Is Self-Concealment Associated With Acute and Chronic Pain?

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Objective: Self-concealment is the predisposition to hide negative personal information. The present research examined whether self-concealment was associated with acute and chronic pain. ***Methods:*** In Study 1, undergraduate students ($N = 44$) completed an online questionnaire packet and then completed a cold-pressor task in the laboratory. In Study 2, individuals with chronic pain ($N = 85$) completed an online survey. ***Results:*** Study 1: Trait self-concealment was negatively associated with pain tolerance. Study 2: Self-concealment of chronic pain (hiding aspects of one's chronic pain condition from others) was associated with higher levels of self-reported pain and lower psychological well-being, independent of disclosure of feelings regarding pain. Furthermore, this association was mediated by autonomy and competence needs. ***Conclusions:*** Self-concealment was found to be associated with higher levels of pain in both healthy and chronic pain samples. Moreover, the findings also suggest that intervention methods using the self-determination theory framework (i.e., autonomy and competence supportive) might be effective for individuals with chronic pain.

Keywords: self-concealment, pain, chronic pain, self-determination

Self-concealment is defined as the tendency to hide negative or distressing personal information from others (Larson & Chastain, 1990). The concealed information has three characteristics; it is private and personal, consciously accessible, and actively kept hidden (Larson & Chastain, 1990). In other words, self-concealment entails an active, conscious process to hide distressing personal information. Past studies suggest that self-concealment is associated with negative health outcomes. For instance, self-concealment is linked to physical symptoms and psychological distress (Larson & Chastain, 1990), depression and anxiety (Kahn & Hessling, 2001; Kelly & Achter, 1995), rumination (King, Emmons, & Woodley, 1992), and overall well-being (Uysal, Lin, & Knee, 2010). Moreover, self-concealment accounted for a significant amount of variance in these outcomes, even after controlling for self-disclosure. Studies have also shown the long-term health consequences of self-concealment. For example, in a longitudinal study involving women who had an abortion, it was found that keeping the abortion secret predicted increase in distress two years after the abortion (Major & Gramzow, 1999). Similarly, men who concealed their homosexuality were more likely to experience infectious diseases over a five year period (Cole, Kemeny, Taylor, & Visscher, 1996).

Although the negative association between self-concealment and various health outcomes has been examined previously, the link between self-concealment and pain has not been studied yet. Research suggests that conflict over emotional expression is associated with pain (Lu, Uysal, & Teo, in press) and social sharing of emotions has physical and social benefits (Pennebaker, 1989;

Rimé, Finkenauer, Luminet, Zech, & Philippot, 1998). Researchers have also investigated the health effects of emotional disclosure in the context of chronic pain (e.g., Keefe et al., 2008; Kelley, Lumley, & Leisen, 1997). However, self-concealment is different from a lack of emotion disclosure or self-disclosure. Self-concealment involves active inhibition of revealing personal information, and it consumes cognitive and emotional resources (Lane & Wegner, 1995). For instance, telling someone that one has chronic pain would be an act of self-disclosure, however not telling this information would not be an act of self-concealment unless one was actively trying to keep it hidden. Furthermore, studies show that self-concealment is uniquely associated with health outcomes, independent of self-disclosure or distress disclosure (e.g., Kelly & McKillop, 1996; Larson & Chastain, 1990; Uysal et al., 2010). Therefore, this study aims to investigate the link between self-concealment and pain.

Self-Concealment and Pain

Self-concealment is generally considered to be a personality trait, but it can also be assessed more specifically for different contexts. Thus, the relationship between self-concealment and pain can be investigated in two ways. First, it can be examined as the association between trait self-concealment and sensitivity to acute pain. Second, it can be investigated in the chronic pain context, as the relationship between trying to hide one's chronic pain condition and intensity of chronic pain. Past research has provided some indirect evidence for the link between these associations.

Research suggests that suppression of pain is associated with higher levels of acute pain. For instance, Cioffi and Holloway (1993) found that participants who were instructed to suppress their pain during a cold-pressor task were slowest to recover from pain compared to participants in distraction and monitoring conditions. In another study, participants who were trained to suppress their pain reported higher pain intensity and displayed lower pain tolerance during the cold-pressor task (Masedo & Esteve, 2007).

Similarly, individuals who suppressed their pain related thoughts prior to the cold-pressor task also reported experiencing more pain during the task than did participants who did not attempt to suppress those thoughts (Sullivan, Rouse, Bishop, & Johnston, 1997). On the other hand, previous research also revealed that trait self-concealment was associated with conflict over emotional expression (King et al., 1992). Based on these findings, it can be suggested that people who are high on trait self-concealment would also be more likely to suppress their pain related thoughts and emotions, and consequently display lower pain tolerance.

