure pain severity and duration, affect, and pain-related functioning.

PDUQ
This measure is a 42-item structured interview developed to guide clinician assessments of prescription medication misuse risk [21]. The interview takes approximately 20–30 minutes to administer and asks the participant a series of questions related to pain condition, patterns of opioid use, social and family factors, family history of pain and substance abuse, and patient substance abuse and psychiatric history. The PDUQ has been found to be an acceptable measure of misuse and abuse in chronic pain populations [22]. Examples of interviewer-scored PDUQ items that elicited discussion about patterns of opioid use include: “Does the patient report using analgesics for symptoms other than those prescribed for (i.e., insomnia, anxiety, depression)?” and “Is there a pattern of the patient increasing prescribed analgesic dose or frequency?”

POQ
The POQ is an 18-item scale, developed and validated for use in a VA patient population that measures several facets of the effect of pain on physical and psychological adjustment [23]. Five subscales of the POQ were examined in the current study. For the current study, we combined the POQ subscales Activities of Daily Living (ADL), Mobility (MOB), and Vitality (VIT) into a single pain-related physical function measure (α = 0.84), with 0 indicating perfect pain-related physical functioning and 110 indicating worst possible pain-related physical functioning. We combined the Negative Affect Subscale, and Fear of Pain Subscale into a single pain-related mental function measure (α = 0.80), with 0 indicating perfect pain-related mental function and 70 indicating worst possible pain-related mental functioning. Participants were asked to report answers to the POQ for two scenarios, if applicable: 1) functioning during the most recent period in which they received an opioid prescription, and 2) functioning during a recent period in which they were not prescribed opioids. Responses from scenario 1 are used for the analyses in this article.

POQ ADL Subscale
The ADL subscale consists of four items about how much pain interfered with the patient’s independence of self-care (e.g., independence in bathing, dressing, and grooming). Participants rated responses on an 11-point scale where 0 was “not at all” and 10 was “all the time.” Scores on items were added together to create a sum score with higher scores reflecting worse functional status. Reliability for this subscale in the current sample was good (α = 0.88).

POQ MOB Subscale
The MOB subscale consists of four items about the patient’s ability to walk, climb, and carry items. Participants rated how much pain interfered with their ability to engage in these activities on an 11-point scale where 0 was “not at all” and 10 was “all the time.” Scores on items were added to create a sum score with higher scores reflecting more difficulty with mobility. Reliability for this subscale in the current sample was adequate (α = 0.79).

POQ VIT Subscale
The VIT subscale consists of three items that reflect overall physical energy, strength, and endurance. Participants rated how much energy they had on an 11-point scale where 0 was “not at all” and 10 was “all the time.” Scores on items were added to create a sum score with higher scores reflecting worse functional status. Reliability for this subscale in the current sample was adequate (α = 0.79).
with higher scores reflecting less vitality. Reliability for this subscale in the current sample was good ($\alpha = 0.87$).

**POQ Negative Affect Subscale**

The Negative Affect subscale consists of five items about the extent to which the patient experienced anxiety and depressed mood. Items were rated on an 11-point scale where 0 was “not at all” and 10 was “all the time.” Scores on items were added to create a sum score with higher scores reflecting higher negative mood in response to pain. Reliability for this subscale in the current sample was good ($\alpha = 0.84$).

**POQ Fear of Pain Subscale**

The Fear of Pain subscale consists of two items about how much patients worry about re-injury and fear exercise. Items were rated on an 11-point scale where 0 was “not at all” and 10 was “all the time.” Scores on items were added to create a sum score with higher scores reflecting greater fear of pain. The inter-item correlation between the two items was $r = 0.80$.

**Pain Severity: Average Pain**

Average pain in the last week was rated on a numerical rating scale where 0 was “no pain at all” and 10 was “worst pain possible.”

**Pain Duration**

Patients provided data on pain duration in response to the question “How long have you had the pain for which you are now receiving opioids?” Patients were divided into those whose duration of pain was between 6 months and one year vs greater than one year.

**Patterns of Use Coding**

The first and third authors coded every reported instance of symptomatic, strategic, or scheduled use from the detailed notes taken during the PDUQ for all participants who reported pain lasting longer than 6 months. For 31 participants, there was not enough information present in responses to identify a pattern of use. Of the 157 remaining patients, 90 reported only one pattern of use and 25 reported multiple patterns; an additional 11 were coded as “nonusers”.

