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Pain catastrophizing as a predictor of suicidal ideation in chronic pain patients with an opiate prescription

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Abstract

Chronic pain and opioid use are associated with increased risk for suicidal ideation and behaviors (SIB) in cross-sectional studies, particularly among individuals who catastrophize about their pain. This study examined the longitudinal association between two styles of pain coping, catastrophizing and hoping/praying, as predictors of subsequent SIB, as well as possible mediators of this association among patients with chronic pain receiving long-term opioid therapy. Participants ($n = 496$) were adults with chronic nonmalignant pain on long-term opioid therapy who did not develop an opioid use disorder. Participants were assessed for pain coping, suicidal ideation, depression, social support and pain interference at baseline, and were assessed for SI, depression, and pain interference at 6- and 12-month follow-ups. Catastrophizing was a significant predictor of increased subsequent SIB, whereas hoping/praying did not protect against future SIB. The relationship between catastrophizing and future SIB was mediated by depression, but not social support or pain interference. In conclusion, catastrophizing is an important predictor of subsequent SIB due to its effect on increasing depression among patients with chronic nonmalignant pain receiving long-term opioid therapy. Future research should explore the extent to which targeting catastrophizing reduces subsequent depression and suicide risk.

Keywords

opioid therapy; suicidal ideation; chronic pain; pain catastrophizing; pain coping; depression

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Author Statement

Dr. Brown conceptualized the data analysis and wrote the majority of the manuscript.

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Dr. Cheatle collected the data and provided guidance on the conceptualization of the data analysis.

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Conflict of Interest
None

1. Introduction

More than one-quarter of adults in the United States experience chronic pain, which is associated with a variety of negative health outcomes (Ilgen et al., 2008). One such negative health outcome is suicide risk. Approximately one-fifth to one-half of pain patients report suicidal ideation (Braden & Sullivan, 2008; Edwards et al., 2006; Hinkley & Jaremko, 1994; Hitchcock et al., 1994; Kowal et al., 2014; Saffier et al., 2007; Tang & Crane, 2006), with some studies showing twice the rate of suicidal ideation in individuals with versus without chronic pain (Magni et al., 1998). Patients with chronic pain are 2–3 times more likely to make suicide attempts (Magni et al., 1998; Ratcliffe et al., 2008) and are up to 9 times more likely to die by suicide (Calati et al., 2015; Penttinen, 1995; Mélanie Racine, 2018; Stenager et al., 1994). The association between chronic pain and suicide risk holds even after controlling for psychiatric and medical comorbidities (Ilgen et al., 2008). Among chronic pain patients who reported thoughts of suicide with a suicide plan, 75% identified overdose as the method of choice (Smith et al., 2004). Given the access to lethal means available to patients with chronic pain prescribed opioids, it is essential to understand risk factors for suicide in this patient population.

The literature supporting the association between opioid use and suicide risk has expanded at a rapid pace over the past decade, likely due in part to the rising rates of suicide, opioid prescriptions and opioid use disorders, and opioid related overdose deaths in the United States (Bohnert et al., 2010; Braden et al., 2017; Mack et al., 2017; Paulozzi et al., 2006; Warner et al., 2009; Wunsch et al., 2009). Individuals who died by suicide were significantly more likely to have an opioid prescription compared to individuals who died by accident (Vento et al., 2011), and about a third of non-fatal opioid overdoses are characterized by suicidal intent (Maloney et al., 2009). A report from the Centers for Disease Control and Prevention indicated that in 2003, approximately 16% of suicide decedents had an opioid metabolite in their toxicology report, and among suicide decedents where poisoning was the suspected cause of death, opioids were detected in 40% of cases (Control & Prevention, 2006). In a subsequent study of individuals who died from multiple drug intoxication, 79% of cases were positive for opioids and there was an equal proportion of reported accidental and intentional (i.e., suicidal) deaths among individuals with opioids in their system (Carson, 2008). However, there is a dearth of research on the mechanisms that underlie the association between opioid use and suicide risk among patients with chronic pain.

