Understanding the Link between Pain Invalidation and Depressive Symptoms: The Role of Shame and Social Support in People with Chronic Pain

by

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Abstract

One in five Canadian adults live with chronic pain, while 30-60% of people with chronic pain also experience depression. This high comorbidity rate may be due, in part, to the social stigma of chronic pain, which often takes the form of invalidation and discounting the legitimacy of an individual's pain experience. Discounting in particular is associated with worse mental health outcomes among chronic pain samples. Yet, little is known about the mechanisms through which discounting leads to depression for those living with chronic pain. In addition, social support is a known protective factor against depression in chronic pain but very little research has been done on whether social support can buffer the harmful effects of discounting. In line with models of self-stigma, which suggest that stigma is harmful only when the individual agrees with and applies stigmatizing beliefs to oneself, this study hypothesized that feelings of shame about one's pain (i.e., pain-related shame) would link social discounting of pain to depressive symptoms, and that perceived social support would buffer harmful outcomes. A sample of 305 patients seeking treatment for chronic pain were recruited from a network of outpatient pain treatment centres. Participants completed an online survey comprised of standardized, validated questionnaires. Data was analyzed using moderated mediation analysis. Results demonstrated that higher levels of discounting were associated with higher levels of depressive symptoms, and that greater pain-related shame helped to explain this relationship. Results also revealed protective effects of general (but not peer) support on the association between discounting and depressive symptoms, such that higher perceived levels of social support weakened this relationship. Results highlight pain-related shame as a promising psychological treatment target in addressing depressive symptoms among those with chronic pain.

Lay Summary

One in five Canadian adults live with chronic pain, while 30-60% of people with chronic pain also experience depression. Chronic pain is a stigmatized condition because others often do not understand or believe the severity of a person's pain. Experiencing social stigma can contribute to depression, but it is unclear how this happens. This study shows that feelings of shame about one's pain, exacerbated by others discounting the legitimacy of a person's pain, may play a key role in linking stigma and depression for people with chronic pain. This finding suggests that pain-related shame could be addressed in psychotherapy to help alleviate symptoms of depression. This research also found that people who feel supported by their social networks are less likely to experience depressive symptoms when others discount their pain. Enhancing supportive social connections may be another way to help protect against the harmful effects of discounting in people with chronic pain.

Preface

This thesis is an original intellectual product of the author, Alanna Teresa Coady. The author was primarily responsible for the identification and design of the research program, the performance of the various parts of the research, and the analysis of the research data. The University of British Columbia's Okanagan Behavioural Research Ethics Board granted ethical approval for this research on 24 September 2020. The ethics approval certificate number for this research is H20-02449. As of the date of this submission, the results of this thesis have not been published.

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Dedication

This work is dedicated to my husband, Andrew Stauffer. *Sine qua non.*

Chapter 1: Introduction

Approximately one in five adult Canadians live with chronic pain (Schopflocher et al., 2011). Chronic pain is typically defined as pain that is persistent most days for at least 12 weeks (Treede et al., 2019), and can result from a wide range of factors, including muscle and nerve damage from injury; chronic health conditions such as arthritis, fibromyalgia, and diabetes (Boyle et al., 2001; Grosschadl, et al., 2014; McVinnie, 2013; Narouze & Souzdalnitski, 2015); or surgery (Holtzman et al., 2014). However, chronic pain may not always involve a known cause or observable tissue damage (De Ruddere et al., 2016; Hatcher & Arroll, 2008; Mcbeth et al., 2015). Regardless of cause, chronic pain can significantly interfere with functioning across multiple domains, including activities of daily living, employment, and socialization (Breivik et al., 2006; Moulin et al., 2002). In addition, chronic pain can result in a heavy financial burden for patients (Hogan et al., 2016).

Not surprisingly, there is a high comorbidity rate between chronic pain and depressive disorders. Approximately 30-60% of people with chronic pain also experience depression (Bair et al., 2003; Goesling et al., 2013). Studies show that this cooccurrence results in worse health outcomes across multiple domains than pain or depression alone, including significantly poorer quality of life and greater pain severity (Arnow et al., 2006; Bair et al., 2003; Burke et al., 2015; Goesling et al., 2013). Chronic pain is also significantly associated with greater risk of suicide, with odds estimates of lifetime and past 12-month suicidality being two to three times higher in people with chronic pain, depending on pain condition, compared to normal populations (Campbell et al., 2015). Further, research suggests that chronic pain and psychiatric conditions like depression mutually sustain each other over time, as depression can result in social isolation and diminished engagement in enjoyable life activities, which can in turn, exacerbate pain

severity and interference (Darnall, 2019; Asmundson & Katz, 2009). People with chronic pain thus can be caught in a cycle wherein their emotional, physical, and social health are mutually eroded over time.

Indeed, the biopsychosocial model of chronic pain is well-supported by a large empirical literature demonstrating that the experience of pain is not solely physiological, but is shaped by one's psychological processes and social context (Gatchel et al., 2007; Turk & Monarch, 2002). By contributing to better pain-related health outcomes, higher levels of social support are a demonstrated protective factor for people with chronic pain. For example, studies show that people living with chronic pain who report high levels of social support and satisfaction with support tend to report lower levels of pain severity (Evers et al., 2003; Hughes et al., 2014) and are less likely to experience mental health concerns (McKillop et al., 2017). Hence, evidence suggests that wellbeing among chronic pain populations is shaped in part by social and emotional factors, and that pain can significantly interfere with social and emotional functioning. Importantly, while social support can benefit those living with chronic pain, it is necessary to identify the ways in which chronic pain can elicit negative social responses, altering the social context in which individuals are coping with their chronic condition.

1.1 Chronic Invisible Illness and the Risk of Social Stigma

Stigma is characterized by social responses that devalue or discredit individuals who are perceived to possess characteristics that deviate from social norms, thereby relegating these individuals to a lower social status (Goffman, 1963). North American social norms emphasize health and functionality until old age, while biomedical healthcare models generally characterize illness as acute and curable (Nettleton, 2006). This leaves many with chronic illnesses, including chronic pain, at odds with given cultural norms and susceptible to stigma (Ablon, 2002;

Albrecht, Walker, & levy, 1982; Karos et al., 2018; Nettleton, 2006). Recent work on stigma and health has culminated in the health stigma and discrimination framework (Stangl et al., 2019), which breaks down health-related stigma into drivers of stigma, which may vary depending on type of illness, including deviation from social norms seen in chronic illnesses, fear of infection, or belief that the person is responsible for the illness (i.e., blame). Drivers manifest as negative social experiences (e.g., social rejection) and internalized stigma, contributing to worse health outcomes.

Chronic pain is characterized as an invisible illness, as there are often no external markers indicating to others that the person is living with a chronic health condition (Crowe et al., 2017; Dow et al., 2012; Kempner et al., 2017; Monsivais, 2013). Invisible illnesses are therefore highly contestable, making people living with such illnesses vulnerable to social doubt and stigma, as others may not understand or believe the nature of their symptoms (Armentor, 2017; Joachim & Acorn, 2000). Indeed, there is evidence that individuals who lack a clear biomedical pathology to explain their pain symptoms are at even greater risk of stigma and social exclusion (De Ruddere et al., 2016; De Ruddere et al., 2013; De Ruddere et al., 2012; Karos et al., 2018). In accordance with the health stigma and discrimination framework, the chronicity, invisibility, and contestability of chronic pain can be understood as drivers of stigma that give rise to negative social responses. As a result, chronic pain is often considered a stigmatized condition that entails unique social challenges (De Ruddere & Craig, 2016; Scott et al., 2019).

Experiences of health-related stigma have injurious implications for mental health. Social status theories suggest that disruptions in social status due to stigma can lead to depressed mood (Gilbert & McGuire, 1998; Gilbert & Trower, 1990; Gruenewald, Dickerson, & Kemeny, 2007; Price et al., 1994). Studies across numerous health conditions have found a consistent

relationship between perceived stigma and depressive symptoms (Crockett et al., 2019; Gonzalez & Jacobsen, 2012; Logie et al., 2012; Mickelson, 2001; Sehlo & Bahlas, 2013; Tao et al., 2017). For instance, in a recent study with HIV-positive Chinese men who have sex with men, a one point increase in endorsement of perceived stigma resulted in a 4% increased likelihood of depression (Tao et al., 2017). In patients with chronic pain, one study found that 38% of people experienced stigmatizing social interactions and adopted those stigmatizing attitudes toward themselves, which was, in turn, negatively associated with self-esteem and pain self-efficacy (Waugh et al., 2014). Another recent study with a chronic pain sample demonstrated that reports of stigma related to one's illness were associated with worse daily functioning and greater levels of depression, even after controlling for demographic factors and pain intensity (Scott et al., 2019). Consequently, stigma is an important psychosocial factor to attend to in the relationship between chronic pain and depression.

Understanding stigma and the nature of stigmatizing experiences as they relate to health is therefore essential to improving patient outcomes. However, "stigma" is an ambiguous concept that can take many forms. For example, some studies have referred to stigma as discrimination (Crockett et al., 2019; Slade et al., 2009), while others argue the concept of stigma should be differentiated from explicit acts of discrimination, and should instead refer to processes of social "othering, blaming, and shaming" (Deacon, 2006). Importantly, not all types of stigmatizing experiences explored in the health literature are pertinent to the experience of living with chronic pain. It is therefore helpful to identify how stigma manifests in chronic pain contexts specifically.

1.1.1. Invalidation: A Common Stigmatizing Response to Chronic Pain

Numerous studies indicate that individuals with chronic pain routinely face misunderstanding and social stigma that denies the legitimacy of their pain (Broom et al., 2015; De Ruddere & Craig, 2016; Glenton, 2003; Holloway et al., 2007; Honkasalo, 2001; Jackson, 2005; Lillrank, 2003; "My Life as a Heartsink Patient: Living with Chronic Pain.," 2011; Nguyen et al., 2012; Slade et al., 2009; Toye et al., 2013; Werner et al., 2004; Werner & Malterud, 2003). Stigmatizing experiences described by those with chronic pain predominantly consist of being misunderstood (Harding et al., 2005), disbelieved (Carr et al., 2017; De Ruddere & Craig, 2016; Newton et al., 2013; Nicola et al., 2021), and consequently treated or judged unfairly (Eccleston et al., 1997; McParland et al., 2011; MacParland & Knussen, 2010; Sullivan et al., 2008). Many of those living with pain lack a clear biomedical explanation for their symptoms, or experience pain that is disproportionate to an observable physical injury, which also makes it easier for others to doubt or question their pain experience (May et al., 2000; Stone, 2014). As time goes on without medical explanation or reprieve, patients with chronic pain often report ongoing struggles to appear credible to healthcare providers and loved ones (Dow et al., 2012; Werner & Malterud, 2003). As Kleinman (1988, p.57) writes, "If there is a single experience shared by virtually all chronic pain patients it is that at some point those around them – chiefly practitioners, but also at times family members – come to question the authenticity of the patient's experience of pain." Contending with contestation from others is therefore a common experience among those living with chronic pain conditions.

Given the above evidence, the construct of invalidation may better capture stigmatizing responses specific to chronic pain than the broader concept of stigma, as it reflects patient perceptions that their chronic pain condition is not recognized, understood, or considered

legitimate by the social environment (Kool et al., 2010; Santiago et al., 2017). Invalidation has recently received attention as a form of stigmatization especially pertinent to chronic pain (Cameron et al., 2018; Kool et al., 2010; Molzof et al., 2020; Santiago et al., 2017). The construct of invalidation is comprised of two dimensions: discounting a person's experience, and not understanding it (Kool et al., 2010). Discounting captures negative responses and social rejection, including actively disbelieving, criticizing, dismissing, or questioning the legitimacy of pain-related struggles and limitations (Santiago et al., 2017). Lack of understanding generally reflects an absence of positive responses to a person's reports of pain, including failure to recognize or comprehend the pain experience and failure to provide emotional support.