1. **Symptomatic Use** was coded when opioid medications were taken in response to symptoms of pain, physical sensations, or negative affect. Participants who endorsed symptomatic use typically took medication “as needed” in response to symptoms.
2. **Strategic Use** was coded when opioid medications were used for the purpose of increasing functioning. Participants who endorsed strategic use took medication to assist in activities (e.g., physical therapy, recreational activity, to get chores done, increase function).
3. **Scheduled use** was coded when opioid medications (long-acting or short-acting) were taken by participants at regular, timed intervals. Patients reporting scheduled use might take opioid medication three times per day or every 4 hours regardless of symptoms or activities.
4. **Nonuse** was coded when participants reported using one to two pills of a prescription then choosing not to use it again.

Of the total sample, 10% ($N = 20$) was randomly selected for initial coding and to establish reliability. Two-raters reviewed coding criteria for the three patterns of use (symptomatic, strategic, and scheduled) and coded these interviews independently. Mismatches on codes were discussed and the coding criteria were refined. A second random sample of 20% ($N = 40$) were then coded and inter-rater reliability estimates were good to excellent (symptomatic use, Kappa = 0.83; strategic use, Kappa = 0.83; scheduled use, Kappa = 1). Discrepancies were resolved by review and discussion, and the remaining interviews were coded using the final criteria.

**Statistical Analysis**

To address our first aim we provide a descriptive analysis of each pattern of use. Our second aim was to examine the associations between different use patterns, pain severity, and pain-related mental health. Three separate analyses of covariance (ANCOVAs) were conducted to determine the associations between symptomatic, scheduled, and strategic opioid use and pain-related mental functioning, including the duration of the pain condition (6 months to 1 year vs greater than 1 year), and pain-related physical functioning as covariates. An additional three separate ANCOVAs were conducted to determine the associations between symptomatic, scheduled, and strategic opioid use and pain severity, again including the duration of the pain condition and pain-related physical functioning as covariates. For models predicting mental functioning and pain severity, each ANCOVA included a single pattern of use comparing those individuals who were coded as having that particular use pattern vs those who did not mention that use pattern. Given uncertainty regarding the actual use patterns of those who did not report a clear pattern of use, we repeated analyses excluding these participants, and note when this resulted in a substantive difference in the findings.

**Results**

**Aim 1: Examples of Patterns of Use and Descriptive Analysis**

The following examples are from the detailed notes taken by the second author during the PDUQ interviews but are not direct quotes from subjects.

**Symptomatic Use**

A typical subject who was coded as using his medication symptomatically reported that: “He tries as much as
possible not to take it but if the pain is so severe he’s suffering real bad he’ll take it. Sometimes he takes one, or if it’s severe pain he’ll take two. He only takes it when he has severe pain. Some days he doesn’t take it at all.” This 61-year-old African American male subject reported that he had gout, neuropathy, diabetes, back problems, and heart problems as well as depression and PTSD. He received nine prescriptions (20–60 tablets each) of hydrocodone/acetaminophen in the prior year. He used his medication in response to pain that he was already experiencing, actively resisting taking medication until the pain is “severe.” He also avoids taking the medication when he is not in pain or when the pain is less than severe.

**Strategic Use**

A subject who used his medications strategically stated that “He takes pills when he gets out of his chair, he takes as needed, like before he goes out in his garden.” This 72-year-old White male subject has vascular disease, arthritis, a recent surgical procedure on his foot, and had previously been diagnosed with depression. But he also reported swimming regularly and working in his garden every day. He stated later that “He doesn’t take meds late at night, they’re for when he’s active.” This subject defined “needing” his medications as situations where they enabled him to be active, for example, to garden. His definition also explicitly excludes taking medications late at night, when they might help with sleep or relaxation rather than activity. He received 120 low-dose oxycodone tablets each month.

**Scheduled Use**

A very typical description of using medications in a scheduled way came from a 62-year-old White male who reported a variety of minor pain problems: “He takes his meds in the morning and evening.” This subject did not contextualize his medication use in terms of his pain levels or activity levels, but in terms of the time of day. A more extreme example from an 85-year-old White male subject made this pattern of use explicit when he said that after a fall that exacerbated his sciatica “He was using it as prescribed, regularly, whether he needed it or not.” This subject presents himself as in compliance with the instructions for using the medication—not taking more than recommended—but also does not contextualize his medication use in terms of pain levels or his planned activities.