Pain catastrophizing may operate as a critical risk factor for suicide among patients with chronic pain. Pain catastrophizing involves a sense of helplessness and pessimism about one's ability to tolerate pain (Sullivan et al., 2001) and is associated with worsened pain intensity and psychological distress more generally (Picavet et al., 2002; Turner et al., 2002). In addition, a cross-sectional report in internal medicine patients demonstrated that higher pain catastrophizing was associated with a greater likelihood of a history of intentional opioid overdoses and suicide attempts (Sansone et al., 2014). Furthermore, in a cross-sectional sample of Veterans, pain catastrophizing significantly differentiated individuals with versus without suicidal thoughts (Legarreta et al., 2018). Several additional cross-sectional studies have demonstrated that pain catastrophizing is significantly associated with suicidal ideation (Noyman-Veksler et al., 2017; Racine et al., 2014; Racine et al., 2017;

Rathod et al., 2016). These cross-sectional reports are consistent with conceptual models that posit pain catastrophizing as a critical link between pain and depression (Linton & Bergbom, 2011), and with findings supporting the longitudinal association between pain and general distress (i.e., not specific to suicide risk) that is linked by pain catastrophizing (Noyman-Veksler et al., 2017). However, there are few longitudinal studies on the association between pain catastrophizing and suicidal ideation among patients with chronic pain.

Due to the limited literature on longitudinal associations between chronic pain and suicide risk broadly, as well as on catastrophizing in the context of chronic pain and suicide risk specifically, there are even fewer published studies on mechanisms underlying these associations. One prior cross-sectional multivariate analysis in a sample of 1,512 patients with chronic pain revealed that older age, higher depression severity, greater pain interference, and pain catastrophizing were each associated with a greater likelihood of categorization in a suicidal ideation group, whereas using prayer to cope with pain protected against suicidal ideation (Edwards et al., 2006). In addition, pain catastrophizing significantly interacted with depression to predict suicidal ideation severity, such that the highest severity of suicidal ideation was reported among patients with both high depression severity and pain catastrophizing (Edwards et al., 2006). However, this study did not examine longitudinal associations among these variables. In a separate cross-sectional study, the effect of pain catastrophizing on suicidal thoughts was mediated by depression and social support (Shim et al., 2017). Therefore, age, depression, pain interference, and social support may be important to understand the relationship between coping with chronic pain (including catastrophizing or using prayer, well-established coping strategies) and suicide risk.

The goal of this study was to understand the extent to which coping style, including catastrophizing and using prayer to cope with pain, predicted suicidal ideation/behavior (measured with the Suicide Behavior Questionnaire-Revised, SBQ-R, Osman et al., 2001, a measure of suicidal ideation and behavior), in patients with chronic pain. Participants were recruited as part of a larger parent study (Cheatle et al., 2019) in which patients with chronic nonmalignant pain (CNMP) on long-term opioid therapy (LTOT) were evaluated at baseline, followed longitudinally and re-assessed at 6- and 12-month follow-up. Participants were excluded if they met criteria for any substance use disorder (SUD, except nicotine). First, the associations between baseline age, coping style and suicidal ideation at 6- and 12-month follow-ups was evaluated, controlling for baseline suicidal ideation/behavior. Based on the prior literature (Edwards et al., 2006), we hypothesized that older age and catastrophizing would each be associated with higher suicidal ideation/behavior, whereas using prayer to cope would be associated with lower suicidal ideation/behavior. Second, interactions between time and coping style were examined to explore the effect on suicidal ideation/behavior. Given that participants were followed naturalistically (i.e., without the administration of an intervention which might alter coping style over time), we did not have *a priori* hypotheses about the associations between coping style and suicidal ideation over time. Finally, depression, social support, and pain interference were examined as possible mediators of the association between coping style and suicidal ideation/behavior. Based on prior literature (Shim et al., 2017), we hypothesized that each of these three variables would

serve as mediators of the association between coping style and suicidal ideation/behavior, such that higher severity of catastrophizing at baseline would be associated with reduced social support plus higher severity of depression and pain interference at 6-month follow-up, which would be associated with greater severity of suicidal ideation/behavior at 12-month follow-up. In contrast, we hypothesized that using prayer to cope at baseline would be associated with increased social support plus reduced depression and pain interference at 6-month follow-up, which would be associated with reduced severity of suicidal ideation/behavior at 12-month follow-up.

