Factors Associated with Suicidal Ideation in Patients with Chronic Non-Cancer Pain

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Abstract

Objectives. This study’s aim was to identify the most important general and pain-related risk factors of suicidal ideation in a large sample of patients with chronic non-cancer pain.

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Methods. A total of 728 patients with chronic non-cancer pain were recruited from the waitlists of eight multidisciplinary pain clinics across Canada. Patients were assessed using self-administered questionnaires to measure demographic, pain-related (intensity, duration, interference, sleep problems), psychological (anxiety, anger, depressive symptoms including suicidal ideation), cognitive (catastrophizing, attitudes/beliefs), and health-related quality of life variables. A hierarchical logistic regression analysis was used to identify the factors that were associated with presence/absence of suicidal ideation while controlling for depressive symptoms.

Results. The results showed that being a male, longer pain duration, higher anger levels, feelings of helplessness, greater pain magnification, and being more depressed were significant independent predictor factors of suicidal ideation, while better perceived mental health was related with a lesser likelihood of suicidal ideation. Moreover, being in a relationship and believing in a medical cure for pain might be protective of suicidal ideation while being anxious may be more associated with suicidal ideation.

Conclusions. These results indicate that development of suicidal ideation is more closely related to pain chronicity and certain psychosocial factors than how severe or physically incapacitating the pain is. Many of these factors could potentially be modified by early identification of suicidal ideation and developing targeted cognitive interventions for suicidal at-risk patients. Research to examine the efficacy of these interventions for reducing suicidal ideation is warranted.

Key Words. Chronic Non-Cancer Pain; Suicidal Ideation, Depression; Health-Related Quality of Life; Cognitive Factors; Mental Well-Being; Physical Functioning

Introduction

Suicide is the fifteenth leading cause of death, accounting for at least 1.4% of all deaths worldwide [1]. Individuals experiencing chronic non-cancer pain (CNCP) are an at-risk group for suicide as they are two to three times more likely to endorse suicidal ideation (SI), make suicidal attempts and complete suicide [2] compared to those without CNCP. The World Health Organization has recognized the importance of CNCP as a risk factor for suicide and has recommended that any individual over 10 years of age who presents a CNCP condition should be assessed with respect to potential suicidal behaviors [1,3]. However, in order to determine the domains that should be part of such an assessment, it is important to know the factors that are associated with suicidal behaviors in individuals with chronic pain (CP)—in particular, the factors that might be modifiable and therefore could respond to treatment.

There is a growing body of research that has examined the factors associated with SI, suicide attempts, and suicide completion in individuals with CP. One review highlights the importance of both general demographic and psychological factors (e.g., being a female, comorbid depression) and pain-related risk factors (e.g., pain intensity, sleep-onset insomnia, pain catastrophizing) as potential predictors of suicide-related outcomes in individuals with CNCP [2]. More recently, a narrative review has confirmed the relationships between CNCP and increased risk of presence for all three suicidal variables [4].

In this context, early-identification of potential predictors associated with SI is of particular importance. Unfortunately, much of the research done in this area is based on [1] large epidemiological survey studies that did not evaluate the relative importance of multiple demographic and pain-related risk factors as predictors of SI [2, 5–8]; studies with small numbers of subjects [9–15], restraining the ability to detect associations due to low power; and [3] studies examining SI in specific CNCP syndromes [10,14–23], limiting the potential generalization of findings to other CNCP conditions. Moreover, no study to date has investigated the relationship between SI and anger while only a few have examined important modifiable factors such as pain catastrophizing [9,11,24], pain-related attitudes/beliefs [9,11] or health-related quality of life [9,23,25]. Thus, there is a need to identify possible risk factors in larger samples of individuals experiencing CP.

Given these considerations, the aim of this study was to identify the general and pain-related risk factors for SI in a large tertiary care sample of individuals with CP. Based on the results of previous research, we hypothesized that demographic (being a female, being unemployed or on disability), pain-related (pain intensity and duration, pain interference, pain-related sleep problems), and psychological (anxiety) variables would all make independent contributions to the prediction of SI when depressive symptoms were controlled. We also sought to examine other psychosocial factors (anger, health-related quality of life, pain catastrophizing, and pain-related attitudes/beliefs) that we anticipated might be associated with SI.