Concealment of chronic pain, that is self-concealment measured in the context of chronic pain, involves hiding issues regarding one's chronic pain condition. Individuals with chronic pain might conceal aspects of their condition for various reasons. For instance, they might perceive pain as a source of stigma (Slade, Molloy, & Keating, 2009) or as a burden for close others. We hypothesized that concealment of chronic pain would be associated with higher pain intensity and lower well-being. We turn to self-determination theory (Deci & Ryan, 1985, 2000) to explain why.

According to self-determination theory, autonomy, competence, and relatedness needs are three basic needs that are essential for well-being (Deci & Ryan, 2000). Autonomy refers to fully endorsing one's actions and engaging in volitional activities that are not controlling or imposed, competence refers to feeling self-efficacious and optimally challenged, and relatedness refers to feeling genuinely connected to others and having a sense of belonging. Several studies have shown that when these needs are thwarted, negative psychological and physiological outcomes follow (see Deci & Ryan, 2000, for a review).

Recently, researchers suggested that self-concealment leads to negative psychological well-being because it is detrimental to the satisfaction of autonomy, competence, and relatedness needs (Uysal et al., 2010). Similarly, we suggest that concealment of chronic pain would be associated with higher levels of pain due to unfulfilled needs. That is, concealment of chronic pain would lead to unfulfilled autonomy, competence, and relatedness needs, which would be detrimental to pain intensity and well-being of these individuals.

Concealment of chronic pain would thwart autonomy needs because individuals who conceal their chronic pain condition would feel constrained and controlled in their thoughts, expressions, and behavior around others. For instance, a person with chronic pain might take his medications secretly at work. Alternatively, he might try to hide the fact that he has regular appointments at the health center. These behaviors would make him feel controlled and pressured, thwarting his autonomy needs. Similarly, he might begin to perceive his condition as a stigma, thinking that other people would see him as incompetent if they knew about his condition. By concealing his condition, this individual forgoes the opportunity to receive validation from others and feel competent. Furthermore, he might also feel that people do not know what he is going through and therefore does not feel genuinely related to them, impeding his relatedness needs. In sum, concealment of chronic pain could thwart autonomy, competence, and relatedness needs, and these unfulfilled needs would then result in lower well-being and higher pain intensity.

The Current Studies

In two studies, we tested the hypothesis that self-concealment would be positively associated with pain. In Study 1, undergraduate students completed a questionnaire packet containing the Self-Concealment Scale (Larson & Chastain, 1990) before visiting the laboratory. Then they underwent a cold water task, during which their pain threshold and pain tolerance times were measured. We hypothesized that self-concealment would be associated with lower pain threshold and lower pain tolerance. Past research suggests that self-concealers would be more likely to suppress their emotions (King et al., 1992), whereas suppressing pain related thoughts and emotions during the cold-pressor task leads to an increase in pain experience (Masedo & Esteve, 2007). Therefore, we also measured trait emotion suppression to examine whether the association between self-concealment and acute pain was due to emotion suppression.

In Study 2, individuals with chronic pain completed a survey containing measures of concealment of chronic pain, basic need satisfaction, pain intensity, and psychological well-being constructs. We hypothesized that concealment of chronic pain would be negatively associated with the satisfaction of basic needs, which in turn would predict higher pain intensity and lower well-being.

Study 1 Method

Participants

Participants were undergraduate students at a large state university. As the lab session involved a cold-pressor task, participants were not eligible to participate if they had a history of cardiovascular disorder, fainting or seizures, Reynaud's phenomenon, frostbite, or an open cut or sore on their nondominant hand, or a fracture in their nondominant hand. Forty-four students (70% female) participated in the study. Ages ranged from 18 to 33 with a mean of 21.55 ($SD = 2.71$). Participants were ethnically diverse (32% Hispanic, 27% Caucasian, 18% Asian, 16% African, and 7% "Other"). Two participants reported a chronic pain condition (temporomandibular joint disorder [TMJ], ovarian cyst). The study was approved by the Institutional Review Board of the university, and the students received extra credit at the end of the study.

Procedure

Initially participants completed an anonymous online questionnaire packet containing measures of demographics, self-concealment, and emotion suppression, along with other sets of measures that are not relevant to this study. Most of the participants completed the packets several days before the lab session, and after completing the packets, they signed up for a lab session scheduled at least 12 hours after the completion of the packet. At the beginning of the lab session, participants were reminded about the ineligibility criteria and the study procedures were explained. After consenting to the study, participants completed the cold-pressor task.