2. Methods

2.1. Participants

Participants ($n = 496$) were recruited from multiple ambulatory pain and primary care practices in urban and surrounding suburban areas of the Northeast, Pacific Northwest, and Midwest. These sites included the Philadelphia region (University of Pennsylvania and suburbs), Seattle (University of Washington and suburbs), Salt Lake City (Lifetree Clinical Research and Pain Clinic and suburbs), and Boston (Brigham and Women's Hospital, Harvard Medical School; see Table 1). The University of Pennsylvania, University of Washington, Lifetree and Harvard University Institutional Review Boards approved the protocol and patients provided written consent before participating and were compensated for their time. Of the full sample, 300 (60.5%) completed the 6-month assessment, and 241 (48.6%) completed the 12-month assessment.

Participants were patients with CNMP identified and recruited through referrals from practice physicians and staff. Participants who consented were screened for study eligibility using information from the electronic medical record (EMR) and self-report measures. Inclusion criteria were: adult patients (age ≥ 18) with CNMP of musculoskeletal or neuropathic origin persisting ≥ 6 months in duration and receipt of LTOT, defined as receiving opioids consistently (monthly prescriptions) for 6 months or longer; and having no evidence of past SUD (excluding nicotine). Patients with pain syndromes due to cancer, gynecologic, abdominal, visceral, dental, trigeminal neuralgia, post-stroke syndrome, or migraine-related pain; or neuropathic pain due to metabolic disease were excluded due to the more diverse etiologies of these pain conditions (Fillingim et al., 2014).

2.2. Measures

2.2.1. Demographics.—Participants completed a self-report measure of gender, age, ethnicity, and education status at baseline.

2.2.2. Suicide Behavior Questionnaire-Revised (SBQ-R).—The Suicide Behaviors Questionnaire-Revised (SBQ-R) is a 4-item assessment of suicidal ideation/behavior (Osman et al., 2001). The measure evaluates history of suicidal ideation and attempts, presence of suicidal ideation during the past year, history of communicating suicide risk, and the likelihood of a future suicide attempt. Scores range from 3 to 18, with the most useful cutoffs for the general population being greater than or equal to 7 and greater than or equal to 8 for clinical samples. The 6- and 12-month assessments queried about the

time since last assessment. Coefficient alphas show good internal consistency in the current study ($\alpha = .70$).

2.2.3. Coping Style Questionnaire (CSQ).—The CSQ is a 50-item assessment of cognitive and behavioral methods used to cope with pain (Rosenstiel & Keefe, 1983). Cognitive methods are assessed using 6 different subscales: ignoring, reinterpreting, diverting attention, coping self-statements, pain catastrophizing, and praying/hoping. Behavioral methods are assessed with 2 subscales: increasing activity and increasing pain behaviors. The current studies relied on the catastrophizing and hoping/praying subscale, in light of prior research indicating the importance of these subscale for predicting suicidal ideation. Scores are reported on a 0 (never do that) to 6 (always do that) scale. The measure has strong in chronic pain populations (Lawson et al., 1990). Internal consistency was high in the current study (catastrophizing $\alpha = .85$; hoping/praying $\alpha = .72$).

2.2.4. Patient Health Questionnaire (PHQ-4).—The PHQ-9 is a 9-item measure of depression severity that is brief and widely used. The measure has strong construct validity, sensitivity, and specificity (Kroenke et al., 2001). The current study used a 4-item version of the measure. Each item is rated on a 0 (*not at all*) to 3 (*nearly every day*) point Likert scale reflecting past 2-week symptoms. Mild, moderate, moderately severe and severe depression are reflected by scores of 5, 10, 15, and 20 respectively (Kroenke et al., 2001; Martin et al., 2006). Internal consistency was high in the current study ($\alpha = .87$).

2.2.5. Duke Social Support Index (DSSI).—The DSSI is a 23-item measure of social support with three subscales: Social Interaction (SIS), Subjective Social Support (SSS), and Instrumental Social Support (ISS; Koenig et al., 1993). Items are rated on a 0 – 3 point Likert scale for SIS and SSS subscales, and on a dichotomous scale for the ISS subscale, such that the possible range of scores is from 0 – 45, with higher scores indicating more social support (Koenig et al., 1993). The measure has strong convergent and divergent validity as well as reliability (Jia & Zhang, 2012; Powers et al., 2004). Internal consistency was high in the current study (total score $\alpha = .77$). The current study focused on the total score to limit variables for inclusion to reduce Type I error.