Methods

Participants

The data used in the present study came from a larger epidemiologic study (The Canadian STOP-PAIN Project). Only variables that were needed to address the current study objectives and hypotheses were used. Readers interested in other research findings related to the Canadian STOP-PAIN Project are referred to previous published papers that also used data from this project [26–28].
The study sample consisted of 728 patients with CNCP who agreed to participate in the study while they were waiting to receive their first clinic appointment in one of the eight participating multidisciplinary pain treatment clinics located in seven provinces across Canada. A total of 3343 letters were sent. From these, 1351 patients (40%) agreed to be contacted, 191 were not reachable, 422 were not eligible, and 10 who were eligible and were contacted did not complete all study measures, resulting in a final study-corrected participation rate of 25%.

Procedures

The medical directors of each pain clinic sent a letter of invitation to individuals who were waiting for their first appointment at the pain clinic. Those interested in participating were invited to return by mail a response card confirming that they were willing to be contacted by one of the study nurses to obtain further details about participation. The research nurse then called potential participants and the study was described to them. If patients were interested in participating, the research nurse evaluated their eligibility and asked them to provide a written consent form as well as to complete a series of self-administered questionnaires that were sent by mail. Study eligibility criteria were the following: 1) 18 years or older, 2) capable of providing informed consent, 3) able to complete questionnaires in French or English, and 4) reported having a non-cancer related pain that has been present for at least 6 months and that did not require urgent medical care. All study participants provided signed informed consent, and the research ethics boards of all participating clinics approved the study.

Measures

Demographic Measures

All participants were asked to provide demographic information including sex, age, marital status, educational level, and employment status.

Pain Characteristics and Physical Functioning

Participants were asked to indicate the duration of their pain problem (months or years) and to rate their average pain intensity during the past week using a 0–10 numerical rating scale (NRS-11) (0 = “No pain” to 10 = “Worst possible pain”) [29]. Pain interference was assessed using the Pain interference scale of the Brief Pain Inventory (BPI) [30]. The BPI consisted of seven items (general activity, mood, walking ability, normal work, sleep, relations with others, enjoyment of life) rated on a 0 to 10 NRS (0 = “Does not interfere” and 10 = “Completely interferes”) where patients were asked to indicate which degree their pain interfered with their day-to-day activities over the previous 7 days. The BPI interference items have been extensively used in chronic non-cancer-related pain and BPI scores have been shown to be valid and reliable [31–33]. Sleep pain-related problems were examined using the Chronic Pain Sleep Inventory (CPSI) [34]. The CPSI comprises four items (difficulty to fall asleep, needs of sleep medication, awaken by pain during the night, awaken by pain in the morning) which are rated on using a four-point Likert scale ranging from 1 = “Almost never” to 4 = “Almost always.” An additional item measures overall sleep quality on a 0–10 scale (0 = very bad, 10 = excellent). Reports from this questionnaire have demonstrated good convergent and discriminant validity [34]. As suggested by the authors of this questionnaire, we computed the sleep index (items 1, 3, and 4) that has been considered to be reliable and more specific to sleep pain-related problems [34].

Psychological Variables

Depressive symptoms and suicidal ideation were assessed using the 21-item Beck Depression Inventory (BDI-I) [35], which is one of the most widely used and well-validated instruments available to measure depressive symptoms in chronic pain populations. Moreover, question 9 of the BDI has also often been used to assess SI in pain research [11,13,15,23,24]. Patients were asked to indicate the severity of 21 common depressive symptoms (including one item asking about SI) on a 0 to 3 Likert scale indicating increasing symptom severity over the last week. The total score is computed by summing the items, and thus ranges from 0 to 63. The measure also has standard cut offs used to classify individuals with respect to different levels of depression (i.e., 0 to 9 = no depression, 10 to 18 = mild to moderate depression, 19 to 29 moderate to severe depression, and 30 to 63 extremely severe depression). To assess SI in the present study, the BDI item number 9 was employed to classify participants as having 1) no SI (“Have no thoughts of killing myself”), 2) passive SI (“I have thoughts of killing myself, but I would not carry them out”), and 3) active SI (endorsing either “I would like to kill myself” or “I would kill myself if I had the chance”). Anxiety and anger levels during the past 2 weeks were also examined with two single 0 to 10 NRS questions (How anxious [or angry] have you been feeling in the past two weeks?) ranging from 0 = “Not at all” to 10 = “Extremely.”