Cold-Pressor Task

Cold-pressor pain was assessed by having participants immerse their nondominant hand up to the wrist in 5 °C water. The water

temperature was controlled by a refrigeration unit (Techne RU-200 Dip Cooler, Burlington, Techne Inc, NJ) and a thermo regulator (Techne Model TE10D, Burlington, Techne Inc, NJ). The units kept the water temperature constant at 5 °C (41 °F; +/-0.1C) and constantly circulated the water to prevent local warming around the submerged hand. Participants washed their hands with soap before immersion. A plastic armrest was used to control the depth of immersion and to make sure that arm muscles were relaxed.

Participants were told to immerse their nondominant hand in the 5 °C (41 °F) cold-water, and to keep it there as long as they could until it became too unbearable to keep it immersed. They were instructed:

> We want you to immerse your hand in this cold water and leave it in as long as you can. You may feel uncomfortable, and it may even start to hurt after some time. However, please do not remove your hand unless it gets unbearable to leave it in. Basically, keep your hand in the water as long as you can. This procedure is commonly used in research, and it is completely safe. After immersing your hand, please let me know when you first feel pain by saying "Now." Also, during the process, whenever I say "Report," please give a verbal report of your pain level by using this scale."

> I'll tell you when it's time to put your arm in the cold water. You'll put it in all at once, right up to here (the experimenter showed the second line above the wrist to indicate depth of immersion). Lay your hand face up on this armrest like this (the experimenter demonstrated without immersing the hand). Please keep your fingers open and do not move them during the procedure. Once you've put your hand in, I'd like you to leave it in for as long as you can, even if it starts to hurt. But you can take your arm out if it gets too painful to leave it in.

The experimenter stood behind the participant and recorded the measurements. The time elapsed until the participants first felt pain was measured in seconds as the pain threshold score, and the time elapsed until they removed their hand was measured in seconds as the pain tolerance score. To prevent any physical harm, none of the participants were allowed to keep their hands in the water for more than five minutes. At the end of the cold-pressor task, participants were given two minutes of relaxation time; then they completed some other procedures and were debriefed.

Trait Measures

Self-concealment. Self-concealment was assessed by the 10-item Self-Concealment Scale (Larson & Chastain, 1990), which measures the degree to which one tends to conceal personal information, using a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). Sample items include, "There are lots of things about me that I keep to myself" and "I'm often afraid I'll reveal something I don't want to." The scale is unidimensional (Wismeijer, Sijtsma,Van Assen, & Vingerhoets, 2008). It has good internal consistency and reliability (Cramer & Barry, 1999; Larson & Chastain, 1990) and is associated with lower well-being (e.g., Larson & Chastain, 1990; King et al., 1992; Uysal et al., 2010). Internal reliability was .89.

Emotion suppression. Emotion suppression was measured using the suppression subscale of the Emotion Regulation scale (Gross & John, 2003). The subscale consists of four items ("I control my emotions by not expressing them") that participants rate from 1 (*strongly disagree*) to 7 (*strongly agree*). Internal reliability for the suppression subscale was .68.

Results and Discussion

Means, standard deviations, and correlations are presented in Table 1. As expected, self-concealment showed a significant negative correlation with pain tolerance ($r = -.30$, $p = .05$). People who were high on self-concealment were less likely to tolerate pain by keeping their hands in the cold water. The association between self-concealment and pain threshold was not significant ($r = -.22$, $p = .18$). We also tested the partial correlations controlling for gender, as there might be gender differences. When gender was controlled, self-concealment was more strongly associated with pain tolerance ($r = -.44$, $p = .003$), but it was still not significantly associated with pain threshold ($r = -.17$, $p = .32$). Finally, self-concealment was moderately correlated with emotion suppression ($r = .44$); however, emotion suppression was not associated with pain outcomes.

These preliminary findings were in line with our hypothesis that self-concealment would be associated with lower pain tolerance, however the findings for pain threshold did not reach significance. The results were encouraging in the sense that they established the basic link between trait self-concealment and laboratory-induced acute pain in a sample of healthy participants. The results also suggested that the association between self-concealment and acute pain was not due to emotion suppression.

In Study 2, we examined the link between concealment of chronic pain and pain intensity in a sample of individuals with chronic pain. We adapted the self-concealment scale to chronic pain so that the scale measures the tendency to have secrets or hide aspects of one's chronic pain condition. Furthermore, we used self-report measures of pain and psychological well-being as outcome variables. More important, we also tested the basic needs model to examine how concealment of chronic pain is associated with pain and well-being. That is, the concealment of chronic pain would be negatively associated with autonomy, competence, and relatedness needs, which would then predict higher levels of pain and lower well-being. Finally, past research suggests that emotional disclosure has beneficial effects on the severity of symptoms among individuals with chronic pain (Kelley et al., 1997), thus we also controlled for disclosure of feelings regarding pain in correlation analyses to examine the unique associations between concealment of chronic pain and the outcomes.