**Nonuse**

An example of a participant coded as deciding to not use his or her opioid medication is a 57-year-old White male subject with chronic moderate low-back pain. He reported that while he does have pain all the time, he tries not to think about it and he does not like taking any medications for it. When his back acts up he uses exercises or gets a massage to help manage the pain. A few months prior to the interview, he had a hernia operation and was given an opioid. He reported that he took it for a few days but had a bad reaction and was concerned that it was addictive. The medical record confirmed that he received only one prescription for an opioid despite having chronic pain. For this patient, nonuse was a conscious choice based on clear preferences for managing his painful condition, although he did retain the remaining opioid medication to have an available supply in his possession.

Many participants reported more than one pattern of use. Among patients who reported one or more than one (i.e., nonexclusive) patterns of use, nearly half of our sample endorsed symptomatic use (49%, N = 77), with fewer reporting scheduled use (31%, N = 49), and strategic use (11%; N = 17). Of the 157 participants who reported chronic pain and received opioids, only 7% (N = 11) reported that they did not use their opioids. Among participants who reported only one pattern of use, 36% (N = 57) of the patients reported symptomatic use only, 17% (24) reported scheduled use only, and 4.5% (7) reported strategic use only. In this sample, it was most common to report symptomatic use, then scheduled use, and then strategic use regardless of whether the participant reported using one or multiple patterns. Among those reporting multiple patterns of use, 9.5% (15) reported both symptomatic and scheduled, 1% (2) reported symptomatic and strategic, 3% (5) reported scheduled and strategic, and 2% (3) reported all three. A subgroup analysis of patients with long-acting opioid prescriptions—who should be instructed to use their opioid in a scheduled pattern—showed that they reported a variety of use patterns.

Descriptive information on demographics by pattern of use is presented in Table 1. The only significant difference between the groups was the average number of prescriptions a patient received in the prior 12 months. Patients who reported any symptomatic use received 7.5 prescriptions, scheduled users received 12.2, and strategic users received 13.1. (Participants could be counted in more than one of these groups.) Scheduled users received a significantly greater number of prescriptions than did nonscheduled users, as did strategic users compared with nonsstrategic users.

Results for the patterns of use and pain outcomes are presented in Table 2. Across measures of pain severity, pain-related mental functioning, and pain-related physical functioning, mean differences were in the direction of worse outcomes for symptomatic vs nonsymptomatic users of opioid medication (with the exception of the mobility subscale). Symptomatic and nonsymptomatic users reported statistically significant differences on pain-related mental functioning scales. Based on Clark et al.’s [23] suggestions for estimating clinically significant differences on the POQ subscales (using medium effect sizes in the validation outpatient population sample), the observed differences on the fear and negative affect scales between symptomatic and nonsymptomatic users are in the clinically significant range.

Mean differences for the pain-related mental functioning measures tended toward better outcomes for scheduled vs nonscheduled users of opioid medication (Table 2).
Table 1  Descriptive statistics by pattern of use

<table>
<thead>
<tr>
<th></th>
<th>Symptomatic Use</th>
<th>Scheduled Use</th>
<th>Strategic Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Any Symptomatic</td>
<td>No Symptomatic</td>
<td>Any Scheduled</td>
</tr>
<tr>
<td></td>
<td>Use (N = 77)</td>
<td>Use (N = 80)</td>
<td>Use (N = 49)</td>
</tr>
<tr>
<td>Age</td>
<td>M = 61.0; SD = 11</td>
<td>M = 63.6; SD = 12</td>
<td>M = 64.2; SD = 11</td>
</tr>
<tr>
<td>Gender</td>
<td>%, female</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.4% P = 0.20</td>
<td>4.9% P = 0.11</td>
<td>4.1% P = 0.26</td>
</tr>
<tr>
<td>%, Non-White</td>
<td>31.2% P = 0.30</td>
<td>23.5% P = 0.58</td>
<td>24.5% P = 0.58</td>
</tr>
<tr>
<td>Average years</td>
<td>M = 14.5; SD = 2.5</td>
<td>M = 14.3; SD = 2.4</td>
<td>M = 14.2; SD = 2.3</td>
</tr>
<tr>
<td>of education</td>
<td>64.6% P = 0.04</td>
<td>47.5% P = 0.09</td>
<td>55.1% P = 0.21</td>
</tr>
<tr>
<td>%, Partnered</td>
<td>74.0% P = 0.37</td>
<td>66.7% P = 0.53</td>
<td>67.3% P = 0.53</td>
</tr>
<tr>
<td>%, Disability</td>
<td>M = 7.5; SD = 6.4</td>
<td>M = 8.5; SD = 7.4</td>
<td>M = 12.2; SD = 8.0</td>
</tr>
<tr>
<td>payments</td>
<td>9.3% P = 0.03</td>
<td>9.3% P &lt; 0.01</td>
<td>9.3% P &lt; 0.01</td>
</tr>
<tr>
<td>Average number</td>
<td>M = 7.5; SD = 6.4</td>
<td>M = 8.5; SD = 7.4</td>
<td>M = 12.2; SD = 8.0</td>
</tr>
<tr>
<td>of prescriptions</td>
<td>P = 0.03</td>
<td>P &lt; 0.01</td>
<td>P &lt; 0.01</td>
</tr>
</tbody>
</table>