Cognitive Variables

Pain-related attitudes/beliefs were examined using the 14-item Survey of Pain Attitudes-Short Form (SOPA-SF) [29,36]. This questionnaire can be scored to assess seven pain belief dimensions (control, disability, harm, emotion, medication, solicitude, and medical cure) that are hypothesized to play a role in adjustment to chronic pain. Each belief item is rated on a five-point Likert scale from 0 = “This is very untrue for me” to 4 = “This
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is very true for me." The SOPA has shown adequate internal consistency, reliability, and convergent/discriminant validity [36]. Catastrophic thoughts about pain were assessed using the 13-item Pain Catastrophizing Scale (PCS) [37] where patients are asked to rate on a five-point Likert scale (0 = “Not at all” to 4 = “All the time”) how often they have catastrophizing responses while experiencing pain. The PCS is a frequently used measure in pain research and PCS scores have demonstrated to be valid and reliable in adult chronic pain studies [38–40]. The PCS can be scored to assess overall global catastrophizing, as well as three subdomains of catastrophizing: rumination, magnification, and helplessness subscales. Higher scores indicate greater catastrophic thinking.

Health-Related Quality of Life

This dimension was examined using the Medical Outcomes Study 36-item Short-Form Health Survey version 2 (SF-36v2), a measure that has been extensively used in chronic pain studies [41]. The SF-36v2 assesses patients’ perceptions of their physical and psychological health over the past month within eight different domains (physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, role limitations due to physical health problems, role limitations due to emotional problems and mental health) that can be summarized into a Physical and a Mental Component Summary Score, where a higher score represents a better self-reported health state.

Data Analyses

Descriptive statistics (means and standard deviations for continuous variables, frequency tables for categorical variables) were first computed to assess passive (without plan) and active (with a plan) SI as well as the levels of depressive symptoms in the sample. The distribution of the study variables was then examined to ensure that they met the assumptions of the study planned statistical analyses. Three demographic variables (marital status (single, married, common law, separated or divorced, widowed), employment status (full-time job, part-time job, homemaker, student, retired, on temporary disability, on permanent disability, unemployed), and education level (elementary school, high school, college-technical school, university)] were dichotomized in order to obtain an adequate number of patients per category for the planned statistical analyses. The participants’ response to item 9 of the BDI was also dichotomized into 1) those denying any SI (response of 0 to item 9) and 2) those endorsing at least some SI (response of 1, 2, or 3) in order to perform the planned hierarchical logistic regression analyses (HLRA) to test the study hypothesis regarding the predictors of SI.

In order to control for the effects of depressive symptoms on SI, the BDI total score (with item 9 removed) was entered first (Step 1) in the HLRA model. Using the Enter method, the 23 variables of interest were then added in Step 2 in order to assess whether they predicted SI independently of depressive symptoms. Considering the conservative nature of this analysis (i.e., the relationship between an individual predictor and SI was only assessed with the relationships between all of the other predictors and SI, and were removed from the prediction equation), we also performed a series of exploratory HLRA for each independent variable while only controlling for depression levels in Step 1. This less conservative approach allowed us to further explore potential predictors of SI that might have been overlooked in the main model. Semi-standardized beta coefficients were calculated in order to estimate the relative importance of the predicted probability of each variable in the model. Since semi-standardized beta coefficients are bounded by −1 and 1 standard deviation (SD), they can be viewed as indicating the proportion of the maximum possible change in the predicted probability of the outcome [42]. Odd ratios (OR) obtained in the HLRA analyses were then further investigated in terms of effect size [43] where small (d = 0.25), medium (d = 0.50), and large (d = 0.80) effect sizes represented OR values of 1.57, 2.47, and 4.25, respectively, and to 0.64, 0.40, and 0.24 for OR < 1.00. All analyses were conducted using SPSS version 17.0 (IBM, http://www-01.ibm.com/software/analytics/spss/), with the exception of semi-standardized beta weights, which were computed using Microsoft Excel macro [42].

Results

Sample Characteristics

The sample was composed of 728 patients with CNCP mostly middle-aged (Mean = 50.8 years old, SD = 12.6) women (61%) who were married or living with a romantic partner (64%). Close to one half of the patients reported an education level that was lower or equivalent to a high school degree (46%) and a high proportion were currently unemployed or on temporary/permanent disability (42%). Almost all of the participants (90%) reported that they had constant pain. Participants’ mean pain duration was 8.83 years (SD = 9.15 years), with pain onset associated with a trauma (42%), no specific event (26%), an illness (19%), a surgery (9%), or other causes (4%). At the time of recruitment, confirmation of a chronic pain diagnosis was not possible because potential study participants were still waiting to meet with the pain clinic physician when they were enrolled.