2.2.6. Brief Pain Inventory Interference Subscale (BPI-Int).—The BPI assesses the extent to which pain interference with 7 key life domains, namely general activity, walking, mood, sleep, work, relations with other persons, and enjoyment. Each item is rated on a 0 (*no interference*) – 10 (*interferes completely*) point scale. The measure has strong convergent and divergent validity (Engel et al., 2000; Tan et al., 2004). The BPI Interference subscale had strong internal consistency ($\alpha = .89$).

2.3. Data Analysis.

We used generalized estimating equations (GEE) models (Fitzmaurice, Laird and Ware, 2011) to regress 6-month and 12-month SBQR total scores on baseline variables, and on lagged time-varying variables. The models included two baseline covariates: a three-level baseline factor for site (Boston, Philadelphia, and Seattle), and the SBQR total score. Time was included as a two-level categorical variable, to accommodate different rates of change in

the SBQR score (the measure of suicidal ideation/behavior) from baseline to six-months and from six-months to 12-months, and we used a compound symmetry structure for the working correlation model. For each predictor, we first tested for a predictor by time interaction, to test for significant differences in the effect of the predictor on the six-month and 12-month SBQR totals. If the interaction was non-significant, we dropped the interaction term, and used a main effects model to estimate and test the predictor effects. To assess whether any significant effects of baseline variables on the month 12 SBQR were mediated by their effects on month six characteristics, we used the Baron and Kenny causal steps approach, and used the PROCESS macro (Hayes, 2018) to estimate indirect effects, with bootstrap standard errors for these estimates.

3. Results

3.1. Multivariate Interaction Models

After controlling for recruitment site and baseline suicidal ideation/behavior, interactions between time and each predictor were not significant (all p -values $> .07$). These associations held after controlling for age and gender.

3.2. Multivariate Main Effect Models

After controlling for recruitment site and baseline suicidal ideation/behavior, the CSQ pain catastrophizing subscale ($B = 0.023$, $SE = 0.01$, 95% $CI: 0.007 - 0.048$, $z = 2.67$, $p < .01$) was significantly associated with suicidal ideation/behavior. No other variables were associated with suicidal ideation/behavior at the six-month and 12-month time points. These associations held after controlling for age and gender.

3.3. Mediation Models

For the 6-month DSSI, there was a significant negative association with baseline CSQ pain catastrophizing ($\beta = -0.22$, $SE = 0.05$, $p < 0.0001$), and a non-significant negative association between 12-month suicidal ideation/behavior and 6-month DSSI, controlling for baseline CSQ pain catastrophizing ($\beta = -0.03$, $SE = 0.02$, $p = 0.15$). For the 6-month PHQ-4, there was a significant positive association with baseline CSQ pain catastrophizing ($\beta = 0.76$, $SE = 0.15$, $p < 0.0001$), and a significant positive association between 12-month suicidal ideation/behavior and 6-month PHQ-4, controlling for baseline CSQ pain catastrophizing ($\beta = 0.07$, $SE = 0.03$, $p = 0.03$). The 6-month BPI-Int score was positively associated with baseline CSQ pain catastrophizing ($\beta = 0.23$, $SE = 0.03$, $p < 0.0001$), and there was no association between 12-month suicidal ideation/behavior and 6-month BPI-Int ($\beta = 0.004$, $SE = 0.01$, $p = 0.43$). Table 3 shows the estimated indirect effects, bootstrap 95% confidence intervals, and Sobel test p -value, for 6-month DSSI, BPI-Int and PHQ-4 as intervening variables for baseline CSQ pain catastrophizing and CSQ praying/hoping on 12-month suicidal ideation/behavior. There were significant indirect effects for CSQ pain catastrophizing via DSSI and via PHQ-4, and not for the 6-month BPI-Int. After controlling for baseline suicidal ideation/behavior, the DSSI effect was no longer significant. There were no significant indirect effects for CSQ praying/hoping.