Table 1
Correlations and Descriptive Statistics for Study 1

	1	2	3	4
1. Self-concealment	—	−.32	−.36*	—
2. Pain threshold	−.22	—	.36	—
3. Pain tolerance	−.30*	.36*	—	—
4. Emotion suppression	.44**	.13	.05	—
Mean	2.71	17.35	126.95	3.45
SD	.93	16.75	117.39	1.23

Note. Zero order correlations are presented below the diagonal, partial correlations (controlling for emotion suppression) are presented above the diagonal.
* $p < .05$. ** $p < .01$.

Study 2 Method

Participants and Procedure

Individuals with a diagnosed chronic pain condition were recruited from a Facebook page for chronic pain (Chronic Pain Info). The study was announced on the web page, and the participants were offered $25 gift certificates for completing the online survey. The survey was anonymous; however, participants provided an e-mail address at the end of the study in order to receive their gift certificates. The study was approved by the Institutional Review Board of the university.

Eighty-five participants, mostly female (91%), completed the study. Participants' ages ranged from 22 to 63 with a mean of 44 ($SD = 9.84$), and the sample was predominantly Caucasian (91%). All of the participants reported consulting a physician regarding their chronic pain and they were diagnosed with various chronic pain conditions, with the most common condition being fibromyalgia (58%). Eighty-eight percent of the sample reported having their condition for 20 years or fewer with an average length of 12.93 years ($SD = 10.51$), a minimum of 6 months and a maximum of 59 years.

Measures

Concealment of chronic pain. Concealment of chronic pain was measured by adapting the Self-Concealment Scale (Larson & Chastain, 1990) items to a chronic pain context. Participants were also instructed to consider their chronic pain condition while responding to the items. The scale included 10 items such as, "There are lots of things about my chronic pain that I keep to myself," "I'm often afraid I'll reveal something about my chronic pain that I don't want to," "I have negative thoughts about my chronic pain that I never share with anyone," and "Telling a secret about my condition often backfires and I wish I hadn't told it" on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale. Principal components analysis showed one component that explained 62.4% of the variance. Internal reliability was .93.

Basic need satisfaction. Need satisfaction was assessed by the 21-item General Need Satisfaction scale (Deci & Ryan, 2000), which measures satisfaction of autonomy, competence, and relatedness in the general domain of everyday life. Each subscale consists of seven items. Respondents rated statements such as, "I feel like I am free to decide for myself how to live my life" (autonomy), "Most days I feel a sense of accomplishment from what I do" (competence), and "People in my life care about me" (relatedness) on a scale of 1 (*strongly disagree*) to 7 (*strongly agree*). Each need can be scored separately, or the items can be combined into a basic need satisfaction score. Internal reliabilities for autonomy, competence, and relatedness subscales were .80, .81, and .85, respectively.

Self-reported pain. General level of pain was measured by the modified version of the short form of McGill Pain Questionnaire (SF MPQ; Dworkin et al., 2009; Melzack, 1987). This version of SF MPQ (Dworkin et al., 2009) consists of 22 items and measures the intensity of different kinds of pain and related symptoms (e.g., throbbing pain, hot-burning pain) over the previous week. Participants rated items on a 0 (*none*) to 10 (*worst possible*) scale considering how they felt during the past two weeks. SF

MPQ is shown to be valid and reliable (Grafton, Foster, & Wright, 2005). Internal reliability was .92.

Emotional disclosure of pain. Disclosure of feelings regarding pain was measured with the social support seeking subscale items from the Pain Coping Questionnaire (Reid, Gilbert, & McGrath, 1998). Participants rated five items such as, "When I am in pain, I let my feelings out to a friend" and "When I am in pain, I talk to a family member about how I feel" on a 1 (*never*) to 5 (*very often*) scale. Internal reliability was .91.

Psychological Well-Being Measures

Self-reported symptoms. The short form of the Brief Symptoms Inventory (Derogatis, 2000) was used to measure self-reported symptoms. Participants reported how much they were distressed by various symptoms over the last two weeks on a 1 (*not at all*) to 5 (*extremely*) scale. The measure consisted of 18 items that measured somatic symptoms ("faintness or dizziness"), depressive symptoms ("feelings of worthlessness"), and anxiety ("spells of terror and panic"). An overall score was calculated by averaging the items. A total score was used to indicate global symptoms and psychological distress. Internal reliability was .92.