Depressive Symptoms and Suicidal Ideation

As shown in Table 1, depression was commonly experienced [mean (SD): 18.8 (±10.1)] with 50% of the patients reporting moderate to extremely severe depressive symptoms while less than 20% had no depressive symptoms. In addition, SI was frequent, with more than 1 out of 3 patients expressing either passive (31%) or active (44%) SI.
Table 1 Depressive symptoms and suicidal ideations in our sample of patients with chronic pain

<table>
<thead>
<tr>
<th>Depressive Symptom Levels</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No symptoms (score: 0 to 9)</td>
<td>18%</td>
</tr>
<tr>
<td>Mild to moderate (score: 10 to 18)</td>
<td>32%</td>
</tr>
<tr>
<td>Moderate to severe (score: 19 to 29)</td>
<td>34%</td>
</tr>
<tr>
<td>Extremely severe (score: 20 to 63)</td>
<td>16%</td>
</tr>
</tbody>
</table>

Suicidal Ideations (BDI – Responses to Item 9)

| I don't have any thoughts of killing myself (no thoughts)   | 65%        |
| I have thoughts of killing myself, but would not (passive thoughts) | 31%        |
| I would like to kill myself (active thoughts)               | 3%         |
| I would kill myself if I had the chance (active thoughts)   | 1%         |

BDI = Beck Depression Inventory.

Identification of Factors Predicting the Presence/ Absence of Suicidal Ideation

All variables met the assumptions of the planned statistical analyses. The depression variable (with SI item 9 removed) was entered at Step 1. The HLRA model was statistically significant ($\chi^2 = 152.36$, df 1, $P < 0.001$) and explained 27% of the variance [pseudo-$R^2$ (Nagelkerke) = 0.27] in SI while increasing the model overall prediction to 75% with a correct percentage rate of presence of SI of 49%. Results from Step 1 showed that patients who reported being more depressed were significantly more likely to also endorse the presence of SI (OR = 1.08, $\beta = 0.167$, $P < 0.001$) (see Table 2).

In Step 2, the 23 variables of interest were then entered as a block and explained an additional 11% of the variance in SI [pseudo-$R^2$ (Nagelkerke) = 0.38] ($\chi^2 = 221.46$, df 24, $P < 0.001$). The overall prediction model remained the same (75%), but the correct response rate for detecting presence of SI increased by another 6%. As shown in Table 2, of the demographic variables examined, only sex emerged as a significant predictor, with men reporting significantly more SI than women (OR = 1.58, $\beta = 0.050$, $P = 0.026$). Longer pain duration was also associated with the presence of SI (OR = 1.02, $\beta = 0.043$, $P = 0.053$). Neither average pain intensity nor physical functioning variables (i.e., pain interference and pain-related sleep problems) were found to be significant predictors. For anxiety and anger levels, the results showed that patients with higher anger levels were significantly more likely to endorse the presence of SI (OR = 1.12, $\beta = 0.080$, $P = 0.010$). With respect to catastrophizing, patients who exaggerated or magnified the threat value of their pain experience endorsed more SI (OR = 0.88, $\beta = 0.098$, $P = 0.005$). At first glance, this result appears to be at odds with the data presented in Table 2, where PCS magnification scale and SI are negatively related ($b = -0.133$). However, further examination of the data (see below for more details) suggested a suppression effect. Participants who reported higher ratings of helplessness about their pain were more likely to report having SI (OR = 1.12, $\beta = 0.147$, $P = 0.001$). We found no significant association between SI and patients’ attitudes/beliefs toward pain. With respect to patients’ health-related quality of life, our results revealed that those who perceived themselves to have better mental health state were also more likely to have less SI (OR = 0.97, $\beta = 0.97$, $P < 0.017$) whereas no such difference was observed for perceived physical health. The effect sizes of the individual predictors range from very small to small (all $ds \leq 0.25$).

As indicated previously, exploratory HLRA analyses for each independent variable were also performed controlling only for depression. As presented in Table 2 (last two columns), in this analysis, sex no longer reaches statistical significance ($P = 0.062$), while pain duration, SF36 mental component summary, anger levels, and PCS helplessness scales remain significant. In addition, we found that patients who reported being in a relationship (married, common law) ($P = 0.047$) and those who tended to believe that a medical cure existed for their pain were as well less likely to report SI ($P = 0.024$). Our results also showed that higher anxiety levels were associated with SI endorsement ($P = 0.047$). The effect sizes ranged from very small to small in magnitude (all $ds \leq 0.20$) (data not shown). In addition, we obtained a pattern of results suggesting that the PCS magnification scale was acting as a suppressor variable in our main HLRA model (see Results, Depressive Symptoms and Suicidal Ideation). Specifically, we observed that the PCS magnification variable became non-significant when entered after controlling for depression ($P = 0.524$). Knowing that the PCS magnification variable was meeting the assumptions of the planned statistical analyses (i.e., the PCS magnification scale was significantly and positively correlated with the presence of SI ($r = 0.22$, $P < 0.001$) and was not strongly associated with any of the other independent variables, we further explored the contribution of this variable by performing a single logistic regression analysis between PCS magnification and SI without controlling for depression. The results indicated that the PCS magnification scale was significantly and positively associated with SI (OR = 1.54, $b = 0.14$, $P < 0.001$) suggesting that the PCS magnification variable provides a substantial indirect contribution to the prediction of SI.