4. Discussion

In a cohort of individuals with CNMP receiving LTOT with no evidence of opioid abuse or developing an OUD, baseline pain catastrophizing significantly predicted suicidal ideation/behavior up to one year later. Specifically, individuals who reported maladaptive coping strategies for managing their pain (CSQ-Catastrophizing) reported higher scores on a measure of suicidal ideation/behavior at 6- and 12-months after baseline. These associations held even after controlling for baseline suicidal ideation/behavior, recruitment site, age, and gender. Depression symptom severity (measured by the PHQ-4) and social support were each significant mediators of the association between pain catastrophizing and suicidal ideation/behavior. This is the first study of its kind to support a longitudinal association between pain catastrophizing and subsequent suicidal ideation/behavior when compared alongside other clinical and demographic factors in a multivariate analysis. In contrast to prior research (Edwards et al., 2006), hoping/praying as a coping strategy did not significantly predict subsequent suicidal ideation/behavior. There were not significant interactions between time and pain catastrophizing or time and hoping/praying, suggesting that the rate of change in either coping style was unrelated to future suicidal ideation/behavior.

The current findings are consistent with prior research on the importance of pain catastrophizing in pain patients with chronic pain. At least six prior cross-sectional studies have reported on the positive association between pain catastrophizing and suicidal ideation or attempts across a variety of studies, including internal medicine patients, pain clinic patients, and Veterans (Legarreta et al., 2018; Noyman-Veksler et al., 2017; Racine et al., 2014; Racine et al., 2017; Rathod et al., 2016; Sansone et al., 2014). The current study extends on these cross-sectional findings by demonstrating the predictive role of pain catastrophizing on suicidal ideation/behavior using a longitudinal design. In addition, these findings are consistent with conceptual models that posit pain catastrophizing as a critical link between pain and depression (Linton & Bergbom, 2011), and with a longitudinal association between pain and distress that is linked by pain catastrophizing (Noyman-Veksler et al., 2017).

Consistent with prior research, the association between pain catastrophizing and suicidal ideation/behavior was mediated by depression symptom severity (Shim et al., 2017). Therefore, catastrophizing about pain may increase one's experience of negative affect or anhedonia, which might drive suicidal ideation. Also consistent with prior research (Shim et al., 2017), social support was a significant mediator of the association between catastrophizing and suicidal ideation. This was an expected finding given that social connection is integral to theoretical models of suicide risk (Joiner, 2005). Indeed, cross-sectional studies have demonstrated significant univariate or multivariate associations among interpersonal distress (e.g., perceived burdensomeness, social withdrawal, etc.) and suicidal ideation, among other variables including depression and pain duration in some studies (Cheatle et al., 2014; Kanzler et al., 2012; Kowal et al., 2012; Noyman-Veksler et al., 2017; Wilson et al., 2013). However, not all of the prior cross-sectional reports included as many other clinical or demographic variables as were included in the current study. The

relationship between praying/hoping and suicidal ideation/behavior was not mediated by depression, social support, or pain interference.

Contrary to our hypothesis and prior research (Edwards et al., 2006), pain interference was not a significant predictor of suicidal ideation/behavior, nor a significant mediator of the relationship between catastrophizing and suicidal ideation/behavior (Shim et al., 2017). The lack of a significant effect of pain interference in the current study may be due to a restricted range, as the sample all had chronic pain that necessitated prescription of an opioid. However, our findings are consistent with more recent research in which other pain indicators, specifically pain intensity, was neither associated with passive nor active suicidal ideation (Racine et al., 2014). Future research should replicate these findings before strong conclusions are drawn.

Recent theoretical models hypothesize that the experience of chronic pain increases risk for a variety of near- and long-term risk factors for suicidal behavior, including interpersonal distress, depression, increased desire to escape pain, increased capability for suicide, and psychache (Hooley et al., 2014). However, this theoretical model has not been formally tested. The current study is the first to our knowledge to explore the multivariate, longitudinal associations among a variety of risk factors for suicide in patients with chronic pain receiving opioid therapy. This is an important area of research to inform strategies to mitigate eventual suicide risk in patients who are prescribed an opioid. At least one prior report has demonstrated that reducing access to opioids results in reduced rates of suicide by this method (Lester, 1989). However, the majority of individual who receive a prescription for an opioid do not develop symptoms of a SUD or suicidal ideation (Cheatle et al., 2018; Volkow & McLellan, 2016). Therefore, the current findings may be used to guide personalized prescribing of opioids to prevent subsequent suicidal ideation or behavior among patients who are prescribed an opioid. Specifically, patients who engage in maladaptive catastrophizing in the presence of pain should be provided with additional assessments and referrals to mitigate their risk of developing suicidal ideation or behavior.