Perceived stress. Perceived stress was assessed using the 10-item Perceived Stress Scale (Cohen & Williamson, 1988), which measures how frequently respondents have felt stressed during the last two weeks. Using a scale of 1 (*never*) to 5 (*very often*), the participants indicated how often they "felt difficulties were piling up so high that they could not overcome them" or "felt nervous and stressed." Internal reliability was .90.

Life satisfaction. Life satisfaction was assessed with the five-item Satisfaction with Life scale (Diener, Emmons, Larsen, & Griffin, 1985). Participants rated items such as "The conditions of my life are excellent" and "I am satisfied with my life" on a scale of 1 (*strongly disagree*) to 7 (*strongly agree*). Internal reliability was .91.

Results

Preliminary Analyses

Initially, the data were examined for demographic differences in the variables. Results showed that, among the demographics variables (age, gender, income, education level, and pain duration), none of the variables were significantly associated with concealment of chronic pain and pain intensity.

Next, we investigated whether concealment of chronic pain was uniquely associated with the outcomes independent of demographic variables. Regression analyses were conducted for each outcome, controlling for the demographic variables (age, income, education level, and pain duration). Results showed that concealment of chronic pain was positively associated with pain intensity ($\beta = .33$, $p = .003$), self-reported symptoms ($\beta = .43$, $p < .001$), and perceived stress ($\beta = .35$, $p = .001$), and negatively associated with basic need satisfaction ($\beta = -.53$, $p < .001$) and life satisfaction ($\beta = -.31$, $p = .003$), independent of age, income, education level and pain duration.

Path Analyses

Table 2 shows the means, standard deviations, and correlations for the variables used in path analyses. Correlation analyses further

Table 2
Correlations and Descriptive Statistics for Study 2

	1	2	3	4	5	6	7	8	9
1. Concealment of chronic pain	—	−.49**	−.38**	−.45**	.32*	.40**	.34*	−.32*	—
2. Autonomy	−.52**	—	.49	.72**	−.45**	−.67**	−.58**	.53**	—
3. Competence	−.40**	.51**	—	.50**	−.39**	−.64**	−.70**	.63**	—
4. Relatedness	−.51**	.73**	.52**	—	−.21	−.59**	−.55**	.51**	—
5. Pain	.30**	−.45**	−.38**	−.20	—	.54**	.39**	−.39**	—
6. BSI total	.43**	−.68**	−.65**	−.61**	.53**	—	.83**	−.57**	—
7. Perceived stress	.34**	−.58**	−.70**	−.53**	.39**	.83**	—	−.64**	—
8. Life satisfaction	−.36**	.55**	.64**	.54**	−.38**	−.58**	−.64**	—	—
9. Emotion disclosure	−.33*	.17	.16	.34**	−.01	−.20	−.06	.20	—
Mean	2.55	4.74	4.05	5.28	5.93	2.50	2.45	2.80	1.96
SD	1.11	1.19	1.32	1.06	1.81	.80	.81	1.65	.91

Note. BSI = Brief Symptoms Inventory. Zero order correlations are presented below the diagonal, partial correlations (controlling for emotion disclosure) are presented above the diagonal.
* $p < .01$.   ** $p < .001$.

revealed that concealment of chronic pain is also negatively associated with each need: autonomy ($r = -.52$, $p < .001$), competence ($r = -.40$, $p < .001$), and relatedness ($r = -.51$, $p < .001$). Moreover, partial correlations showed that the associations between concealment of chronic pain and the outcomes were still significant after controlling for the disclosure of feelings regarding pain. In brief, the findings for the correlation analyses were similar to the findings of Study 1.

We conducted a preliminary mediation analysis using regression to test whether the association between concealment of chronic pain and pain intensity was mediated by basic need satisfaction. Results showed that concealment of chronic pain was positively associated with pain intensity ($\beta = .30$, $p = .005$) and negatively associated with basic need satisfaction ($\beta = -.56$, $p < .001$). Moreover, when both concealment of chronic pain and need satisfaction were entered as predictors of pain, need satisfaction was significantly associated with pain ($\beta = -.35$, $p = .006$) and the effect of concealment of chronic pain was no longer significant ($\beta = .11$, $p = .39$). These results suggest that the association between concealment of chronic pain and pain intensity was fully mediated by need satisfaction (Sobel $Z = 2.56$, $p = .01$). The findings are summarized in Figure 1.