P-values represent results of comparisons between those reporting vs not reporting a specific pattern of use using t-tests for continuous variables and chi-squared tests for categorical variables. SD = standard deviation.

Pain severity was similar in scheduled vs nonscheduled users. There was no clear pattern of better or worse mean pain scores across domains in strategic vs nonstrategic users, but strategic users tended to have higher scores for pain-related mental and physical functional impairment.

Aim 2: Patterns of Use and Functioning

Because of the small number of individuals in each group of multiple use patterns reported, we focused on conducting analyses regarding type of use pattern acknowledging that participants could fall into more than one group. We conducted three separate ANCOVAs to test associations between each use pattern and pain related mental function. Results for pain-related mental functioning revealed that for symptomatic use, the overall model was significant (Table 3). Between subjects effects were found such that those who used opioids symptomatically reported experiencing worse pain-related mental functioning than did those who did not endorse symptomatic use. Specifically, estimated marginal means for pain-related mental functioning were 22.8 (SE 1.9) for patients reporting symptomatic use vs 28.5 (SE 1.3) for those who did not use on a schedule. For strategic use, although the overall model was significant, there was no difference in pain-related mental functioning between those who did and did not endorse strategic use.

Excluding participants with no clear pattern of use did not substantially alter results. Results for pain severity revealed that the overall models were significant, but there were no significant differences in pain severity between those who did or did not endorse symptomatic, scheduled, or strategic use (Table 4). In this case, when the 31 participants with no clear pattern of use were excluded, the model was somewhat improved ($R^2 = 0.23$) and symptomatic use was significantly associated with pain severity ($F = 5.20, P = 0.024$), when controlling for duration of pain ($F = 16.23, P < 0.001$) and pain-related physical function ($F = 12.31, P = 0.001$). Here, estimated marginal means for pain severity were 5.72 (SE 0.24) for patients reporting symptomatic use vs 4.84 (SE 0.30) for patients who did not endorse a pattern of use other than symptomatic use.

Discussion

We found that symptomatic use of opioid medications was associated with worse mental health functioning, and scheduled use of opioid medications was associated with better mental health functioning. The size of the observed...
Table 2  Pain outcomes findings by patterns of use