Invalidation is emerging as an important factor related to health outcomes in chronic pain samples (Blom et al., 2012; Kool & Greenen, 2012; Molzof et al., 2020). Importantly, research suggests that invalidation is common across diverse pain conditions for both women and men (Kool et al., 2014; Santiago et al., 2017), suggesting that invalidation is pervasive among those living with chronic pain. In particular, the factor of discounting is shown to have especially harmful effects on both physical and mental health (Ghavidel-Parsa et al., 2015; Kool et al., 2010; Kool et al., 2013). For example, higher reported rates of discounting are associated with greater disability due to pain (Molzof et al., 2020; Wernicke, Huberts, & Wippert, 2017), greater pain severity (Kool et al., 2010; Kool et al., 2013; Molzof et al., 2020), increased loneliness (Kool & Geenen, 2012), diminished pain acceptance and self-efficacy (Cameron et al., 2018), and greater depressive symptoms (Molzof et al., 2020). Social responses that serve to discount a person's pain are therefore especially harmful forms of invalidation. As a result, it is important to focus on experiences of pain discounting within chronic pain populations and to identify mechanisms that facilitate the relationship between discounting and depressive symptoms.

1.2. Shame as a Potential Mediator of Stigma and Mental Health Outcomes

Evidence cited above demonstrates that stigmatizing social experiences related to illness are linked to a greater likelihood of depression, but how this occurs remains an open question. In studies across diverse medical conditions, various possible pathways have been explored to explain the relationship between stigma and depression, including general increases in negative affect as well as maladaptive coping such as behavioural avoidance (Himmelstein et al., 2018; Koball & Carels, 2011). Yet, little is known about the mechanisms through which social invalidation of chronic pain contributes to negative mental health outcomes.

Recent theoretical research has highlighted the need to integrate affective science into studies on social relationships and health, as emotion may play a critical role in constituting a pathway through which social relationships can impact health outcomes (Farrell et al., 2018; Sbarra & Coan, 2018). There is strong evidence for the relationship between emotions and health broadly. Negative emotions are commonly associated with worse health outcomes (Kubzansky & Kawachi, 2000), while positive emotions have demonstrated protective effects across diverse health conditions (Fredrickson & Levenson, 1998; Stellar et al., 2015). Importantly, emotions are shaped by and recursively intertwined with social relationships (Sbarra & Coan, 2018; Smith & Weihs, 2019). In a recent model elucidating the interaction of social relationships, affect, and health, Sbarra & Coan (2018) suggest that emotions are elicited in response to cognitive appraisals of social resources; negative emotions emerge when social resources are perceived to be limited or harmful, which in turn negatively impact health. This theoretical model, in conjunction with strong empirical evidence, makes emotion a rich arena to explore for potential mechanisms linking relationships with health outcomes.

One possible affective mediator that has received limited attention in the health literature broadly, and none in the context of chronic pain, is that of shame. Shame is a painful self-conscious emotion consisting of a global negative evaluation of the self (Tangney et al., 1992; Tangney & Tracy, 2011). In theories of emotion, shame is categorized as a social emotion, in that it is formulated in response to the perceived or anticipated actions, thoughts, or feelings of others (Tangney & Tracy, 2011). It is also a moral emotion as it attributes blame to oneself for a perceived or actual moral failing (Haidt, 2003; Stuewig et al., 2010; Tangney et al., 2007). Shame is often differentiated from the closely related self-conscious emotion of guilt, in that it is directed toward the self, while guilt is typically oriented toward a specific action or transgression committed (Tangney & Tracy, 2011). This distinction is important, as research shows that shame but not guilt is associated with greater likelihood of psychopathology and distress (Averill et al., 2002; LeBlanc et al., 2020; Pineles et al., 2006; Tangney et al., 1992; Wong & Tsai, 2007). In particular, shame is a strong predictor of depression and worse health outcomes across multiple contexts and health conditions (Andrews, Qian, & Valentine, 2002; Bennett et al, 2016; Gambin & Sharp, 2018; Kim, Thibodeau, & Jorgensen, 2011; Tangney, Burggraf, & Wagner, 1995; Tangney, Wagner, & Gramzow, 1992; Weingarden et al., 2016). For instance, research shows that feelings of shame are associated with depressive symptoms, less healthcare utilization, and poorer physical health among persons living with HIV (Bennett et al., 2016).

Despite its association with negative mental health outcomes, shame has remained generally overlooked in medical contexts. Aaron Lazare identified shame as an important factor for those living with and adjusting to health conditions in the late 1980s (Lazare, 1987), but this work was largely neglected until a recent resurgence of interest in shame-specific research (Dolezal, 2015; Harris & Darby, 2009). Recent theoretical work has called for a greater focus on

shame as a possible affective determinant of health, as shame is associated with biological processes including proinflammatory immune activity (Dickerson et al., 2004; Rohleder et al., 2008; Tracy et al., 2007) as well as avoidance patterns that impede health behaviours and social connectedness (Dolezal & Lyons, 2017).

Importantly, shame is identified as a common emotional response to stigmatizing, invalidating, and de-legitimizing health-related experiences (Bennett et al., 2016; Dolezal & Lyons, 2017; Luoma & Platt, 2015; Shaughnessy, 2018). Yet, shame still generally remains underacknowledged in studies on stigma and health (Scheff, 2003, 2014). This omission may be a result of the common conceptual elision of shame within the notion of "internalized stigma," an inconsistently defined construct that aims to capture stigma-induced feelings of worthlessness or inferiority (Bennett et al., 2016; Waugh et al., 2014). Unfortunately, internalized stigma is often defined and measured in diverse ways, with measures partially capturing feelings of shame but also other constructs such as stereotype endorsement and experiences of discrimination (Bennett et al., 2016). For example, one study with a chronic pain population examined rates of "internalized stigma," which was measured by endorsement of types of discriminatory experiences, acceptance of stereotyped views of persons with pain, as well as social withdrawal and alienation, which included some items specific to shame (Waugh et al., 2014). Similarly, Scott and colleagues (2019) assessed stigma in a chronic pain sample using a measure that captures both enacted stigma (i.e., stigmatizing actions of others), and internalized stigma (i.e., feelings of embarrassment and social alienation). Such measures conflate experiences of stigma with reactions to those experiences. Measuring shame directly results in greater specificity regarding relationships between discrete components of internalized stigma and harmful outcomes.

Conceptually cleaving shame from stigma and examining it as possible mediator is beneficial for two reasons. First, stigmatizing experiences may not always result in feelings of shame. According to models of self-stigma, stigmatizing responses from others are only harmful when the individual agrees with and applies stigmatizing attitudes to the self (De Ruddere & Craig, 2016). This is consistent with models of social relationships and emotions, wherein emotional responses are first determined by cognitive appraisals of the social situation (Sbarra & Coan, 2018). Shame is therefore only a potential consequence of stigma, and as such, may be a more proximal and informative predictor for the negative sequelae of stigmatizing experiences (Lewis, 1995; Bennett et al., 2016). Second, shame may be more easily targeted than stigma in clinical treatment (Luoma & Platt, 2015; cf. Weiss et al., 2006). Clinicians can focus on helping patients learn to adaptively cope with common invalidating responses from various social sources by reducing feelings of shame, potentially interrupting the link between stigma and depression.

1.2.1. The Current State of Research on Shame in Chronic Pain Populations

A recent model synthesizing social factors related to pain suggests that chronic pain can be understood as an assault on the social self by interfering with three key domains: one's interpersonal need for social belonging, intrapersonal need for personal autonomy, and moral need for justice or fairness (Karos et al., 2018). As a social, self-conscious, moral emotion that sits at the intersection of interpersonal, intrapersonal, and moral domains, shame may be an especially salient emotion for research on health conditions that threaten the social self, such as chronic pain (Bailly et al., 2014; Dickerson et al., 2004; Dolezal & Lyons, 2017).

Given the prevalence of stigma in chronic pain experiences, it is unsurprising that shame consistently emerges as a theme in qualitative studies of chronic pain (Bailly et al., 2014; Broom

et al., 2015; Dow et al., 2012; Gustafsson et al., 2004; Honkasalo, 2001; Munday et al., 2019; Werner et al., 2004; Werner & Malterud, 2003). For example, in a study on musculoskeletal pain patient outcomes one year after a rehabilitation program, the most common theme to emerge from patient reports was experiencing a transition from feelings of shame upon entering the program to feelings of self-respect (Gustafsson et al., 2004). In interviews (Werner et al., 2004; Werner & Malterud, 2003) and diary studies (Broom et al., 2015) of women living with chronic pain, reports of shame emerge due to stigmatizing social responses and challenges with being believed by others. Further research shows that, in the absence of an alternative explanation for pain symptoms, patients with chronic pain may come to view their pain as a function of a personal characterological flaw (Smith & Osborn, 2007) or their own failure to be "successfully ill" within a biomedical model that emphasizes recovery (Nettleton, 2006; Slade et al., 2009; Wong & Tsai, 2007), making shame a common experience for those with chronic pain.

However, very few quantitative studies have examined shame in the context of chronic pain. Only two were found that directly examined shame in chronic pain populations (ten Klooster et al., 2014; Turner-Cobb et al., 2015). Both studies investigated whether shame proneness (i.e., the general tendency to feel shame across various circumstances) was elevated within chronic pain populations compared to normal controls, with conflicting results. Turner-Cobb and colleagues (2015) found that a group of individuals with diverse conditions of musculoskeletal pain had significantly elevated rates of self-conscious emotions, including shame proneness, compared to normal controls, indicating that self-conscious emotions warrant further investigation across chronic pain conditions. Contrastingly, ten Klooster and colleagues (2014) found that patients with rheumatoid arthritis (RA) reported levels of shame proneness that were not significantly different from pain-free control groups, which may be because rheumatoid

arthritis is generally more socially understood and accepted compared to other chronic pain conditions. However, ten Klooster and colleagues (2014) did find that shame proneness was associated with greater self-blame among the RA sample, which has been linked with depression (Tabriz et al., 2019; Weickgenant et al., 1993; Wong et al., 2011) and greater pain severity (Tse, Wan, & Wong, 2013) among people with chronic pain. As shame proneness may be an imprecise way to measure shame that stems from the chronic pain experience itself, the current study measured shame *specifically related to a person's chronic pain.*

1.3. Social Support as a Buffer Against Invalidation

Broadly speaking, social support refers to the perception or actual presence of being cared for, receiving assistance when needed from others, and belonging to a social network. Research over recent decades has consistently shown that availability of social support and subjective feelings of social connectedness are major predictors of better health outcomes across health conditions (Pietromonaco & Collins, 2017). Empirical research provides evidence for the stress-buffering hypothesis of social support, which suggests that perceived social support can weaken the relationship between a perceived stressor and negative health outcomes by providing interpersonal resources that enable effective coping (Cohen, 2004; Cohen & Wills, 1985; Penn et al., 2019). Therefore, social support may be an important protective factor against social stressors such as social invalidation in relation to chronic pain experiences.

Amongst those with chronic pain, social support is associated with numerous benefits (Demange et al., 2004; Neugebauer & Katz, 2004) including less pain interference (Penn et al., 2019), more adaptive coping strategies (e.g., cognitive reframing and emotional expression; Holtzman, Newth, & DeLongis, 2004), diminished pain and pain catastrophizing (Holtzman & DeLongis, 2007), and greater autonomy, which in turn promotes greater self-efficacy (Matos et

al., 2017). In particular, evidence shows that social support is a key factor to help protect against depression for people living with chronic pain (McKillop et al., 2017; Rao et al., 2012; Van Dyke et al., 2018). For instance, in a longitudinal study over a period of six months with individuals living with chronic pain, those who endorsed experiencing more companionship and emotional support from others reported a decrease in depressive symptoms (Van Dyke et al., 2018). Outside the pain literature, studies have found that greater social support can diminish the strength of the relationship between perceived stigma and depression in diverse samples, including parents of special needs children (Mickelson, 2001), people with various mental health conditions (Kondrat et al., 2017), patients seeking treatment for addiction (Birtel, Wood, & Kempa, 2017; Cooper & Nielsen, 2017), and patients living with HIV (Casale et al., 2019; Rao et al., 2012).