To further investigate the role of each need, and also the psychological well-being outcomes, a path analysis was conducted using Mplus software (Muthen & Muthen, 2010). The model included each need separately as mediators, and psychological well-being variables along with pain as the outcomes. That is, the model included concealment of chronic pain as the predictor; autonomy, competence, and relatedness needs as the mediators; and pain intensity, psychological symptoms, perceived stress, and

life satisfaction as the outcomes. Residual correlations were allowed between the three needs as they are part of a general construct. Relatedness needs were not uniquely (independent of autonomy and competence needs) associated with well-being outcomes; thus those paths were dropped from the model. The fit indices showed that the model had a good fit, $\chi^2(10) = 8.33$, $p = .60$, root mean square error approximation [*RMSEA*] = .00, standardized root mean square residual [*SRMR*] = .03. A nonsignificant chi square value indicates good fit. Similarly, RMSEA values below .05 and SRMR values below .08 (a 0 SRMR reflects a perfect fit) is considered a good fit. The findings are presented in Figure 2.

As the study was correlational in nature, other models were also possible. For instance, pain intensity could be a predictor of concealment of chronic pain or unfulfilled needs. Therefore, we tested two alternative models. First, we removed pain intensity from the outcomes and included it as the predictor of concealment of chronic pain. We kept the rest of the model the same (i.e., pain—concealment of chronic pain—basic needs—well-being outcomes). This model did not show a good fit, $\chi^2(13) = 42.43$, $p < .001$, *RMSEA* = .16. Second, we tested another model in which pain predicted basic needs (i.e., pain—basic needs—concealment of chronic pain—well-being outcomes). This model also did not show a good fit, $\chi^2(11) = 77.48$, $p < .001$, *RMSEA* = .27.

In sum, results suggested that concealment of chronic pain was detrimental to autonomy, competence, and relatedness needs. Autonomy and competence needs, in turn, predicted lower self-reported pain and greater well-being. On the other hand, relatedness showed a positive association with pain. The model explained 30% of the variance in pain, 59% in symptoms, 48% in life satisfaction, and 57% in perceived stress.

Discussion

We examined the association between self-concealment and pain in two studies. In Study 1, self-concealment was measured as a general personality trait that would predict laboratory-induced pain in a healthy sample of undergraduate students. The findings showed that high self-concealers were less likely to tolerate pain.

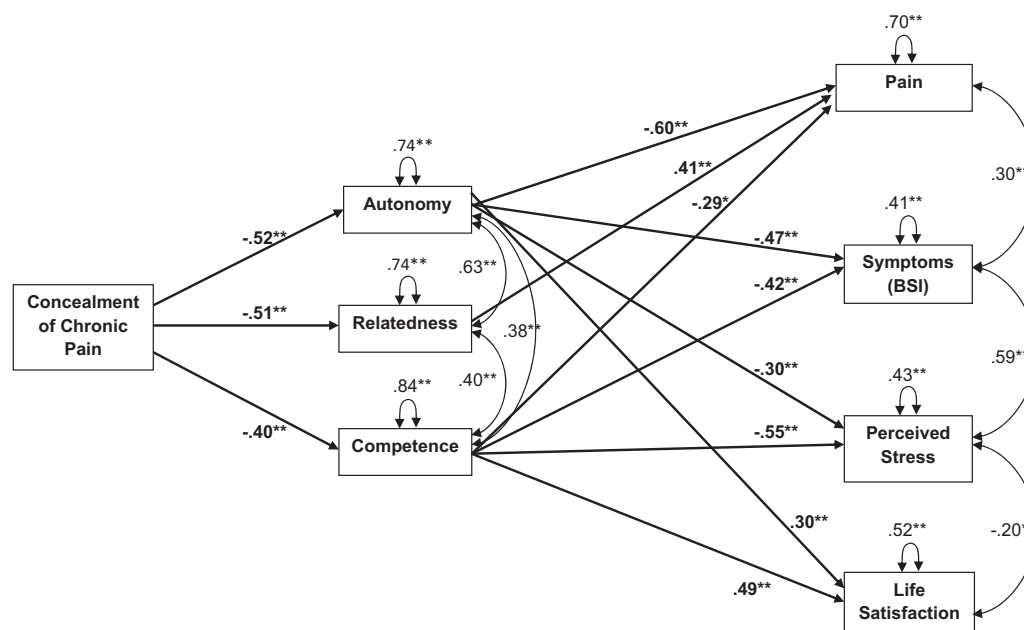*Figure 1.* Mediation Model for Study 2. * $p < .01$. ** $p < .001$.

Figure 2. Path Analysis for Study 2. * *p* < .01. ** *p* < .001.

In Study 2, self-concealment was measured as the concealment of chronic pain in a sample of individuals with chronic pain. Results suggested that concealment of chronic pain was associated with higher self-reported pain and lower well-being, and this association was mediated by autonomy and competence.