Discussion

The aim of this study was to better identify factors that make independent contributions to the prediction of SI in patients with CP. Male sex, longer pain duration, higher anger levels, helplessness, pain magnification, and depressive symptoms were associated with greater likelihood of SI. In contrast, better perceived mental health was an independent predictor of the absence of
SI. Using exploratory HLRA's, our results also revealed that patients involved in a partnered relationship (i.e., married/common law) and those who believed in a medical cure for their pain were less at-risk for SI, while those who reported being more anxious were more likely to endorse SI. Contrary to our hypotheses, however, pain severity and physical disability were not significantly associated with SI. In summary, these findings suggest that SI is more closely related to psychologically modifiable factors that can be targeted through cognitive behavioral interventions than to pain-related factors.

Even though it is fairly well established in the general population that being a woman, younger, less educated, or unmarried were all important factors associated with SI [44–47], these relationships do not seem as clear in individuals with CP. Most studies having examined demographic factors associated with SI in individuals with CNCP found no support for a relationship with sex [12–14,24,48], age, marital status, education levels [9,12–14,23,48,49], and work status [12,13,23,49], while a few others have reported a relationship between SI and female sex [49,50], older age [24], and being unemployed or on disability [9,24,51]. In our study, the male sex was identified as a significant predictor of SI, albeit only when the other predictor factors were included in the model. Interestingly, we observed a similar trend in one of our previous studies [9], where being a man was associated with SI at a univariate level, but was no longer significant when other demographic variables were entered into a regression model.

Considering the inconsistencies in the pain literature, further research is needed to elucidate the relationship between sex and SI in individuals with CP. Furthermore, we found that being in a relationship emerged as a protective factor for SI. This finding is consistent with a