Given the above evidence of the protective effects of social support against harmful consequences of stigma and depressive outcomes, people with chronic pain who feel they have adequate social support may have some protection against the negative sequalae of invalidating social encounters. Yet, to date, very little research has been done on the buffering effects of social support related to chronic pain invalidation. Kool and colleagues (2013) found that perceived social support moderated the relationship between invalidation from family members and worse mental health outcomes, but did not find the same effects for invalidation from other social sources. Further research on the protective effects of perceived social support for invalidation related specifically to depressive symptoms and feelings of shame about one's pain condition is needed. Hence, the current study examined moderating effects of perceived social support on outcomes of pain-related shame and depressive symptoms associated with social discounting of a person's pain.

1.3.1. Unique Sources of Social Support: Exploring Similar Others

While previous research points to a protective role of strong, supportive relationships in the face of stigma and invalidation (Penn et al., 2019; Rao et al., 2012), there is still much to be learned about the type of support that would be most helpful in this context. Research increasingly indicates that health outcomes may be differently impacted depending on the source of social support (Masters et al., 2007; Pow et al., 2018). Among those with chronic illness, social support typically comes from one's close social network, such as friends, family, and healthcare providers. Yet these are the very sources of social invalidation often reported by those with chronic pain. Indeed, studies show that invalidating responses from one's spouse have the worst effects on pain outcomes (Burns et al., 2018, 2019; Kool et al., 2013), and those who experience invalidation from their healthcare providers are less likely to trust their medical team (Homma et al., 2018). A recent study demonstrated that more perceived discounting by family members was associated with greater pain severity, disability, and depression when compared to other sources of invalidation (Molzof et al., 2020). Because invalidation is common within people's given social networks, it may be important to examine alternative sources of social support for those living with pain. Among those with pain and other stigmatized illnesses, support from experientially similar others may be particularly beneficial resource for understanding and validation that offsets invalidation experienced elsewhere (Guan & So, 2016; Pflum et al., 2015).

The social identity model for understanding the influence of social relationships on health outcomes suggests that the extent to which an individual identifies with a person or group providing support will play a role in how that support is received (Haslam et al., 2009). By sharing in a social identity, the support provider may have greater insight into the receiver's lived

experience, while the receiver may be more willing to trust the provider (Guan & So, 2016; Haslam et al., 2009). Research supports the idea that there is a positive correlation between perceived social support and perceived social similarity. For example, in a study with patients under stress after heart surgery, Haslam and colleagues (2009) found that the more a person personally identified with the social identity of the individual or group providing support, the more they felt supported.

Evidence suggests that individuals living with chronic illnesses can uniquely benefit from social support provided by experientially similar others, meaning others who have also lived with the same illness (Gage, 2013; Thoits, 2011), either informally or formally through peer support programs (Bernardes et al., 2017; Cooper et al., 2020; Fisher et al., 2014; Gage-Bouchard et al., 2017; Schwarz, 2015). One randomized controlled trial with individuals managing arthritis pain found that those who received an intervention involving peer support had improved health-directed behaviours, skill acquisition, and stiffness compared to controls (Crotty et al., 2009). Support from similar others is also identified as being especially important and effective for those facing stigma (Frost et al., 2016; Pflum et al., 2015). Individuals belonging to stigmatized groups can connect with others who share in that group identity and therefore better understand the realities of stigma and its harmful effects. In a study with a women's peer support group for fibromyalgia, participants reported feeling heard, believed, and understood by their peers in ways that were otherwise lacking in their social worlds (Sallinen et al., 2011). Social support from experientially similar peers may therefore be especially pertinent in the context of pain, as both a stigmatized and chronic illness.

Yet, a recent review of informal social support studies for chronic pain revealed that a minority of studies examine social support as a buffer or moderator in general, and moderating

effects of peer support specifically remains understudied (Bernardes et al., 2017). Similar others are not commonly included in measures of social support, contributing to the paucity of research regarding the nature and prevalence of informal peer support for people with chronic pain. The unique impacts of social support from peers with chronic pain remains understudied, particularly outside of formal support groups. Specifically, it is currently unknown whether peer support can effectively mitigate the harmful impacts of invalidation, despite peers being an especially promising resource for validation and understanding. This study investigated whether social support from others living with chronic pain additionally attenuates the relationship between invalidation and associated harmful outcomes of pain-specific shame and depressive symptoms.

1.4. Specific Aims and Hypotheses

The overarching goal of the current study was to address current gaps in the literature regarding affective mechanisms linking stigma and depression in chronic pain, as well as protective social factors. The **first specific aim** was to determine whether pain discounting is associated with depressive symptoms among patients with chronic pain, and to examine pain-related shame as a potential mediator of this relationship. The following two hypotheses were put forth:

H1: Higher levels of pain-related invalidation in the form of discounting are expected to be associated with greater depressive symptoms

H2: Pain-related shame will mediate the relationship between discounting and depressive symptoms

The **second specific aim** was to examine whether general and peer-specific support would buffer the harmful effects of pain discounting on pain-related shame and depressive symptoms. There is currently insufficient data in the literature regarding the nature and availability of peer support

for people with chronic pain. As such, the hypotheses related to peer support were considered exploratory. All hypotheses of this study were pre-registered with Open Science Framework (OSF).

H3: General perceived availability of social support will moderate the relationship between discounting and depressive symptoms such that higher rates of perceived social support will diminish the strength of the association between discounting and depressive symptoms.

H4: General perceived availability of social support will moderate the relationship between discounting and pain-related shame such that higher rates of perceived social support will diminish the strength of the association between discounting and pain-related shame.

H5: Perceived availability of support from peers with pain will moderate the relationship between discounting and depressive symptoms, such that higher rates of perceived peer support will diminish the strength of the association between discounting and depressive symptoms.

H6: Perceived availability of support from peers with pain will moderate the relationship between discounting and pain-related shame, such that higher rates of perceived peer support will diminish the strength of the association between discounting and pain-related shame.

Chapter 2: Research Study

2.1 Methods

2.1.1 Participant Recruitment and Data Collection

Data collection began November 1, 2020 and concluded March 30, 2021. Based on prior power analysis, the proposed analytic model required a minimum of 220 participants to achieve an estimated power of .80. It was therefore decided that data collection would stop on March 31, unless the minimum target sample of 220 had not been achieved, in which case data collection would stop only when that target number was collected. By March 31, 2021, recruitment had exceeded the minimum target sample, so data collection was stopped.

Through a community-based partnership, participants were recruited from a network of four local outpatient medical clinics in the Okanagan valley, British Columbia, specializing in the treatment of chronic pain. As part of this partnership, the study author developed and implemented a research registry housed in the coordinating clinic and trained a small team of volunteers to invite patients to add their contact information to the registry in order to be contacted about ongoing research opportunities. Two recruitment strategies were then employed. The first strategy involved placing recruitment posters and brochures in the clinic waiting rooms. The second strategy involved directly emailing or phoning clinic patients (based on their preferred method of contact) who had previously expressed interest and willingness to be added to the clinic research registry. A total of 729 potential participants were contacted directly via email or telephone inviting them to participate in the survey. Additional participants may have been recruited through posters and brochures available in recruitment site clinics. To be included in the current study, participants were required to have chronic pain (i.e., pain for at least 12 weeks), be at least 18 years old, and be fluent in English. There were no exclusion criteria.

2.1.2 Procedure

This study employed a cross-sectional survey design. After providing informed consent, participants completed a survey comprised of demographic questions (e.g., age, employment status, marital status, education history, gender, ethnicity) and standardized, validated questionnaires of psychological, emotional, and physical health outcomes. Participants were given the option to complete an online or paper-and-pencil version of the survey. Four participants completed paper-pencil versions, and the remainder of respondents responded online. Upon completion of the survey, participants were given the option to enter their name into a draw for one of three $100 CAD Amazon gift cards.

2.1.3 Measures

2.1.3.1. Outcome Variable: Depressive Symptoms

Beck Depression Inventory II. The BDI-II (Beck, Steer, & Brown, 1996) is a 21-item self-report inventory designed to capture symptoms of depression such as hopelessness, fatigue, and concentration difficulties. Items are rated on a scale of 0 to 3, with 0 indicating the absence of a symptom, and 3 indicating the most severe possible level of a symptom. For example, respondents are given the following options to rate their level of sadness: "0. I do not feel sad; 1. I feel sad much of the time; 2. I am sad all the time; 3. I am so sad or unhappy that I can't stand it." Item numbers 16 and 18 have additional options to assess bi-directional changes in eating and sleeping patterns. For example, response options include responses indicating increases in eating behaviours or decreases in eating behaviours. Total summed scale scores range from 0-63 and are grouped as minimal (0-13), mild (14-19), moderate (20-28), or severe (29-63) (Beck, Steer, & Brown, 1996).

The BDI-II is one of the most widely used measures to assess depressive symptoms across diverse populations worldwide (McDowell, 2006; Wang & Gorenstein, 2013) . The BDI-II was developed in 1996 (Beck, Steer, & Brown, 1996), which was a revision of the original 1961 BDI (Beck et al., 1961) to be consistent with evolutions in diagnostic criteria and conceptualizations of depression (Wang & Gorenstein, 2013). In terms of psychometric properties, a meta-analysis of studies using the BDI-II found the measure to have strong internal consistency of 0.90 and good retest reliability, ranging from 0.73 to 0.96 (Wang & Gorenstein, 2013). Overall, empirical literature supports the BDI-II as an effective measure of depressive symptoms with good construct validity and reliability across settings (Dozois, Dobson, & Ahnberg, 1998; Wang & Gorenstein, 2013). In this study, the BDI-II demonstrated excellent internal reliability consistent with previous research ($\alpha = .93$).

2.1.3.2. Independent Variable: Invalidation (Discounting)

The Illness Invalidation Inventory (3*I). The Illness Invalidation Inventory was designed to capture perceptions of invalidating social responses to a person's illness (Kool et al., 2010). The measure is intended to be applicable across a wide range of medical conditions, but it was developed and validated specifically using chronic pain populations (Kool et al., 2010). It is a 40-item measure, with eight items identifying illness invalidation from five different social sources (spouse, family, medical professionals, work environment, and social services). Participants rate perceived frequency of invalidating experiences on a Likert scale from 1 to 5, with 1 indicating "Never" and 5 indicating "Very Often." Participants are instructed to skip social subscales that do not apply to them (e.g., a person without a spouse may skip the subscale dedicated to invalidation from one's spouse).

The Illness Invalidation Inventory measures two factors. The first is discounting, which captures active denial or doubt regarding the legitimacy of a person's pain experience (e.g. "… makes me feel like I am an exaggerator" and "… thinks I can work more than I do."). The second factor is a lack of understanding, which shows an absence of positive social responses to the person's pain experience (e.g., "… gives me the chance to talk about what is on my mind" (reverse scored)).

For this study, the discounting factor was used as the predictor variable, which was calculated as the mean score of items on the discounting subscale. A discounting score was calculated for every participant that completed at least two of the social source subscales. Although previous studies have required completion of at least three social source subscales (Cameron et al., 2018; Kool et al., 2013), this approach would have led us to disproportionately exclude single or unmarried individuals from our study sample (i.e., because the spouse subscale was the third most skipped subscale).

Studies show that the Illness Invalidation Inventory demonstrates good reliability and shows strong invariance across genders (Kool et al., 2014). A recent study validated the Illness Invalidation Inventory in an American chronic low back pain population and found that it demonstrated excellent construct validity (Molzof et al., 2020). The discounting measure demonstrated excellent internal reliability in the current study ($\alpha = .93$).