Importantly, the directional association between chronic pain, catastrophizing, opioid use, and suicidal thoughts and behaviors cannot be determined from the current study as all patients began the study after the onset of their chronic pain and first prescription of opioids. In fact, prior research has demonstrated that catastrophizing increases the risk of the development of chronic pain (Picavet et al., 2002). Therefore, it is possible that the tendency toward catastrophizing might serve as one predisposing risk factor for a variety of negative health outcomes, including pain and suicidal thoughts and behaviors. Future research should attempt to understand the contribution of catastrophizing as: 1) a risk factor for suicide and pain independently; 2) a mechanism linking chronic pain to suicidal thoughts and behaviors; or 3) a risk factor for chronic pain, which leads to suicidal thoughts and behaviors. A mechanistic hypothesis was not supported by the current study because the degree of pain intensity or pain interference was not directly related to subsequent suicidal thoughts. However, we could not test the presence or absence of pain as a predictor of suicidal behavior (which may or may not be mediated by catastrophizing) because all study participants had chronic pain at the time of enrollment. This should be explored in future research.

There are several limitations of the current study that require consideration. First, no participants in the longitudinal arm of the study met criteria for an OUD. Therefore, these findings may not translate to patients who meet criteria for an OUD, but this study is still important for understanding the risk for suicidal ideation in patients with chronic pain receiving opioids. Second, less than half of participants (39.8%) endorsed suicidal ideation/behavior during the initial clinical interview. While this is a sizable proportion, the sample was not recruited based on elevations in suicide risk, and therefore the findings may not translate to more samples with more severe suicidal ideation. Nevertheless, the findings are still of relevance for understanding risk for suicide among the average patient presenting to a clinic for an opioid prescription. Third, participants were entirely white (due to the genetic aims of the study), and the majority were recruited from the Philadelphia area. While we controlled for recruitment site in all analyses, the findings may not translate to more diverse samples. Fourth, catastrophizing was not assessed at 6- or 12-month follow-ups. Therefore, we are not able to test reverse mediation models.

In summary, this is the first study of its kind to explore the multivariate, longitudinal associations among clinical and demographic risk factors for suicidal ideation in patients with chronic pain who are prescribed opioids. Pain catastrophizing was the most robust predictor of suicidal ideation at 6- and 12-month assessments, even after controlling for a variety of other factors. The effect of pain catastrophizing on suicidal ideation was mediated by depression and social support. Therefore, pain catastrophizing, depression, social support, and suicide risk should be assessed in patients with chronic pain on opioid therapy to reduce the risk of future suicidal thoughts and behaviors.

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Highlights

- Chronic pain and opioid use are associated with increased risk for suicidal ideation and behaviors (SIB) in cross-sectional studies.
- Catastrophizing was a significant predictor of increased subsequent SIB among adults with chronic nonmalignant pain on long-term opioid therapy
- Hoping/praying did not protect against future SIB.
- The relationship between catastrophizing and future SIB was mediated by depression.

Table 1

Demographics and Clinical Characteristics

Ethnicity (White)	497 (100.0%)
Gender (Female)	167 (33.6%)
Age	54.64, <i>SD</i> =12.91 (range 19–84)
Education	
Some high school or less	33 (7%)
Graduated high school/GED	219 (44%)
Associates or bachelor's degree	152 (31%)
Graduate or professional degree	92 (18%)
Site	
Philadelphia	353 (71.0%)
Seattle	43 (8.7%)
Salt Lake City	8 (1.6%)
Boston	93 (18.7%)
CSQ-Pain Catastrophizing	13.24, <i>SD</i> =8.23 (range 0–36)
CSQ-Praying/Hoping	17.56, <i>SD</i> =8.24 (range 0–36)
PHQ	4.78, <i>SD</i> =3.66 (range 0–36)
DSS Total	31.56, <i>SD</i> =6.32 (range 3–45)
BPI-Int	38.32, <i>SD</i> =17.57 (range 0–70)
Methadone dose (log ₁₀ scale)	1.77, <i>SD</i> =0.47 (range 0.01–3.29)
SBQ-R Score	4.62, <i>SD</i> =2.49 (range 3–18)