### Table 2: Identification of predictive factors that best distinguish between the presence or absence of SI

<table>
<thead>
<tr>
<th>Variables</th>
<th>(b)</th>
<th>SE (\hat{b})</th>
<th>(\hat{\beta}^*)</th>
<th>OR (95%CI)</th>
<th>ES **</th>
<th>(P) value</th>
<th>OR (95%CI)</th>
<th>(P) value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEP 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI – Depression</td>
<td>0.076</td>
<td>0.02</td>
<td>0.167</td>
<td>1.08 (1.04–1.12)</td>
<td>0.04</td>
<td>0.000***</td>
<td>1.12 (1.02–1.15)</td>
<td>0.000***</td>
</tr>
<tr>
<td><strong>STEP 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>0.456</td>
<td>0.20</td>
<td>0.50</td>
<td>1.58 (1.06–2.35)</td>
<td>0.25</td>
<td>0.026***</td>
<td>1.40 (0.98–2.00)</td>
<td>0.062</td>
</tr>
<tr>
<td>Age</td>
<td>0.010</td>
<td>0.01</td>
<td>0.028</td>
<td>1.01 (0.99–1.03)</td>
<td>0.01</td>
<td>0.281</td>
<td>1.01 (0.99–1.02)</td>
<td>0.520</td>
</tr>
<tr>
<td>Marital status</td>
<td>–0.358</td>
<td>0.20</td>
<td>0.039</td>
<td>0.70 (0.47–1.04)</td>
<td>0.19</td>
<td>0.075</td>
<td>0.70 (0.49–0.99)</td>
<td>0.047***</td>
</tr>
<tr>
<td>Education level</td>
<td>–0.036</td>
<td>0.20</td>
<td>0.004</td>
<td>0.97 (0.65–1.44)</td>
<td>0.02</td>
<td>0.862</td>
<td>1.14 (0.80–1.61)</td>
<td>0.471</td>
</tr>
<tr>
<td>Work status</td>
<td>0.033</td>
<td>0.21</td>
<td>0.004</td>
<td>1.03 (0.68–1.57)</td>
<td>0.02</td>
<td>0.877</td>
<td>1.07 (0.75–1.53)</td>
<td>0.721</td>
</tr>
<tr>
<td>Pain duration</td>
<td>0.021</td>
<td>0.01</td>
<td>0.043</td>
<td>1.02 (1.00–1.04)</td>
<td>0.01</td>
<td>0.053***</td>
<td>1.02 (1.00–1.04)</td>
<td>0.047***</td>
</tr>
<tr>
<td>Average pain intensity</td>
<td>–0.077</td>
<td>0.06</td>
<td>0.033</td>
<td>0.93 (0.82–1.05)</td>
<td>0.04</td>
<td>0.231</td>
<td>0.99 (0.90–1.09)</td>
<td>0.784</td>
</tr>
<tr>
<td>BPI – Pain interference</td>
<td>–0.003</td>
<td>0.01</td>
<td>0.010</td>
<td>1.00 (0.98–1.02)</td>
<td>0.00</td>
<td>0.814</td>
<td>1.00 (0.99–1.02)</td>
<td>0.895</td>
</tr>
<tr>
<td>CPSI – Sleep quality</td>
<td>–0.075</td>
<td>0.05</td>
<td>0.043</td>
<td>0.93 (0.85–1.02)</td>
<td>0.04</td>
<td>0.115</td>
<td>0.93 (0.86–1.01)</td>
<td>0.066</td>
</tr>
<tr>
<td>SF-36v2 – Physical</td>
<td>0.004</td>
<td>0.02</td>
<td>0.008</td>
<td>1.00 (0.97–1.04)</td>
<td>0.00</td>
<td>0.787</td>
<td>1.02 (1.00–1.04)</td>
<td>0.112</td>
</tr>
<tr>
<td>SF-36v2 – Mental</td>
<td>–0.031</td>
<td>0.01</td>
<td>0.097</td>
<td>0.97 (0.94–0.99)</td>
<td>0.01</td>
<td>0.017***</td>
<td>0.96 (0.94–1.11)</td>
<td>0.000***</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.002</td>
<td>0.05</td>
<td>0.001</td>
<td>1.00 (0.91–1.10)</td>
<td>0.00</td>
<td>0.974</td>
<td>1.08 (1.00–1.16)</td>
<td>0.047***</td>
</tr>
<tr>
<td>Anger</td>
<td>0.112</td>
<td>0.04</td>
<td>0.080</td>
<td>1.12 (1.03–1.22)</td>
<td>0.06</td>
<td>0.010***</td>
<td>1.13 (1.06–1.20)</td>
<td>0.000***</td>
</tr>
<tr>
<td>PCS – Rumination</td>
<td>–0.003</td>
<td>0.04</td>
<td>0.003</td>
<td>1.00 (0.92–1.08)</td>
<td>0.00</td>
<td>0.944</td>
<td>1.02 (0.97–1.07)</td>
<td>0.407</td>
</tr>
<tr>
<td>PCS – Magnification</td>
<td>–0.133</td>
<td>0.05</td>
<td>0.098</td>
<td>0.88 (0.80–0.96)</td>
<td>0.07</td>
<td>0.005***</td>
<td>0.98 (0.92–1.04)</td>
<td>0.524</td>
</tr>
<tr>
<td>PCS – Helplessness</td>
<td>0.109</td>
<td>0.03</td>
<td>0.147</td>
<td>1.12 (1.05–1.19)</td>
<td>0.06</td>
<td>0.001</td>
<td>1.05 (1.02–1.09)</td>
<td>0.005***</td>
</tr>
<tr>
<td>SOPA – Control</td>
<td>0.045</td>
<td>0.11</td>
<td>0.011</td>
<td>1.05 (0.85–1.29)</td>
<td>0.02</td>
<td>0.676</td>
<td>0.93 (0.79–1.12)</td>
<td>0.461</td>
</tr>
<tr>
<td>SOPA – Disability</td>
<td>0.142</td>
<td>0.08</td>
<td>0.039</td>
<td>1.15 (0.98–1.36)</td>
<td>0.07</td>
<td>0.093</td>
<td>1.13 (0.97–1.30)</td>
<td>0.113</td>
</tr>
<tr>
<td>SOPA – Harm</td>
<td>–0.057</td>
<td>0.11</td>
<td>0.013</td>
<td>0.94 (0.76–1.18)</td>
<td>0.03</td>
<td>0.810</td>
<td>0.95 (0.79–1.14)</td>
<td>0.601</td>
</tr>
<tr>
<td>SOPA – Emotional</td>
<td>–0.081</td>
<td>0.09</td>
<td>0.022</td>
<td>0.92 (0.77–1.10)</td>
<td>0.04</td>
<td>0.378</td>
<td>1.00 (0.89–1.16)</td>
<td>0.970</td>
</tr>
<tr>
<td>SOPA – Medication</td>
<td>0.006</td>
<td>0.11</td>
<td>0.001</td>
<td>1.01 (0.81–1.26)</td>
<td>0.01</td>
<td>0.957</td>
<td>1.06 (0.87–1.29)</td>
<td>0.569</td>
</tr>
<tr>
<td>SOPA – Solicitude</td>
<td>–0.138</td>
<td>0.09</td>
<td>0.038</td>
<td>0.87 (0.73–1.04)</td>
<td>0.08</td>
<td>0.125</td>
<td>0.91 (0.78–1.05)</td>
<td>0.201</td>
</tr>
<tr>
<td>SOPA – Medical cure</td>
<td>–0.159</td>
<td>0.09</td>
<td>0.042</td>
<td>0.85 (0.72–1.01)</td>
<td>0.09</td>
<td>0.068</td>
<td>0.84 (0.72–0.97)</td>
<td>0.024***</td>
</tr>
</tbody>
</table>