2.1.3.3. Mediator: Pain-Related Shame

Chronic Illness Related Shame Scale (CISS). The CISS (Trindade et al., 2017) is a 7-item self-report measure intended to capture feelings of shame specifically related to chronic illness (e.g., "I'm ashamed of talking with others about my illness or symptoms," and "I feel

inadequate because of my illness and symptoms"). For the purposes of this study, wording of items were altered to specifically tap into shame about chronic pain (e.g., "I'm insecure due to my chronic pain"). Items are rated on a Likert scale from 0 ("never true") to 4 ("always true") which are summed to produce scale scores with a possible range of 0-28. The CISS has shown strong construct reliability across samples and good convergent validity (Trindade et al., 2017). The CISS displayed excellent internal reliability in this study (α = .93).

2.1.3.4. Moderators: Perceived Social Support (General and Peers with Pain)

Multidimensional Scale of Perceived Social Support (MSPSS - original). The MSPSS (Zimet et al., 1988) is a commonly used measure of perceived social support. Participants rate levels of social support from three different sources: family, friends, and significant other. Twelve items (four for each support source) are rated on a 7-point Likert scale ranging from 1 = very strongly disagree to 7 = very strongly agree (e.g., "I get the emotional help and support I need from my family," "I can talk about my problems with my friends"). Total scores are summed and range from a possible 12 to 84. The initial study found that the measure demonstrated good internal reliability, with coefficient alphas for the subscales and scale as a whole ranging from .85 to .91 (Zimet et al., 1988). A second study extended the use of the MSPSS with diverse clinical samples and similarly found consistently strong internal reliability and underlying factor structure, confirming construct validity (Zimet et al., 1990). Cronbach's alpha of the MSPSS in this study (α = .93) was consistent with previous research.

Multidimensional Scale of Perceived Social Support - Peers (MSPSS - Peers). To assess perceived support from similar others (i.e., peers with pain), the MSPSS was adapted by replacing the source of support with "others with pain." All items from the original MSPSS were

included, with duplicates removed (e.g., "I can talk about my problems" is asked with respect to both friends and family in the original MSPSS), resulting in a scale of 9 items. Thus, the adapted measure scale scores have a possible range of 9-63. Cronbach's alpha for the measure of MSPSS - Peers in this sample indicated excellent internal reliability (α = .96), similar to the internal reliability of the original MSPSS measure found across studies with clinical samples (α = .92 to .94; Clara et al., 2003; Zimet et al., 1990; Zimet et al., 1988). As addendum to this modified version of the MSPSS, patients were asked to describe who these similar others with pain are within their social network (e.g., family member, friend, peer support group, online community).

2.1.3.5. Control variables: Pain severity and Gender

Brief Pain Inventory – Short Form (BPI-SF). The BPI-SF (Cleeland, 1989) has demonstrated reliability and validity across populations of patients with diverse chronic pain conditions (Mendoza et al., 2005; Tan et al., 2004; Zelman et al., 2005). It measures levels of severity of pain as well as rates of interference in multiple domains of life due to pain. The subscale of pain severity used in this study is captured as the average of four items that ask about worst, least, and average levels of pain within the past week, as well as respondents' current pain. These items are rated on a scale from 0 to 10, with 0 indicating "no pain at all" and 10 indicating "worst pain imaginable." Higher scores reflect greater levels of pain severity. Cronbach's alpha for the pain severity subscale of the BPI-SF in this sample demonstrated good internal reliability (α = .88).

Gender. Gender was assessed by asking participants to select how they self-identify, with options to select "Female," "Male," "Non-binary," or "Prefer to self-describe." Participants who preferred to self-describe were able to provide a written description of their preferred gender identity.

2.2 Statistical Analysis Plan

Study methods and hypotheses were pre-registered with Open Science Framework (OSF; osf.io/xvpu8). Descriptive analyses were conducted in order to capture demographic characteristics of the study sample and properties of main study variables within this sample. Bivariate analyses investigated correlations among main variables to ensure that relationships present between the variables were appropriate for the main study analyses.

To test Hypotheses 1 and 2, a simple mediation analysis was conducted in SPSS using the PROCESS plug-in (PROCESS, Model 4; Hayes, 2018). Discounting was entered as the predictor variable, pain-related shame as the mediating variable, and depressive symptoms as the outcome variable. Bootstrapping was used to simultaneously test the indirect effects of the mediator (Hayes, 2018). For 5000 bootstrap samples, results are considered statistically significant when the 95% confidence intervals do not include zero.

Moderating effects were then examined using moderated mediation analysis (also known as conditional process modeling) using PROCESS in SPSS v.26 (Model 8; Hayes, 2018) to test Hypotheses 3 and 4. Moderated mediation analysis determines whether a variable affects outcomes through a third, mediating variable, and whether those relationships change as a function of another, moderating variable. For this study, the moderated mediation model tested: direct effects of discounting on depressive symptoms and indirect effects mediated by pain-related shame; direct associations between perceived social support, pain-related shame, and depressive symptoms; and moderating effects of perceived social support. This analysis identified whether the strength or size of the relationship of discounting and depressive symptoms changed as a function of general perceived social support (conditional direct effect). The analysis also explored whether the strength of the relationship between discounting and pai-related shame changed as a function of general perceived social support (conditional indirect

effect). A parallel moderated mediation model was then run with perceived social support from peers with pain as the moderator to test the exploratory Hypotheses 5 and 6 of whether perceived peer support moderates the relationships between discounting and shame as well as discounting and depressive symptoms.

For all analyses, predictor variables were centered. Analyses also controlled for pain severity. Although gender was initially proposed as a possible covariate, it was not included in the main analyses because bivariate correlations demonstrated that gender was not associated with the main outcome of depressive symptoms (described below). Consequently, only pain severity was included as a control variable.

2.3 Results

2.3.1 Data Cleaning

In total, 335 participants completed the online consent procedures and began the survey. Main study variables were front-loaded within the structure of the survey. Participants who stopped filling out the survey before answering all main study variable measures were removed from the study analyses, reducing the number of cases from 335 to 312.

The full dataset was then assessed for accuracy by checking that all data points within each item fell within the expected range of their respective measures. No data point was greater than the highest possible value, and no data point was lower than the lowest possible value for all measures examined within the study. Patterns of responses were also initially checked visually to ensure there were no cases of "careless" responding (i.e., answering with the same answer for all questions or taking an unreasonably short amount of time to complete the survey). Responses did not appear to display careless responding.

2.3.1.1. Consideration of missing data. The amount and pattern of missing data was evaluated. Data that is missing randomly within a dataset is less problematic than data that is missing according to a pattern (i.e., non-randomly; Tabachnick & Fidell, 2013). Data that is missing non-randomly may indicate bias within the dataset because it suggests that participants sharing in a characteristic are missing more data than those without that characteristic. To test whether data were missing randomly, a Little's MCAR test was conducted in SPSS. The results were not significant (p = .68), indicating that the data were missing completely at random (Little, 1988). Overall, only 0.009% of items were missing from the dataset. When data are missing completely at random and a very small amount of data are missing (typical guidelines suggest less than 5% overall), a single imputation using the expectation maximization algorithm is considered an appropriate method that provides unbiased parameter estimates (Enders, 2001; Scheffer, 2002). Therefore, missing data were imputed with the expectation maximization method using Missing Values Analysis in SPSS 26.0.

2.3.1.2. Consideration of univariate outliers and normality. Univariate outliers are cases with an extreme value on one variable, which should be addressed due to their potential to distort outcomes in statistical analyses (Tabachnick & Fidell, 2013). Cases with standardized scores greater than z = 3.29 on study variables were considered to be univariate outliers (Tabachnick & Fidell, 2013). To assess for possible outliers, graphical methods in SPSS were used by creating box plots. Two cases were found to deviate from the suggested cut-off and were investigated. One case was identified as a significant univariate outlier on the BDI-II scale. To retain the case's original position in the distribution while attaining continuity with the rest of the scores, the unstandardized score was adjusted to be one unit higher than the next highest value on this scale (Tabachnick & Fidell, 2013). The same was done for one case that was identified as

a univariate outlier on the discounting subscale. The main study analyses were run with original scores and then re-run with the adjusted scores. As the results remained virtually identical, original scores for these two univariate outliers were retained.

A cluster of eight outliers were identified on the low end of the general social support scale; however, visual inspection of the data suggested that these outliers were a continuous part of the normal distribution for this scale and skewness/kurtosis scores were well within the acceptable range (see below). Considering that the data were collected during the COVID-19 pandemic and in a chronically ill population, low scores on perceived support were not unexpected. Thus data points were retained in their original form in the current analyses.

When examining normality, Tabachnick and Fidell (2013) suggest that, for large samples, it is best to review the absolute values of skewness and kurtosis as well as visually examine histograms. For all scales within the study, no absolute skew or kurtosis value was over 1, indicating normal distributions (Byrne, 2010; Hair, 2010; West, Finch, & Curran, 1995). Further visual examination of the histograms confirmed that distributions were normal.

2.3.1.3. Consideration of multivariate outliers. Multivariate outliers were investigated using Mahalanobis distances with a chi-square critical value of $p < .001$ (Tabachnick & Fidell, 2013). Based on this criterion, four cases were found to be multivariate outliers, which is not unexpected in larger samples (Tabachnick & Fidell, 2013). Study analyses were run with these four cases included, and then re-run with the four cases excluded, to explore whether these multivariate outliers significantly altered results. Results were not notably different, so the multivariate outliers were retained within the final analysis.

2.3.2 Sample Characteristics

Following data cleaning of the 312 cases, two cases that completed less than two social source subscales on the Illness Invalidation Inventory and five cases that did not complete the pain severity scale were omitted from analyses. As a result, descriptive and main study analyses were run with 305 participants. Because a smaller number of people endorsed having peers with pain in their social network, the exploratory moderated mediation analysis exploring peer support was conducted with 245 participants.

The majority of the 305 participants in the current study were recruited from the coordinating pain clinic, Bill Nelems Pain and Research Centre in Kelowna (91.7%). Remaining respondents were recruited from the Vernon Interventional Pain Clinic (6.0%), Penticton Regional Hospital (0.3%), and the Salmon Arm Pain Clinic (2.0%). Detailed sample characteristics are reported in Table 1. Participants were predominantly white (92.8%), female (73.1%), and retired (29.5%) or on medical leave or disability (25.6%). The average age of participants was 55.64 years old (*SD* = 13.59, range = 18-89). The average rating of pain severity among the sample was 5.56 (*SD* = 1.73) indicating moderate levels of pain on average in this sample. Participants endorsed a range of events that contributed to their chronic pain and were able to indicate more than one type of contributing event. The majority of the sample (82%) reported that their pain began or worsened following an injury, including workplace injuries, sports injuries, or injuries related to a motor vehicle accident. The next most common event contributing to pain involved health conditions such as cancer, other chronic illnesses, or surgery, endorsed by 48.5% of the sample. Almost one-third (29.5%) of respondents indicated that the cause of their pain is unknown.