These findings contribute to the literature in several ways. To our knowledge, this is the first study to investigate the link between self-concealment and physical pain. Although past research has shown the association between self-concealment and negative health outcomes, self-concealment has not been studied with regard to physical pain. The current research establishes this basic association by demonstrating the link between trait self-concealment and laboratory-induced pain in a healthy sample, as well as the link between concealment of chronic pain and pain intensity in a chronic pain sample.

Second, this study also tests a model based on self-determination theory to explain why concealment of chronic pain is associated with higher pain intensity and lower well-being. Previous research with healthy samples suggests that self-concealment is detrimental to general well-being because it thwarts basic needs (Uysal et al., 2010). The current research tests this model in the context of chronic pain and provides an explanation for why concealment of chronic pain predicts negative health outcomes.

Last, the research also links need satisfaction with physical pain. Intervention methods using the self-determination theory framework (i.e., supporting autonomy and competence) has been shown to be effective in patients with diabetes (Williams, Freedman & Deci, 1998; Williams, Lynch, & Glasgow, 2007), tobacco cessation (Williams et al., 2006), weight loss and physical activity (Fortier, Sweet, O'Sullivan, & Williams, 2007; Silva et al., 2010; Williams, Grow, Freedman, Ryan, & Deci, 1996), and dental care (Münster Halvari & Halvari, 2006). More recently, autonomy support and need satisfaction has been linked with lower anxiety

and fear for dental treatment (Münster Halvari, Halvari, Bjornebekk, & Deci, 2010). The current research suggests that similar intervention methods that support autonomy and competence might also be effective in reducing the intensity of pain in chronic pain patients or in health settings associated with acute pain.

In Study 1, we suggested that self-concealers would be more likely to suppress their pain, which would result in lower pain tolerance. We measured emotion suppression as a trait which was moderately correlated with self-concealment; but it was not correlated with pain outcomes. It seems that our measure of emotion suppression was not a good indicator of pain suppression during the cold-water task. Therefore, we were not able to draw conclusions about the role of emotion suppression. Future studies are needed to examine whether self-concealers are more likely to suppress their pain related thoughts or their facial expressions during the cold-pressor task. It remains to be seen whether the association between self-concealment and acute pain is mediated by pain suppression.

Apart from the mediating role of pain suppression, we think that there is at least one more plausible explanation for the findings of Study 1. Research on regulatory depletion suggest that acts of self-control draw from a limited resource like energy or strength, and overriding natural responses or temptations depletes this resource (Muraven, Tice & Baumeister, 1998; Baumeister & Vohs, 2003). It can be suggested that self-concealers have lower regulatory resources as they use their resources to keep their secrets. Furthermore, pain tolerance during the cold-pressor task would also consume this resource, and thus self-concealers might be displaying lower pain tolerance due to their limited regulatory resources.

In Study 2, self-concealment was investigated in the context of concealing one's chronic pain condition. However, this does not necessarily mean the participants were hiding the fact that they

have a chronic pain condition. They can also be concealing some aspects of their condition. In fact, the participants were recruited from a Facebook group, so these individuals were probably more open about their condition and their friends were probably aware of the fact that they have chronic pain. Nevertheless, even these individuals were trying to hide some aspects of their condition, as their self-concealment scores showed a normal distribution with a mean close to the midpoint of the scale. Unfortunately, we did not ask what they concealed regarding their condition or from whom they concealed.

Studies on social sharing of emotions suggest that chronic pain patients are more likely to share their thoughts and emotions with their close others (Herbette & Rime, 2004; Morley, Doyle, & Beese, 2000). However, close others might also be the main target of concealment as they can be more critical than other people. Furthermore, the consequences might be different for concealing pain from a close other (e.g., spouse) compared to concealing pain from a colleague. These aspects of concealment could be important factors to investigate in future studies.

An unexpected finding in Study 2 was the positive association between relatedness needs and self-reported pain. First, it should be noted that the link between relatedness and pain in the path model reflects the unique association between the two constructs. That is, relatedness predicted higher pain after controlling for autonomy and competence. This suggests a suppression effect as the zero-order correlation between relatedness and pain was negative. In brief, when the negative association between relatedness and pain due to the shared variance with autonomy and competence needs is removed, the link between relatedness and pain becomes positive. This effect might be in line with the research on solicitous responses, social exclusion and pain. Several studies showed that solicitous responses are associated with higher pain intensity (e.g., Buenaver, Edwards, & Haythornthwaite, 2007; Burns, Johnson, Mahoney, Devine, & Pawl, 1996). Similarly, studies also have shown that social exclusion leads to a reduction in pain sensitivity (Borsook & MacDonald, 2010; DeWall & Baumeister, 2006). For instance, after experiencing a mildly negative interaction with a confederate, participants reported lower pain intensity and unpleasantness relative to the baseline; whereas the participants who experienced a positive social exchange did not display any change in their pain ratings (Borsook & MacDonald, 2010). Therefore, it can be speculated that, when the overlapping variance of autonomy and competence needs is removed from relatedness, the remaining construct captures these aspects of relatedness that are positively associated with pain sensitivity. However, this is a tentative explanation, and future studies are needed to clarify this issue.