<table>
<thead>
<tr>
<th></th>
<th>Symptomatic Use</th>
<th>Scheduled Use</th>
<th>Strategic Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Any Use (N = 77)</td>
<td>No Use (N = 80)</td>
<td>Any Use (N = 49)</td>
</tr>
<tr>
<td>% Pain duration &gt;12 months</td>
<td>87.0%</td>
<td>88.7%</td>
<td>95.9%</td>
</tr>
<tr>
<td>% Pain duration &gt;6 months</td>
<td>13.0%</td>
<td>11.3%</td>
<td>4.1%</td>
</tr>
<tr>
<td>and &lt;12 months</td>
<td>P = 0.81</td>
<td>P = 0.06</td>
<td>P = 0.99</td>
</tr>
<tr>
<td>Pain severity: average pain</td>
<td>M = 5.7; SD (2.4)</td>
<td>M = 5.1; SD (2.4)</td>
<td>M = 5.4; SD (2.0)</td>
</tr>
<tr>
<td>0–10 in the last week</td>
<td>P &lt; 0.01</td>
<td>P = 0.06</td>
<td>P = 0.06</td>
</tr>
<tr>
<td>POQ mental function</td>
<td>M = 31.0; SD (17.0)</td>
<td>M = 22.6; SD (15.4)</td>
<td>M = 22.9; SD (15.2)</td>
</tr>
<tr>
<td>M = 19.9; SD (13.0)</td>
<td>P &lt; 0.01</td>
<td>P = 0.06</td>
<td>P = 0.06</td>
</tr>
<tr>
<td>Negative affect</td>
<td>M = 11.0; SD (6.0)</td>
<td>M = 8.6; SD (5.8)</td>
<td>M = 8.6; SD (6.0)</td>
</tr>
<tr>
<td>Fear of pain</td>
<td>P &lt; 0.01</td>
<td>P = 0.06</td>
<td>P = 0.06</td>
</tr>
<tr>
<td>POQ physical function</td>
<td>M = 43.8; SD (25.3)</td>
<td>M = 41.5; SD (24.4)</td>
<td>M = 42.6; SD (24.8)</td>
</tr>
<tr>
<td>ADL</td>
<td>P = 0.55</td>
<td>P = 0.98</td>
<td>P = 0.98</td>
</tr>
<tr>
<td>M = 9.8; SD (11.4)</td>
<td>P = 0.14</td>
<td>P = 0.42</td>
<td>P = 0.42</td>
</tr>
<tr>
<td>Mobility</td>
<td>M = 16.4; SD (11.6)</td>
<td>M = 17.1; SD (12.8)</td>
<td>M = 19.0; SD (13.0)</td>
</tr>
<tr>
<td>P = 0.71</td>
<td>P = 0.12</td>
<td>P = 0.12</td>
<td>P = 0.12</td>
</tr>
<tr>
<td>Vitality</td>
<td>M = 17.6; SD (7.3)</td>
<td>M = 17.2; SD (7.7)</td>
<td>M = 16.3; SD (6.7)</td>
</tr>
<tr>
<td>P = 0.72</td>
<td>P = 0.21</td>
<td>P = 0.21</td>
<td>P = 0.21</td>
</tr>
</tbody>
</table>

P-values represent results of comparisons between those reporting vs not reporting a specific pattern of use using t-tests for continuous variables and chi-squared tests for categorical variables.

ADL = Activities of Daily Living; POQ = Pain Outcomes Questionnaire; SD = standard deviation.
The idea that the pattern of patients’ opioid use could impact the functional outcomes of an opioid prescription has recently been explored, and findings support the concept (i.e., [17]). For example, in a randomized trial of patients taking opioids on a schedule vs symptomatically after a tonsillectomy, use of opioid medication in response to pain (symptomatic use) was less effective at controlling pain than scheduled dosing in children [24]. In our sample, symptomatic use may have reinforced the pain-related distress that triggered the opioid use, thus increasing the frequency of pain-related distress. Likewise, scheduled use may have minimized the impact of chronic pain and opioid use on mood states.

The analyses here are suggestive but do not allow us to determine causality of the associations between mental health functioning and pattern of opioid use. Basic science and clinical studies have identified a link between chronic stress/distress and use of drugs to cope, where modifying stress exposure can alter drug administration and drug administration can alter stress response [27]. Interventions that improve mental health function may reduce use of drugs to cope and vice versa. Reinforcement theory would predict that once associations between distress and opioid reinforcement have been learned, these associations should be bidirectional, with distress triggering opioid seeking, and opioid reinforcement driving repetition of behaviors that lead to distress. These studies leave open the question of whether intentional symptomatic use of opioids drives learning of associations between distress and opioid reinforcement, which may worsen mental health function over time. Randomized trials that vary instructions to opioid naive patients on how to use their opioid medication are needed to address this possibility.
Roughly half of all patients in our sample reported using their medication symptomatically, about one-third used the opioid on a schedule, and only 11% used their opioid strategically. Given associations between mental health functioning and patterns of use, the high rates of symptomatic use suggest that there may be potential for clinical improvement of opioid outcomes by modifying patterns of opioid use. Von Korff et al. [17] found that patients who used opioids in a scheduled way received substantially higher average daily doses compared with patients who used symptomatically. We found that patients who reported scheduled use received substantially more prescriptions over the course of 12 months than patients who reported symptomatic use despite no difference in duration of painful condition. These two findings could reflect either increased effectiveness of opioid therapy with scheduled use or greater development of tolerance and dependence. If scheduled use increased effectiveness, we would expect that patients would be more likely to continue and escalate opioid therapy if they obtained better results in an initial trial. If scheduled use increased tolerance and dependence, we would expect patients to increase doses and have more difficulty with discontinuation. Controlled prospective studies of the effects of opioid use patterns on pain-related mental and physical functioning, and adverse effects in chronic pain patients appear warranted to investigate possible positive and negative impacts of different patterns of use.