Table 1 *Participant demographic characteristics (N =305)*

Demographic Variable	
Age, Mean (SD)	55.64 (13.59)
Gender	
Non-Binary	1.0%
Male	24.6%
Female	73.1%
Ethnicity	
East Asian (e.g., Chinese, Japanese, Korean, etc.)	0.3%
Southeast Asian (e.g., Vietnamese, Cambodian, Thai etc.)	0.3%
Caribbean	0.3%
South Asian (e.g., Indian, Pakistani, Sri Lankan, etc.)	0.7%
Latin, Central, or South American	1.0%
Indigenous or Metis	6.7%
White or European	92.8%
Employment	
Part-time student	0.7%
Full-time student	1.3%
Stay-at-home-parent	3.3%
Unemployed	7.2%
Self-employed	7.9%
Part-Time	8.9%
Full-Time	20.7%
On medical leave/disability	25.6%
Retired	29.5%
Marital Status	
Engaged	2.0%
Widowed	3.9%
Divorced/Separated	9.5%
Single	9.8%
Common law	11.1%
Married	59.0%
Education	
Less than High School	1.0%
High School	13.1%
Bachelor's Degree	14.1%
Graduate or Professional Degree	17.0%
College Diploma	17.4%
Some College or University	29.5%

Table 2 displays social network characteristics of the sample. Average perceptions of discounting were roughly similar across social sources, with the lowest average levels of discounting attributed to medical professionals (M = 2.06), and the highest to social services (M = 2.61; see Table 2). A total of 81% of participants indicated that they currently have at least someone in their social network who also has chronic pain (i.e., peers with pain). The most commonly endorsed peers with pain were friends (endorsed by 46.2% of the sample), and the least frequently endorsed were co-workers (10.5%) or support groups (11.1%, online; 1.6%, in-person).

Table 2 *Social network characteristics of sample*

Social source of discounting	Discounting	
	M	*SD*
Medical Professionals (*n* = 303)	2.06	0.89
Spouse (*n* = 233)	2.25	0.88
Family (*n* = 298)	2.27	0.94
Work Colleagues (*n* = 132)	2.50	1.09
Social Services (*n* = 100)	2.62	1.19

Others with pain in social network	% of sample
No one	18.7%
Friend(s)	46.2%
Significant other	22.6%
Parent(s)	22.3%
Sibling(s)	19.3%
Acquaintance(s)	17.4%
Extended family (e.g., aunt, uncle, cousin, etc.)	15.7%
Child(ren)	14.4%
Pain-related support group (online)	11.1%
Co-worker	10.5%
Pain-related support group (in-person)	1.6%

2.3.3 Descriptive Statistics and Bivariate Correlations

Descriptive statistics and bivariate correlations among study variables are reported in Table 3. Correlations between discounting, pain-related shame, depressive symptoms, and perceived social support (general and peers) were all significant and in the expected direction (all *p's* < .01). Gender (male versus female) was significantly associated with pain-related shame and pain severity (with females reporting significantly higher levels of shame and pain), but was not significantly associated with discounting or depressive symptoms. Pain severity was significantly and positively associated with discounting, pain-related shame, and depressive symptoms, but not perceived social support. As gender was not significantly associated with the outcome variable of depressive symptoms at the bivariate level, only pain severity was retained as a covariate in the main study analyses.

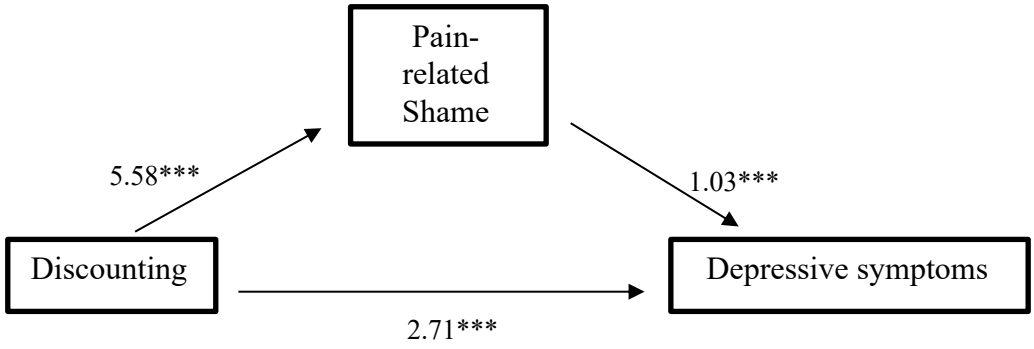
Table 3 *Means, standard deviations, and bivariate correlations of study variables*

	M	*SD*	1	2	3	4	5	6
1. Depressive symptoms	20.19	11.27	-					
2. Pain-related shame	14.26	7.03	0.76**	-				
3. Discounting	2.25	0.73	0.57**	0.60**	-			
4. SS (General)	62.36	14.46	- 0.35 **	- 0.31**	- 0.31**	-		
5. SS (Peers)	40.76	13.19	- 0.23**	- 0.23**	- 0.25**	0.39**	-	
6. Pain severity	5.56	1.73	0.24**	0.25**	0.14*	- 0.11	- 0.02	-
7. Gender	-	-	0.05	0.14*	0.10	- 0.05	0.04	0.12*

n = 305; ** *p* < .01; * *p* < .05

2.3.4 Simple Mediation Analysis

Figure 1 *Simple mediation model (PROCESS Model 4) examining mediating effect of pain-related shame on the relationship between discounting and depressive symptoms*



Note. n = 305; The figure displays unstandardized regression coefficients and significance levels. Pain severity was included as a covariate.
*** $p < .001$; ** $p < .01$; * $p < .05$.

A summary of results of the simple mediation analysis testing the mediating effect of pain-related shame on the relationship between discounting and depressive symptoms is displayed in Table 4 and Figure 1. The total effect of discounting on depressive symptoms was significant (b = 8.43, SE = 0.73, $p < .001$, 95% CI = 7.00, 9.86), supporting Hypothesis 1. Higher levels of discounting were associated with higher rates of pain-related shame (b = 5.58, SE = .44, $p < .001$, 95% CI = 4.72, 6.44), which in turn was associated with greater depressive symptoms (b = 1.03, SE = .08, $p < .001$, 95% CI = 0.88,1.17). The estimate of the indirect effect of discounting on depressive symptoms through pain-related shame was significant (b = 5.73, SE = 0.63, 95% CI = 4.55, 7.03). The direct effect of discounting on depressive symptoms remained significant (b = 2.71, SE = .71, $p < .001$, 95% CI = 1.31, 4.10).

The completely standardized indirect effect (Miočević et al., 2018; Preacher and Kelly, 2011) indicates that depressive symptoms increase by .37 standard deviations for every 1 SD increase in discounting indirectly via pain-related shame. The magnitude of this indirect effect

was moderate (r = .46), while the magnitude of the direct effect was small (r = .21), indicating that the impact of discounting on depressive symptoms was larger when indirectly related through pain-related shame. Taken together, this simple mediation analysis suggested that pain-related shame mediated the association between discounting and depressive symptoms, supporting Hypothesis 2.

Table 4 *Results of simple mediation analysis (PROCESS Model 4) examining mediating effect of pain-related shame on relationship between discounting and depressive symptoms*

	Outcome Variable: Depressive symptoms				*Outcome Variable: Shame*			
	b	*SE*	LLCI	ULCI	*b*	*SE*	LLCI	ULCI
Covariate								
Pain severity	0.36	0.25	-0.13	0.84	0.69***	0.18	0.33	1.05
Predictor								
Discounting	2.71***	0.71	1.31	4.10	5.58***	0.44	4.72	6.44
Mediator								
Pain-related Shame	1.03***	0.08	0.88	1.17	-	-	-	-

Total and Indirect effects				
	Effect	*SE*	LLCI	ULCI
Total effect of Discounting on Depressive symptoms	8.43***	0.73	7.00	9.86
Indirect effect of Discounting on Depressive symptoms via Shame	5.73	0.63	4.55	7.03

Note. n = 305; b = unstandardized coefficients; 95% bootstrapped CI = confidence interval; LL = lower limit, UL = upper limit. Indirect effects are significant when bootstrapped confidence intervals do not include zero. For the final model, R^2 = .35, $F_{2,302}$ = 80.89, p < .001.
*p < .05, **p < .01, ***p < .001;

2.3.5 Moderated Mediation Analysis with General Perceived Social Support

Hypotheses 3 and 4 were tested by expanding the simple mediation model into a moderated mediation model to examine the moderating effects of general perceived social support on the relationship of discounting with both depressive symptoms and pain-related shame. Figure 2 and Table 5 display the results. A significant moderation of the direct effect of discounting on depressive symptoms was identified (b = -.10, SE = 0.04, p = .0133, 95% CI = -0.18, -0.02), supporting Hypothesis 3. A plot of the significant interaction effect is displayed in Figure 3 and suggests that general perceived social support weakened the strength of the relationship between discounting and depressive symptoms. At low and mean levels of social support, higher discounting was significantly related to higher depressive symptoms, b = 3.66, SE = 0.86, p < .001, 95% CI = 1.96, 5.36 and b = 2.22, SE = 0.71, p = .0019, 95% CI = 0.83, 3.62, respectively. However, at high levels of perceived support, discounting was no longer significantly associated with depressive symptoms, b = .79, SE = 0.96, p = .411, 95% CI = -1.10, 2.68.

The moderating effect of perceived social support on the association between discounting and pain-related shame was not significant (b = .003, SE = 0.03, p = .064, 95% CI = -.06, .06), indicating that the indirect effect of discounting on depressive symptoms via shame was significant at each level of social support. Thus, Hypothesis 4 was not supported. Although the interaction term for perceived social support and discounting on pain-related shame was non-significant, there was a significant direct association between greater perceived social support and lower pain-related shame (b = -0.06, SE = 0.02, p = .007, 95% CI = -0.12, -0.02).

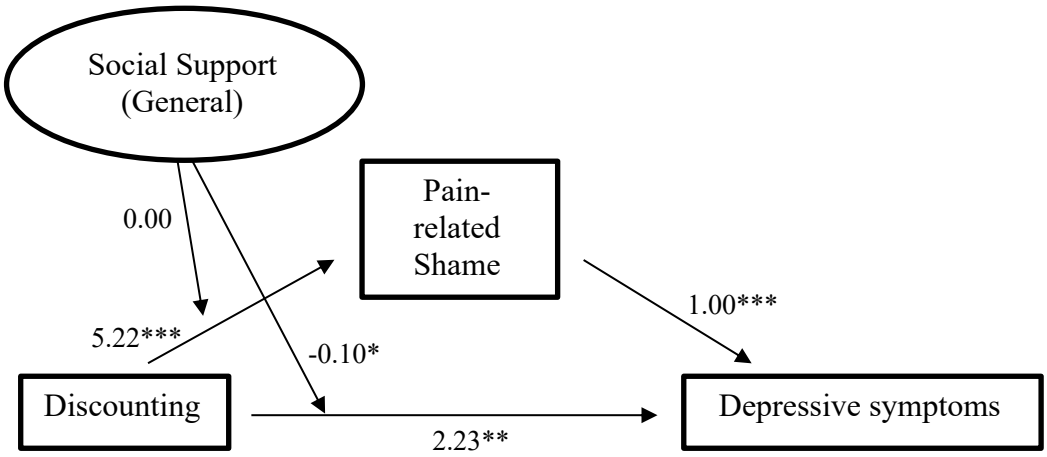
Table 5 *Results of moderated mediation (PROCESS Model 8) examining moderating effects of general perceived social support on relationship of discounting with depressive symptoms and pain-related shame*

	Outcome Variable: Depressive symptoms				*Outcome Variable: Shame*			
	b	*SE*	LLCI	ULCI	*b*	*SE*	LLCI	ULCI
Covariate								
Pain severity	0.35	0.24	-0.130	0.82	0.65***	0.18	0.29	1.01
Predictor								
Discounting	2.22**	0.71	0.61	6.89	5.22***	0.46	4.32	6.12
Mediator								
Shame	1.00***	0.07	0.85	1.14	-	-	-	-
Moderator								
Social Support	-0.09**	0.03	-0.15	-0.03	-0.06**	0.02	-0.11	-0.02
Interaction								
Discounting x Social Support	-0.10*	0.04	-0.18	-0.02	0.00	0.03	-0.06	0.06
Model Summary	R^2 = .61 $F_{5,299}$ = 95.38***				R^2 = .41 $F_{4,300}$ = 51.35***			