\* \(\hat{\beta}\) = semi-standardized beta weight using the mean predicted probability of 0.344.

**ES**: small (\(d = 0.25\)), medium (\(d = 0.50\)), and large (\(d = 0.80\)).

***\(P < 0.05\).
large number of studies showing that global marital satisfaction, higher perceived social support, and partner positive responses are associated with less depressive symptom severity and better psychological well-being in individuals with chronic pain [52–60]. This research supports the view that perceived social support buffers the effects of stress on depressive symptoms [61–63], therefore suggesting that perceived social support may also decrease the likelihood of SI. Another plausible explanation may be found in the interpersonal theory of suicide [64], which proposes that thwarted belongingness can lead a person to develop SI, and that less social isolation—associated with being involved in a relationship—decreases that risk. These findings raise the possibility that a brief intervention aimed at educating spouses or significant others with respect to positive responses (i.e., providing positive reinforcement) while also diminishing social isolation may also reduce the risk for SI. Research to examine this possibility is warranted.

With respect to pain-related variables, contrary to our hypothesis, we found that only longer pain duration was a significant predictor of SI, while pain intensity, pain interference, and pain-related sleep quality were not. The CNCP literature seems inconsistent in this regard. Some research supports the view that longer pain duration [16,24,49], higher pain intensity, greater pain interference [11,14,22–25], and sleep problems [9,13,22,25] are related to SI whereas several other studies have found no such associations (pain duration [9,12,14,24,48], intensity [9,12,13,48], interference [9,13,48], and sleep problems [14,23,48]). One explanation for why we only found longer pain duration to be a predictor of SI might be related to the lack of timely access to multidisciplinary pain clinics in Canada [65]. More than half of the patients waited six months or more to obtain health care services, which is an unacceptable wait-time for pain treatment and contributes to patient deterioration [65,66]. Therefore, it is plausible that, as pain becomes more chronic, the time factor becomes a stronger predictor of SI, underlining a global worsening of patient health over time.

It is well documented in the general population that mood and anxiety disorders are related to SI [1,44,45,67]. These relationships also appear to be present in the CNCP literature, where most studies have found that patients who reported greater anxiety [5,21–25,68] and depressive symptoms [5,14,15,17,18,21–25,48,50,69] were also more likely to present with SI. In this study, we replicated this relationship between depressive symptoms and SI while controlling for other variables of interest. However, anxiety only emerged as a predictor of SI when we performed additional exploratory analyses, which might be explained by the fact that we only used a single-item NRS measure. A very limited amount of research has examined the relationship between anger and SI in adults. One recent population-based study showed that anger was an independent predictor of SI [70]. In our study, we also found support for such a relationship using a single-item NRS. Because of the paucity of research on anger and SI, additional research is needed to determine the reliability of this finding.

Our results also showed that patients who perceived their mental—but not physical—health as better were less likely to report SI, replicating the findings of two recent CNCP studies [9,25]. For pain catastrophizing and pain-related attitudes/beliefs, we found that feeling more helpless about pain and reporting greater pain magnification were significantly associated with SI. Only one pain-related belief appeared to be associated with SI when we performed separated exploratory HLRA; patients who believed more in a medical cure for their pain were less likely to have SI, suggesting that having hope about their treatment for their CNCP might be a protective factor. However, in a previous study [9], we examined PCS and SOPA variables in patients with CNCP and found that only helplessness, but not other beliefs, predicted SI. Thus, the pain beliefs that are consistently associated with SI across different samples remain unclear. Although the significant findings that do emerge are consistent with a model suggesting hope as a protective factor and hopelessness/helplessness as risk factors for SI.