The health effects of emotional disclosure, especially written emotional disclosure, have been a topic of interest in clinical samples (see Frisina, Borod, & Lepore, 2004, for a review), including chronic pain samples (e.g., Keefe et al., 2008; Kelley et al., 1997). These studies found mixed support for the beneficial effects of emotion disclosure in samples with chronic pain. Although one might be tempted to conceptualize disclosure and concealment as opposite ends of the same continuum, the findings of this research, as well as past research (e.g., Kelly & McKillop, 1996; Larson & Chastain, 1990), consistently show that self-concealment is not simply a lack of disclosure and has unique effects independent of disclosure. Future studies can investigate

how these two constructs interact with each other. For instance, self-concealers might benefit more from interventions based on written emotion disclosure.

On the other hand, these findings do not imply that individuals with a chronic pain condition should disclose everything about their pain to others. Under some circumstances, disclosure might result in worse outcomes than concealing would. For instance, if others are critical or unsupportive of the individual with chronic pain, concealment might be the better option. However, we suggest that providing autonomy and competence supportive environments to individuals who tend to hide aspects of their chronic pain condition would buffer the negative consequences of self-concealment.

Research on thought suppression suggests that suppressing unwanted thoughts has the paradoxical effect of making the thoughts easily accessible (Wegner, 1992). Furthermore, when people engage in secrecy, thought suppression and thought intrusion can form a cyclical process, which can lead to psychopathology and negative health consequences (Lane & Wegner, 1995). Research also suggests that self-concealers are more likely to monitor and suppress their negative moods, in order to prevent others from inquiring about their problems (Wismeijer, Van Assen, Sijtsma, & Vingerhoets, 2009). Similarly, the findings of Study 2 can be explained from this perspective. That is, in order to hide their chronic pain condition, concealers might try to suppress their pain, pain-related thoughts, and even behaviors around others. As a result, thoughts about their condition would keep intruding into their minds and they would become preoccupied with thoughts about their condition. This process, in turn, may magnify rumination about pain, or more generally, pain catastrophizing (Sullivan, Bishop, & Pivik, 1995), and pain vigilance (pain needs to be monitored closely in order not to be revealed inadvertently), triggering a fear-avoidance cycle (Vlaeyen, & Linton, 2000), which would then result in higher levels of pain. Thus, concealment of chronic pain may have important implications for pain catastrophizing and fear-avoidance models of chronic pain. Future studies might consider investigating the role of self-concealment in these mechanisms.

Our studies have a number of caveats that need to be mentioned. First, both samples were mostly female, and the chronic pain sample was recruited online from a chronic pain support group page. Second, the sample size in Study 2 was small compared to the number of free parameters in the model. This can be a problem for the statistical precision of the findings. Although the results were strong, these sampling problems should be kept in mind before drawing conclusions about the associations. Future studies are needed to replicate the findings with more representative and larger samples.

Third, the studies were correlational, thus the suggested causal directions are theoretical. In Study 1, self-concealment was measured as a personality trait that would be predictive of behaviors in different situations (i.e., laboratory pain). Although this design supports the hypothesized causal direction, it does not rule out the possibility of a third construct (apart from emotion suppression) that influences both variables. Similarly, in Study 2 the causal directions between the variables might be different. For instance, individuals with more severe pain conditions might be more likely to conceal aspects of their condition, or pain intensity might be the factor thwarting basic needs. These processes could even form a

vicious cycle of self-concealment and pain. That is, concealment of chronic pain could result in lower need satisfaction and higher pain intensity, which then could lead to more concealment. Although we did not find support for the two alternative models using pain intensity as the predictor, future longitudinal and experimental studies can provide more insight into these associations. In brief, our hypotheses regarding the causal directions were based on past research and theory; however, other path models are also possible.

Despite these limitations, the results of the studies complement each other in establishing the basic association between self-concealment and pain and also offer preliminary evidence on how concealment of chronic pain could be detrimental to the well-being of individuals with chronic pain. Furthermore, the findings also suggest that autonomy and competence supportive intervention methods may be effective in management of chronic pain. Future research investigating the role of self-concealment in psychological pain processes may be fruitful in improving our understanding of these mechanisms, which would help designing better intervention methods.

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