Indirect Effect				
Conditional indirect effects of Discounting on Depressive Symptoms through Shame at different levels of Perceived Social Support (M +/- 1 SD)	Bootstrapped indirect effect	Boot *SE*	Boot LLCI	Boot ULCI
-1 SD	5.15	0.71	3.77	6.52
M	5.20	0.66	4.01	6.56
+1 *SD*	5.25	0.88	3.66	7.12

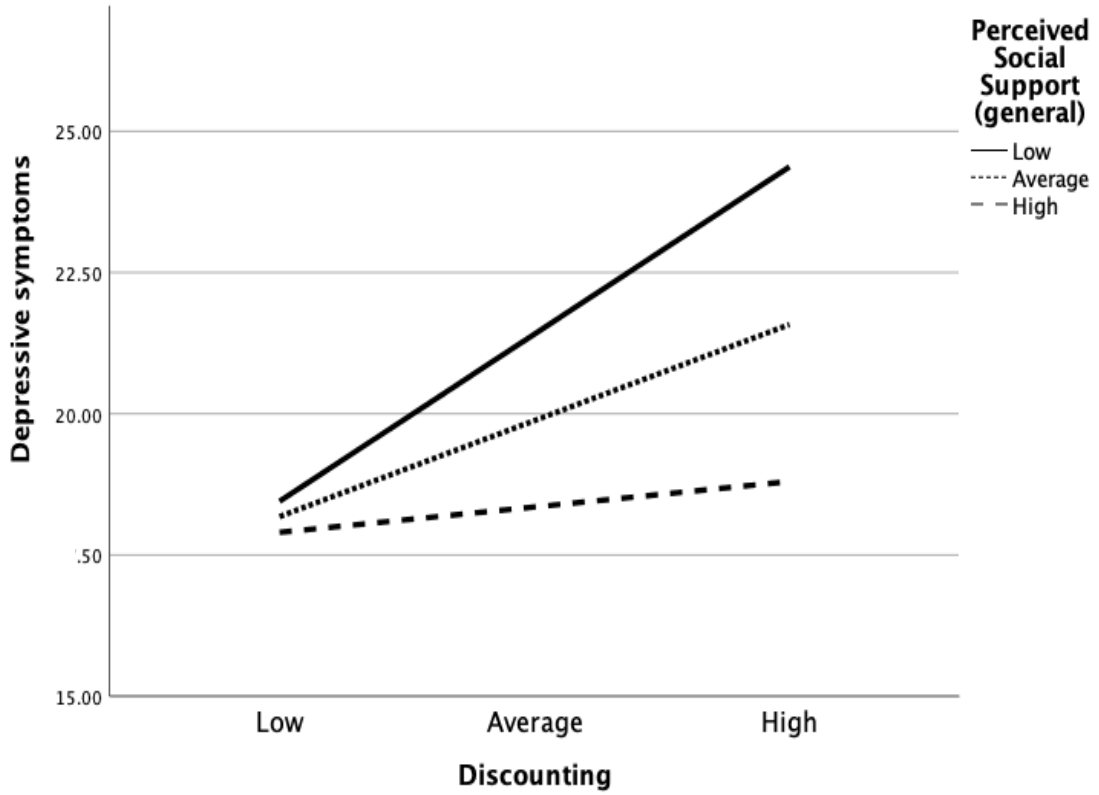
Note. n = 305; b = unstandardized coefficients; 95% bootstrapped CI = confidence interval; LL = lower limit, UL = upper limit. Indirect effects are significant when bootstrapped confidence intervals do not include zero.
*p < .05, **p < .01, ***p < .001

Figure 2 *Moderated mediation model (PROCESS Model 8) examining moderating effects of general perceived social support on relationship of discounting with pain-related shame, and discounting with depressive symptoms*



Note. n = 305; The figure displays unstandardized coefficients and significance levels for regression and interaction terms. The oval shape indicates results of interaction terms. Pain severity was included as a covariate.
*** $p < .001$; ** $p < .01$; * $p < .05$.

Figure 3 *Interaction plot for significant interaction of general perceived social support and discounting on depressive symptoms*



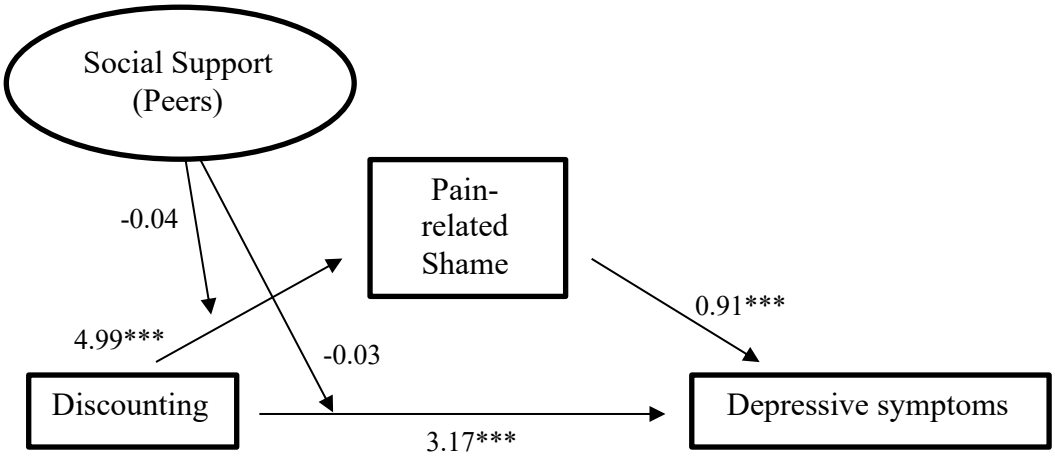
Note. Low = -1 *SD*, Average = Mean, High = +1 *SD*

2.3.6 Moderated Mediation Analysis with Perceived Social Support from Peers with Pain

2.3.6.1. Direct and indirect effects of discounting on depressive symptoms. Figure 4 and Table 6 display the results of the exploratory moderated mediation analysis (n = 245) examining moderating effects of perceived social support from peers with pain. In this model, similar to the primary model, higher rates of discounting were directly associated with higher levels of depressive symptoms (b = 3.17, SE = 0.77, p < .001, 95% CI = 1.65, 4.69) and were also associated with higher levels of shame (b = 4.99, SE = 0.49, p < .001, 95% CI = 4.02, 5.97) in this sample. Bootstrapped confidence intervals of the indirect effect at varying levels of the

moderator variable displayed in Table 6 do not include zero, indicating that pain-related shame mediated the relationship of discounting with depressive symptoms at different levels of the moderator.

Figure 4 *Moderated mediation model (PROCESS Model 8) exploring moderating effects of perceived social support from peers with pain on discounting and pain-related shame, and discounting and depressive symptoms*



Note. $n = 245$; The figure displays unstandardized coefficients and significance levels for regression and interaction terms. The oval shape indicates results of interaction terms. Pain severity was included as a covariate.
*** $p < .001$; ** $p < .01$; * $p < .05$.

2.3.6.2. Moderating effects of perceived social support from peers with pain.

Interaction effects of the moderator, perceived social support from peers with pain, with the predictor, discounting, on the indirect path (via pain-related shame) and direct path with depressive symptoms are shown in Table 6 and Figure 4. There were no significant interaction effects for the moderator of perceived social support from peers with pain, indicating no moderating effect on either the direct pathway from discounting to depressive symptoms or the pathway from discounting to pain-related shame (see Fig. 4). Hypotheses 5 and 6 were therefore not supported. Regression results showed that greater perceived social support from peers with pain was not significantly associated with depressive symptoms (b = -0.03, SE = 0.04, p = .427,

95% CI = -0.10, 0.04) or pain-related shame (b = -0.04, SE = 0.03, p = .1079, 95% CI = -0.10, 0.01). Regression results are displayed in Table 6.

Table 6 *Results of moderated mediation (PROCESS Model 8) exploring moderating effects of perceived social support from peers with pain on relationship of discounting with depressive symptoms and pain-related shame*

	Outcome Variable: Depressive symptoms				*Outcome Variable: Shame*			
	b	*SE*	LLCI	ULCI	*b*	*SE*	LLCI	ULCI
Covariate								
Pain severity	0.49	0.28	-0.05	1.04	0.79***	0.21	0.38	1.19
Predictor								
Discounting	3.17***	0.77	1.65	4.69	4.99***	0.49	4.02	5.97
Mediator								
Shame	0.91***	0.08	0.75	1.08	-		-	-
Moderator								
Social Support	-0.03	0.04	-0.10	0.04	-0.04	0.03	-0.10	0.01
Interaction								
Discounting x Socail Support	-0.03	0.05	-0.13	0.06	-0.04	0.04	-0.11	0.03
Model Summary	R^2 = .58 $F_{5,239}$ = 65.60***				R^2 = .38 $F_{4,240}$ = 37.50***			

Indirect Effect				
Conditional indirect effects of Invalidation on Depressive Symptoms through Shame at different levels of Perceived Social Support (M +/- 1 SD)	Bootstrapped indirect effect	Boot *SE*	Boot LLCI	Boot ULCI
-1 SD	5.04	0.68	3.83	6.51
M	4.48	0.63	3.48	5.96
+1 *SD*	4.09	0.84	2.59	5.85

Note: *n* = 245; *b* = unstandardized coefficients, 95% bootstrapped CI = confidence interval; LL = lower limit, UL = upper limit. Indirect effects are significant when bootstrapped confidence intervals do not include zero.
*$p < .05$, **$p < .01$, ***$p < .001$

Chapter 3: Discussion

This study examined shame as a potential affective mechanism to elucidate how social discounting can contribute to depressive symptoms among people with chronic pain. In line with study hypotheses, higher levels of discounting were directly associated with elevated depressive symptoms, and pain-related shame mediated this relationship. Examination of the potential protective effects of social support found that general perceived social support moderated the direct association between discounting and depressive symptoms, such that higher levels of social support attenuated this relationship. Overall, results from this study suggest that pain-related shame may be an important affective pathway linking social discounting of chronic pain to depressive outcomes, highlighting pain-related shame as a potential treatment target for redressing comorbid depression and chronic pain. Broadly, this study contributes to scientific understanding of affective processes through which social relationships shape health outcomes while also providing evidence for the buffering effects of social support against harms related to stigmatizing social responses to chronic pain.

3.1 Direct effect of discounting on depressive symptoms

Consistent with study hypotheses and previous research emphasizing the particularly harmful impacts of discounting on mental health (Kool et al., 2010; Kool et al., 2013; Molzof et al., 2020), results from this study demonstrated that higher reports of discounting were related to higher levels of depressive symptoms in a sample of people with chronic pain. This finding adds to a growing body of literature that suggests that perceptions of invalidating social experiences that discount or question the legitimacy of a person's pain are directly related to poorer mental health for people living with chronic pain (Kool et al., 2010; Molzof et al., 2020). It is important to note that studies have demonstrated that higher levels of pain severity are commonly

associated with an increased risk of depression (Arnstein et al., 1999; Castillo et al., 2013; Mok & Lee et al., 2008). As a result, current analyses controlled for pain severity as a key variable that can impact the mental health of this clinical sample. Although significant at the bivariate level, pain severity no longer predicted depressive symptoms once discounting and pain-related shame were accounted for in the mediation model, suggesting that discounting and pain-related shame are more strongly predictive of depressive symptoms in people with chronic pain over and above the severity of the pain itself.