In a study using a large sample of patients, Edwards and colleagues [24] found that catastrophizing predicted the severity of SI, and that catastrophizing and depressive symptoms interacted such that higher scores on both of these variables (over and above their individual effect) were associated with more SI. In a recent review [71] these authors suggested that catastrophizing and depressive symptoms have their effects on pain via complex and shared behavioral, cognitive, physiological interacting pathways. Their findings shed some light on why, in our study, pain magnification appears to have exerted a suppressor effect (i.e., indirect contributor to the other variables, more particularly depression in improving the regression effect) in our HLRA. Further studies are needed to more closely examine the role of catastrophizing and its interrelationship with depressive symptoms in SI.

Our study has a number of important limitations, most of which have been discussed in previously published papers [26–28]. These include the fact that our study only included Canadian tertiary care patients and therefore the findings cannot necessarily be generalized to other populations of individuals with CNCP who are treated in the primary or secondary sectors of care in Canada or elsewhere in the world. In addition, the lack of inclusion of measures of pain location(s) and type(s) of pain (e.g., myofascial versus neuropathic) precluded us from performing subgroup analyses, which might have revealed that patients with certain type of pain syndromes might be more or less at-risk of reporting SI. Another limitation is related to the low study response rate (25%), where non-participants may or may not
liable instruments such as the Beck Anxiety Inventory
anger rather than more extensive and perhaps more re-
only two single NRS items to measure anxiety and
within a reasonable completion time, we choose to use
that, in order to keep questionnaires administration
a multicentre design, which enrolled partici-
important strengths, such as its large sample size and
from potential sample biases, it also has a number of
CP. However, even though the present study may suffer
under-estimated the true rates in the population with
consent for collecting these data. It is therefore possible
suffering. Importantly, given that a number of these
patients and non-participants differed in terms of their CNCP profile was not possible to evaluate, because the latter group did not provide informed consent for collecting these data. It is therefore possible that the rates of SI found in our study either over- or under-estimated the true rates in the population with CP. However, even though the present study may suffer from potential sample biases, it also has a number of important strengths, such as its large sample size and the use of a multicentre design, which enrolled participants across Canada. Another important limitation is that, in order to keep questionnaires administration within a reasonable completion time, we choose to use only two single NRS items to measure anxiety and anger rather than more extensive and perhaps more reliable instruments such as the Beck Anxiety Inventory [72] or the Clinical Anger Scale [73]. Use of such measures may have provided more sensitivity and specificity. Finally, although several previous studies also examined SI using item 9 of the BDI [11,13,23–25], it could be argued that a single item is insufficient to reflect the presence/absence of SI. It is unclear whether we would have obtained the same findings if we had used a more detailed measure of SI, such as the Suicidal Behavior Questionnaire Revised [74] or a clinical diagnostic approach. Furthermore, the use of a depression measure that did not have a SI question such as, for example, the Center for Epidemiological Studies-Depression scale [75] might also have possibly yielded different results.

In spite of these limitations, the present study carried out in a large sample of patients with CNCP suggests that being a male, longer pain duration, higher anger levels, helplessness, pain magnification, and depressive symptoms were associated with SI, whereas patients who perceived their mental health as better were less at risk of reporting SI. Moreover, being in a relationship and believing in a medical cure for pain might be protective of SI while those with higher anxiety levels were also more likely to endorse SI. These results support the conclusion that SI is more strongly associated with pain chronicity and psychosocial factors than pain severity or the extent to which pain is physically incapacitating.

In addition, the present findings have important clinical implications. By improving our knowledge about the factors that are associated with SI, they provide for an empirically based way of identifying patients with CNCP who are at risk for SI. Although more research to determine the reliability of our results would be useful, clinicians should consider using the variables found to predict SI in this study as potential “red flags” that may identify patients who are at risk of developing (or have already developed) SI. For such patients, clinicians may choose to develop standardized procedures that are suitable to their clinical setting to provide more timely interventions (e.g., moving these patients up on a waiting list, referring them to a psychologist, etc.) in order to prevent suicide risk and to more effectively reduce their suffering. Importantly, given that a number of these factors are modifiable (e.g., depression, anger, feeling helplessness, pain magnification), an important next step is to develop and evaluate the efficacy of targeted cognitive-behavioral interventions for these patients.

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