Table 1 Note: BPI-Int = Brief Pain Inventory; CSQ = Coping Styles Questionnaire; DSSI = Duke Social Support Inventory; PHQ = Patient Health Questionnaire; SBQ-R = Suicidal Behavior Questionnaire

Table 2

Effect of Time, Catastrophizing, Depression, Social Support, and Pain Interference on the Suicidal Behavior Questionnaire-Reduced (SBQ-R)

	Covariate by month interaction effects					Covariate main effects after month by covariate dropped				
	Estimate (SE)	Lower CL	Upper CL	χ^2	<i>p</i>	Estimate (SE)	Lower CL	Upper CL	χ^2	<i>p</i>
Age	-0.000 (0.006)	-0.013	0.012	0.00	0.949	0.003 (0.006)	-0.008	0.015	0.30	0.584
Gender (Male = 1)	-0.138 (0.202)	-0.533	0.258	0.46	0.497	0.011 (0.146)	-0.275	0.297	0.01	0.938
CSQ-Pain Catastrophizing	0.015 (0.014)	-0.012	0.042	1.08	0.299	0.028 (0.010)	0.007	0.048	6.98	0.008
CSQ-Praying/Hoping	0.016 (0.014)	-0.011	0.042	1.37	0.241	-0.008 (0.010)	-0.028	0.012	0.55	0.458
PHQ-4	0.0069 (0.0338)	-0.0593	0.0731	0.04	0.842	0.0327 (0.0191)	-0.005	0.070	2.77	0.096
DSSI	-0.0185 (0.020)	-0.0580	0.0211	0.82	0.366	-0.021 (0.011)	-0.043	0.001	3.41	0.065
BPI-Int	0.0024 (0.006)	-0.0100	0.0147	0.14	0.713	0.003 (0.004)	-0.006	0.011	0.40	0.526
Daily Methadone Equivalent (log10)	-0.1451 (0.2525)	-0.6400	0.3499	0.33	0.564	-0.160 (0.188)	-0.528	0.208	0.72	0.398

Note: BPI = Brief Pain Inventory; CSQ = Coping Styles Questionnaire; DSSI = Duke Social Support Inventory; PHQ = Patient Health Questionnaire.

Table 3

Mediation Models of the Relationship of Catastrophizing or Praying/Hoping and Suicidal Ideation by Depression, Social Support, and Pain Interference

	Indirect effects of baseline CSQ Pain Catastrophizing on 12-Month SBQ-R			Indirect effects of baseline CSQ Pain Catastrophizing on 12-Month SBQ-R, Controlling for baseline SBQ-R		
	Estimated Indirect Effect	Bootstrap Confidence Interval	<i>p</i> value	Estimated Indirect Effect	Bootstrap Confidence Interval	<i>p</i> value
DSSI	0.021	(0.004, 0.041)	0.005	0.005	(-0.003, 0.014)	0.187
BPI-Int	0.009	(-0.002, 0.022)	0.187	0.003	(-0.004, 0.012)	0.424
PHQ-4	0.030	(0.006, 0.055)	0.001	0.016	(-0.001, 0.032)	0.041
	Indirect effects of baseline CSQ Praying/Hoping on 12-Month SBQ-R			Indirect effects of baseline CSQ Praying/Hoping on 12-Month SBQ-R, Controlling for baseline SBQ-R		
DSSI	-0.008	(-0.021, 0.004)	0.144	-0.001	(-0.006, 0.001)	0.307
BPI-Int	0.009	(0.001, 0.019)	0.067	0.003	(-0.003, 0.009)	0.182
PHQ-4	0.009	(-0.002, 0.025)	0.127	0.004	(0.000, 0.012)	0.111

Note: BPI-Int = Brief Pain Inventory-Interference Subscale; CSQ = Coping Styles Questionnaire; DSSI = Duke Social Support Inventory; PHQ = Patient Health Questionnaire.