The minority stress model posits that individuals who are socially categorized in devalued or marginalized groups are at risk of greater stress, which has negative impacts on health outcomes (Meyer, 2003). This model has been applied to people living with various chronic health conditions (Frost, Lehavot, & Meyer, 2015; Rendina et al., 2017; Turan et al., 2017), as people with chronic illnesses are often stigmatized and socially rejected or devalued (Karos et al., 2018; Jacoby, Snape, & Baker, 2005; Nettleton, 2006; Reidpath et al., 2005). Findings lend support to social status theories (Gilbert & McGuire, 1998; Gilbert & Trower, 1990; Gruenwald, Dickerson, & Kemeny, 2007; Price et al., 1994), as well as the minority stress model, by demonstrating that patients with chronic pain experience pain discounting from a variety of sources, and that this social judgment is associated with worse mental health. Consistent with the health stigma and discrimination framework, this study adds to evidence that the invisible nature of chronic pain makes those living with chronic pain susceptible to social marginalization and discreditation, with injurious health implications. Results of this study suggest that accounting for social factors and stigmatizing social judgments, particularly perceptions that one's pain is being discounted, may be highly valuable in conceptualizing and treating mental health concerns among people with chronic pain.

3.1.1 Consideration of social sources of discounting

Mean levels of discounting from different social sources reported by participants in the current sample fell within similar ranges of previous research, suggesting low to moderate frequency of discounting experiences on average (Kool et al., 2010; Molzof et al., 2020; Santiago et al., 2017). It is also worth noting that results are consistent with previous research demonstrating that invalidation or discounting tends to be lowest from health professionals compared to other social sources (Kool et al., 2010; Kool & Geenen, 2012; Santiago et al., 2017). This may relate to the fact that the current sample was recruited through clinics that specialize in the treatment of pain, meaning that physicians treating this sample are likely knowledgeable and possibly more understanding of the pain experience. Despite this, there continues to be evidence that health professionals can make patients feel blamed, dismissed, (Slade, Molloy, & Keating, 2009; Toye & Barker, 2010, 2012) or that they are exaggerating (Werner & Maltrud, 2003).

The highest levels of discounting were reported from social services, which include vocational rehabilitation staff, unemployment and other government agencies, and health insurance companies. These ratings come from a smaller subset of the sample (n = 100), most likely because it was only applicable for a minority of participants (e.g., those who were still working at the time of data collection). These results are consistent with common reports that people with chronic pain often struggle to be believed by social services when seeking disability or accommodations at work (Stewart et al., 2011), even though chronic pain often results in missed days of work and diminished work performance without appropriate work modifications or accommodations (Blyth et al., 2003; de Sola et al., 2016; Patel et al., 2012).

3.2 Mediating effect of pain-related shame on discounting and depressive symptoms

The current study expanded upon previous research by identifying pain-related shame as a mechanism through which perceived experiences of discounting relate to depressive symptoms among patients with chronic pain. Shame is a global negative evaluation of the self, which, like other self-conscious moral emotions, typically emerges from an awareness of the opinions or judgments of others regarding one's own character or behaviour (Haidt, 2003; Moll, 2008). As such, shame is typically understood as an internalization of negative social evaluations of the self (Allport, 1954; Crocker & Major, 1989; Gruenewald, Dickerson, & Kemeny, 2007). This study suggests that pain-related shame may be an important process through which social stigma of chronic pain is internalized to contribute to a greater likelihood of depression. These findings lend greater conceptual clarity to the affective processes underpinning "internalized stigma," which remains a commonly used but inconsistently defined construct (Bennett et al., 2016).

Results provide evidence for the theory of self-stigma, which suggests that negative social judgments and relegated social status will lead to worse outcomes through internalization processes that apply stigmatizing social beliefs to oneself (Corrigan & Watson, 2002; Luckstead & Drapalski, 2015; Watson et al., 2007). This work adds to previous empirical evidence from non-chronic pain samples that shame mediates social stigma or perceived low social status and deleterious health outcomes across numerous conditions and circumstances (Davies et al., 2020; Feiring, Taska, & Lewis, 2002; Gilbert, 2000; Gruenwald, Dickerson, & Kemeny, 2007; Macaulay & Cohen, 2014; Tracy & Robins, 2007; Wood et al., 2017), while emphasizing the mechanistic role of pain-related shame specifically among chronic pain populations.

3.3 Buffering effects of general perceived social support

3.3.1 Buffering effects of general perceived social support on the direct relationship between discounting and depressive symptoms

Consistent with hypotheses, general perceived social support weakened the direct relationship between discounting and depressive symptoms, such that the association between discounting and depressive symptoms became nonsignificant at high levels of social support. Only one previous study tested the stress buffering effects of social support specifically for invalidation of chronic pain (Kool et al., 2013). Perceived social support moderated the relationship between invalidation from family and mental health outcomes, but did not moderate the relationships between mental health and other social sources of invalidation; however, both social support and invalidation were directly associated with and additively contributed to variance in mental health (Kool et al., 2013). Findings of the current study lend additional support to preliminary indications that social support may protect against poor mental health related to invalidation of chronic pain.

More broadly, results provide evidence for the stress buffering hypothesis of social support (Cohen & Wills, 1985) and add to the extant body of literature demonstrating the buffering effects and coping benefits afforded by social support specifically for people with chronic pain (Ginting, Trip, & Nickel, 2011; Ginting et al., 2016; Holtzman, Newth, & Delongis, 2004; Holtzman & DeLongis, 2005; Kerns, Rosenberg, & Otis, 2002; Matos et al., 2017). Further, the minority stress model emphasizes the importance of social support for protecting against the harms of stress stemming from social marginalization and stigma (Meyer, 2003). Results of this study are consistent with this model and add to growing empirical evidence demonstrating the protective effects of social support for stigmatized conditions (Ablon, 2002; Cariello et al., 2021; Casale et al., 2019; Earnshaw et al., 2015).

3.3.2 Buffering effects of general perceived social support on the relationship between discounting and pain-related shame

Inconsistent with study hypotheses, perceived social support did not moderate the association between discounting and pain-related shame. However, a direct effect of perceived social support on pain-related shame remained, such that lower levels of perceived social support were related to higher levels of pain-related shame. This is consistent with research which demonstrates that higher levels of social support are typically associated with lower rates of negative affect (Dour et al., 2014; Henry et al., 2019).

It is possible that the positive benefits of social support may be undermined by shame. Evidence shows that shame can lead people to socially withdraw and not seek support across diverse health conditions (Chapple, Ziebland, & McPherson, 2004; Dodson & Beck, 2017; Dunford & Granger, 2017; Grodensky et al., 2015) or to not feel worthy of receiving support (Trindade et al., 2018). This is consistent with research on stigma more generally, which shows that greater rates of perceived stigma tend to be associated with reduced social support (Cooper & Neilson, 2017; Galvan et al., 2008; Smith, Rossetto, & Peterson, 2008). As such, shame about a stigmatized health condition may interfere with support seeking, and undermine the efficacy of social support by mitigating the *perception* of social support, serving to maintain feelings of shame. Additionally, as indicated by the direct inverse association of pain-related shame and social support in this study, low levels of perceived social support may also exacerbate feelings of shame, which in turn, may drive further social withdrawal, complicating the protective role of social support for shame as an outcome.

3.4 Buffering effects of perceived social support from peers with pain

In this sample, roughly 81% of participants indicated they had at least one other person living with chronic pain within their social network. Contrary to study hypotheses, perceived social support from peers with pain did not attenuate the negative effects of discounting on pain-related shame or depressive symptoms. Additionally, although perceived support from peers was associated with lower pain-related shame and depressive symptoms at the bivariate level, this association was no longer significant once pain and discounting were entered into the models.

These findings contrast with empirical evidence regarding the positive impacts of peer support for chronic pain. Numerous studies have shown that peers can have beneficial impacts on emotional wellbeing and feelings of being understood among chronic pain populations (Cooper et al., 2014; Cooper et al., 2020; Matthias et al., 2015; Nicola et al., 2021; Sallinen, Kukkurainen, & Peltokallio, 2011). However, most of these studies have examined effects of formalized peer support groups, while, in the current study, only 1.6% of the sample reported having peers from a formal in-person support group for chronic pain, and only 11.1% reported knowing peers from online support groups for chronic pain, which can vary in formal structure and moderation. This indicates that perceived peer support examined in this study was largely informal, which may have impacted results. There is evidence that chronic pain support groups are especially beneficial when structured and facilitated in a way that deemphasizes talking negatively or complaining about pain in order to foster openness and acceptance within the group (Finlay & Elander, 2016; Finlay, Peacock, & Elander, 2018). Groups can foster social validation, mutual understanding, and strategies for managing pain while de-emphasizing negative rumination and emotional reactivity; without guidance in a formal setting, it is possible that the

efficacy of informal peer support may vary depending on whether peers reinforce negativity with each other (Cooper et al., 2017).

Given high rates of distress and disability in this population, peers may also be burdened by their own pain interference and experiences of invalidation, which may impede providing support without formal program guidance and structure. In particular, formal structures within peer support programs may help to maintain consistency of support. For example, a recent study demonstrated no differences in outcomes between control and treatment groups receiving a 6-week volunteer peer-led pain self-management intervention for chronic pain (Matthias et al., 2020). Adherence to treatment was notably low, with only 13% of participants utilizing all 12 recommended contact sessions with peer coaches, and two thirds reporting fewer than 5 sessions. Due to lack of tracking, it was unclear whether the low rate of reported contacts were because patients were difficult to reach or because peer coaches failed to initiate calls. The authors suggested that relying on volunteer models of peer support may be less effective than programs in which peer mentors/coaches are compensated, which may help to sustain consistent engagement from peers and, consequently, group participants (Heisler et al., 2019; Matthias et al., 2020; Tang et al., 2015).

In addition, the current study only examined general perceived availability of support from peers, and not support that was specific to patients' pain. A recent review by Bernardes and colleagues (2017) indicates that impacts of informal social support for people with chronic pain are inconsistent, which may be due, in part, to the preponderance of studies measuring general social support as opposed to pain-specific social support. Pain-specific social support includes distraction (i.e., distracting a person from their pain), solicitousness (i.e., taking over or offering assistance on chores and tasks for the person with pain), promotion of well behaviours and/or

functional autonomy, and validation or empathic understanding (Bernardes et al., 2017; Kerns, Rosenberg, & Otis, 2002; Newton-John, 2002). It is possible that informal social support from peers with pain may be more effective when it is pain-specific support that capitalizes on the shared experience of pain.

3.5 Clinical implications

Findings of this study have important clinical implications for addressing mental health, particularly feelings of shame and symptoms of depression, among patients with chronic pain. First, this study highlights the vital need to address invalidation of chronic pain at the societal level in order to mitigate the psychosocial harms of common negative social responses to chronic pain. Education on the challenges of invisible illnesses and injurious impacts of invalidation for the broader public as well as for formal and informal care providers, physicians, and employers may help to improve understanding of the nature of chronic pain and associated challenges (Arnold et al., 2016). In particular, evidence suggests that enhancing validating responses to a person's pain among the social and professional networks of chronic pain patients will likely help improve patient outcomes (Edlund et al., 2017; Edmond & Keefe, 2015; Greville-Harris, 2017). Additionally, there is some evidence that fostering effective strategies for coping at the individual level, such as improving self-efficacy and pain acceptance, may serve to protect against negative outcomes associated with invalidation (Cameron et al., 2018). General perceived social support emerged in the current study as a protective factor for depressive symptoms related to discounting, adding to existing evidence that enhancing supportive social networks for people with chronic pain can help to ameliorate symptoms of depression (Gaffey et al., 2018; Mckillop et al., 2017; Ryan & McGuire, 2016).

The mechanistic role of shame demonstrated in this study suggests pain-related shame may be an important psychotherapeutic treatment target in people with chronic pain and depressive symptoms. It is especially important to recognize that shame may be a transdiagnostic factor exacerbated by the intersecting stigmatized nature of both chronic pain and depression (Oexle & Corrigan, 2018), as depression is also a highly stigmatized condition (Barney et al., 2006; Roeloffs et al., 2003). Thus, the results of the study demonstrating the detrimental effects of social stigma suggest that shame may be important to address across comorbid physical and mental health conditions, as mental illnesses broadly remain stigmatized and neglected in healthcare settings (Fox et al., 2018; Vistorte et al., 2018).