Limitations

While suggestive, the cross-sectional associations observed here provide only preliminary support for the hypothesis that the context of opioid use (e.g., how opioid medications are actually taken once patients have them) may alter the clinical effects of this pharmacotherapy. Another study limitation is that our sample was enriched for patients with emergency room visits, pain clinic visits, and comorbid mental health and substance use diagnoses. Thus, our sample may overrepresent chronic pain patients with mental health vulnerabilities, which might exaggerate rates of symptomatic use or estimates of the effect of opioid use patterns on the average chronic pain patient. Given the response rate to the invitation to participate, it is possible that our sample may not be fully representative of all patients who receive opioids. Participants were 92% male, and recent findings suggest that women and men may differ in how they use opioids (e.g., [28]). We also acknowledge that 33 patients did not provide sufficient information in their interviews to confidently code use patterns. Future studies will want to examine these patterns of use in a fully representative sample ideally with a standardized and validated measure of patterns of use.

Reinforcement theory suggests that historical patterns of use over time should influence both the tendency to use opioids and pain-related functioning. We used patients’ retrospective self-report of their opioid use pattern based on the assumption that this would most accurately capture behavioral tendencies. Alternative methods such as recorded timing of medication bottle openings or ecological momentary assessment might have provided more objective information about recent timing of opioid use. Patient self-reports of medication use may not be completely reliable as they may not want to reveal patterns that may be different from their physician’s directions. However, even in studies that attempt to record momentary measures of use, patients can remove multiple doses or misuse the memory caps. In addition, individuals’ use patterns are not necessarily consistent across time; individuals with long-lasting chronic pain may have used opioids in a different pattern in the past. Future studies should attempt to examine the interplay between opioid medication and physician instructions, actual amount and pattern of opioid use, and pain-related outcomes to help confirm that group differences are not caused by differences in opioid regimen.

Only a small proportion of our sample (11%) reported strategic use, limiting our ability to examine the effects of strategic use on pain severity and mental functioning. We assume that either primary care physicians do not frequently recommend strategic use of opioids or many chronic pain patients have difficulty following such instructions. Given the theoretical benefits of facilitating and reinforcing active recovery-focused activities with opioids, efforts to develop protocols to instruct patients in strategic use and examine the effects of this use pattern appear worthwhile.

Patients in our sample had a wide variety of painful conditions, pain locations, and types of pain (e.g., inflammatory vs neuropathic), and we expected that this variation would obscure opioid use-related differences in physical functioning. For example, low-back pain might tend to produce substantially different functional impairments than headache or peripheral neuropathy, and the nonhomogeneity in the painful conditions—and often multiple painful conditions—afflicting our sample would make the impact of opioid use patterns difficult to detect. In addition, our measure of function was primarily captured by the POQ ADL and MOB subscales. It is possible that the ADL subscale does not capture relevant activity limitations of an ambulatory chronic pain population. Future studies should examine the impact of patterns of opioid use on physical functioning in a group of patients with similar underlying conditions (e.g., walking outcomes following knee or hip surgery; [29]) and use detailed measures of functionality appropriate to ambulatory chronic pain populations.

Limitations notwithstanding, the current study is one of the first to examine how chronic pain patients describe using their opioid medications and how their patterns of use relate to their functioning. These results provide preliminary support for our hypothesis that patterns of opioid use reported by patients may impact pain-related mental functioning. Reflecting the frequent instruction to patients to use an opioid “as needed,” most patients used their opioid medication symptomatically. The findings here would suggest that this could be detrimental to patients’ mental health, or that those with greater pain-related dysfunction may be more likely to take medications in a symptomatic fashion, which could reinforce a cycle of dysfunction. This
work suggests the need for research in this area as described earlier. Until conclusive studies are conducted, clinicians may wish to consider the potential impact of opioid-related reward mechanisms when prescribing opioids, instructing patients on opioid use, and designing pain management plans with their patients.

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