With regard to individual psychotherapy, although clinical treatment cannot change external social judgments of a person's pain, an individual's emotional response to such judgments can be more readily addressed in a therapeutic setting. Broadly, psychotherapeutic treatment for chronic pain has typically targeted anxiety and depression (Darnall, 2019; Sturgeon, 2014), and, to a lesser extent, feelings of anger and irritability (Holtzman et al., 2015; Sommer et al., 2019). Current evidence-based treatments for chronic pain include Acceptance and Commitment Therapy (ACT), Cognitive Behavioural Therapy (CBT), and mindfulness based practices (Darnall, 2019; Majeed, Ali, Sudak, 2019). These treatment modalities for chronic pain generally involve strategies of self-regulation, including identifying and regulating emotional responses to pain (Boersma et al., 2019; Darnall, 2019). However, evidence suggests that there is significant room for improvement in psychological interventions for chronic pain and associated mental health concerns, as recent meta-analyses demonstrate only small to medium effect sizes in reduction of depression among chronic pain samples treated with CBT (Ehde, Dillworth & Turner, 2014) as well as ACT, with small effects at follow-up (Hughes et al.,

2017; Veehof et al., 2016). Results of this study suggest that targeting pain-related shame may provide a novel avenue for improving treatment outcomes related to comorbid chronic pain and depression.

Indeed, results showed that pain severity was no longer directly associated with depressive symptoms once discounting and pain-related shame were accounted for. This suggests that perceptions of social invalidation and feelings of shame may be just as, if not more, effective treatment targets to ameliorate depressive symptoms than the severity of pain itself. This lends some empirical support to recent arguments that improving the quality of life among people living with chronic pain need not be based primarily on the reduction of pain intensity itself, but rather on redressing maladaptive coping and psychological distress (Sullivan & Ballantyne, 2016). However, high levels of pain remained predictive of higher rates of shame. This suggests that clinicians should be aware that patients who report experiences of social discounting of their pain as well as greater pain severity may be at increased risk of pain-related shame and deleterious downstream impacts on their mental health.

Yet, to date, pain-related shame has received minimal recognition as a central treatment target among chronic pain populations. For example, a recent comprehensive book on psychological treatment for chronic pain does not identify shame as a treatment target or central psychological factor related to chronic pain; in fact, the word “shame” is mentioned only twice within the book without detailed discussion on the subject (Darnall, 2019). A qualitative one-year follow-up study with participants of a rehabilitation program for fibromyalgia highlighted that patient reports indicated that the program helped diminish feelings of shame and cultivate self-respect (Gustafsson et al., 2004), an important therapeutic change given the demonstrated detrimental impacts of shame across mental and physical health conditions (Andrews, Qian, &

Valentine, 2002; Bennett et al., 2016; Chapple, Ziebland, & McPherson, 2004; LeBlanc et al., 2020). Yet beyond this, almost no research has tracked changes in pain-related shame or associated outcomes in chronic pain psychological treatment.

Importantly, shame presents unique challenges in psychotherapy (Dearing & Tangney, 2011). Shame may contribute to negative therapeutic reactions, such as cessation of treatment (Hahn, 2004), and may hinder help-seeking generally (Gilbert, 2011), increase likelihood of non-disclosure in therapy (Candea & Szentagotai, 2013; Farber, 2003), or elicit challenging feelings of shame within the therapist (DeYoung, 2015; Ladany, Klinger, & Kulp, 2011). Although perceived social support did not moderate the relationship between discounting and pain-related shame in the current study, it remained significantly inversely associated with shame, meaning that improving social support may serve to diminish feelings of shame. However, patients high in pain-related shame may avoid seeking out support or may have negative beliefs about the availability of support. As such, enhancing social support and addressing maladaptive beliefs about support availability may be especially important in treatment settings for individuals high in pain-related shame.

That said, a recent systematic review of interventions to reduce shame demonstrated that shame is highly treatable, with 90% of reviewed studies showing significant reductions in shame, and responsive to wide range of treatment modalities, including ACT, CBT, and mindfulness-based interventions (Goffnett, Liechty, & Kidder, 2020). Studies reviewed included those that measured general shame proneness, as well as context-specific shame, meaning shame related to specific experiences, such as sexual abuse or traumatic events. None of the studies reviewed involved chronic illness-related shame or shame specific to chronic pain, but the current study offers conceptual rationale to explore treatment of shame stemming from illness. Importantly,

very few of the treatments reviewed were designed specifically to reduce shame, but were adaptable to be effective in this regard (Goffnett, Liechty, & Kidder, 2020).

ACT is shown to be effective in treating shame across numerous psychiatric conditions (Gutierrez & Hagedorn, 2013; Hayes et al., 2006; Luoma et al., 2012) but research has yet to investigate its impact on pain-related shame specifically. Similarly, CBT has been shown to reduce feeling of shame in patients with social anxiety disorder (Hedman et al., 2013), stigmatized psychosis (Morrison et al., 2016), post-traumatic stress symptoms (Cohen et al., 2004), anxiety and depression (Proeve, Anton, & Kenny, 2018), as well as in non-clinical samples such as prison inmates (Brazao et al., 2015). Lastly, practices of self-compassion have been suggested for treating negative self-evaluation in chronic pain specifically (Barnes et al., 2018) and have been shown to be effective modalities for treating shame across diverse psychiatric conditions (Stefan & Hofman, 2019; Gilbert, 2011). As such, the evidence briefly reviewed here suggests that current treatment approaches for chronic pain can easily integrate a focus on pain-related shame if appropriate for a client's presentation and needs.

3.6 Limitations and future directions

There were several limitations to the current study. First, it is important to note that due to the cross-sectional design of this study, results cannot be used to draw conclusions about causality (Maxwell & Cole, 2007; Maxwell, Cole, & Mitchell, 2011). However, conditional process models conducted with cross-sectional data can be used to inform causal arguments with solid empirical and theoretical backing (Hayes & Rockwood, 2017, 2020). The model proposed in this study is rooted in both theory and past empirical evidence lending conceptual support to the arrangement of variables. Future research should further investigate the mechanistic role of

pain-related shame for people living with chronic pain through longitudinal research designs that can isolate and clarify causal relationships within the model proposed by this study.

Second, there are likely bidirectional relationships between the study variables such that higher levels of depressive symptoms and shame may also influence perceptions of support availability and heighten subjective feelings of invalidation (Chapple, Ziebland, & McPherson, 2004; Dodson & Beck, 2017; Dunford & Granger, 2017; Grodensky et al., 2015; Naushad et al., 2018; Trindade et al., 2018). Future research can help to clarify patterns of mutual influence among perceptions of discounting, shame, and depression in chronic pain samples.

Third, this study's sample had some important demographic differences when compared to chronic pain prevalence studies in Canada, limiting generalizability to the broader Canadian context. With regard to gender, representation of women within the current sample was slightly higher compared to prevalence estimates of chronic pain across Canada, which suggest that around 60% of Canadians impacted by chronic pain are women (Meana, Cho, & DesMeules, 2004; Racine et al., 2013). Further, although representation of Indigenous persons in the current sample was similar to the overall Canadian population, research suggests that Canada's Indigenous communities have the highest incidence rates of chronic pain (Julien et al., 2018; Poulin et al., 2018), indicating that this may be an underrepresentation of these groups within the sample.

In addition, the current study consisted of a predominantly white sample in a Western Canadian context, meaning results may not generalize to other racial or ethnic groups or cultural settings. Cultural differences and context are an important consideration in research on shame, as the experience and expression of this social emotion is highly dependent on cultural values and social norms (Casimir & Schnegg, 2002; Fessler, 2004; Goetz & Keltner, 2007; Grey et al.,

2018; Vanderheiden & Mayer, 2017; Wong & Tsai, 2007). For example, Honkasalo (2001) found that shame was more prevalent among Finnish interviewees with chronic pain compared to American studies. It was suggested that the impact of chronic pain on diminished autonomy and increased social doubt about the truth or legitimacy of patients' pain reports directly conflicted with core cultural values of autonomy and honesty in Finnish society, possibly contributing to elevated rates of shame of this sample (Honkasalo, 2001). As a self-conscious emotion contingent on conceptualizations of the self, research suggests that shame may be more prevalent in cultures in which the self is understood as interdependent with collective society compared to cultures that conceptualize and value the self as individualistic (Fessler, 2004; Grey et al, 2018; Goetz & Keltner, 2007; Wong & Tsai, 2007). Future research can expand upon current findings by exploring cultural factors that predict increased likelihood of pain-related shame.

Future research can also explore how sociodemographic factors shape the pain experience and likelihood of invalidating social responses, and how these might intersect with cultural variations in pain-related shame. It is important to recognize that race and ethnicity have been shown to influence undertreatment and underestimation of chronic pain for minority groups compared to white patients (Anderson et al., 2000; McGuire et al., 2006; Molzof et al., 2020; Paulson, Dekker, Aguilar-Gaxiola, 2007; Ringwalt et al., 2015; Tait, Chibnall, & Kalauokalani, 2009), and differences in reported pain experiences, such as pain severity and pain sensitivity, have been found between ethnic and cultural groups (Nayak et al., 2000; McCracken et al., 2001). Patients who face multiple forms of stigma, including both stigmatized illness and racial prejudices, may be at increased risk of pain-related invalidation and shame, which may in turn differentially impact pain-related health outcomes. Future studies on shame and chronic pain

would benefit from attending to cultural factors for diverse cultural groups and individuals navigating multiple and multifaceted stigmatized identities (Goodin et al., 2018).

Relatedly, research regarding the role of gender on experiences of invalidation is mixed. Some studies suggest that women may experience more discounting or doubt about the legitimacy of their pain symptoms than men (Arman et al., 2020; Daraz et al., 2011; Gaffey et al., 2018; Samulowitz et al., 2018; Werner et al., 2003), while recent research, including the current study, shows that women do not differ from men in reports of invalidation of pain (Kool et al., 2010; Santiago et al., 2017). However, bivariate correlations suggested that women may be more likely to experience pain-related shame, consistent with previous research (Benetti-McQuoid & Bursik, 2005; Ludwig, Fellner-Rohling, Thoma, 2017; Lutwak & Ferrari, 1996). Future studies may investigate whether women with chronic pain are more likely to develop feelings of pain-related shame and negative health impacts from similar rates of discounting.

A fourth limitation was that this study addressed only two possible covariates, pain severity and gender. Gender was not entered into the moderated mediation model because it was not associated with depressive outcomes at the bivariate level. However, other covariates may be important to explore in future research, such as age (Orth, Robins, & Soto, 2010), or pain diagnosis and the extent to which participants' chronic pain has a medical explanation, as a lack of medical explanation may increase the likelihood of invalidation (De Ruddere et al., 2013; De Ruddere et al., 2014; De Ruddere & Craig, 2016; De Ruddere et al., 2016; Eccleston, Williams, & Rogers, 1997; Glenton, 2003; Lillrank, 2003; May, Rose, & Johnstone, 2000; Nettleton, 2006; Slade, Molloy, & Keating, 2009; Stone, 2014). Invalidation is influenced by numerous factors and is shown to differ across chronic pain conditions (Ghavidel-Parsa et al., 2021; Kool et al., 2009; Kool et al., 2010; Kool et al., 2017). Future research could investigate whether rates of

shame vary across diverse pain conditions due to different rates of invalidation. Research may then be able to identify subgroups of pain populations more vulnerable to experiencing the cluster of discounting, pain-related shame, and depressive symptoms demonstrated in this study.

Fifth, this study did not find any moderating effects of perceived social support on the relationship between discounting and pain-related shame, which suggests there may be other factors impacting this relationship. These may include sociodemographic factors listed above, or possibly personality factors. For example, lower levels of both agreeableness and conscientiousness have been found to be associated with higher perceptions of invalidation (Santiago et al., 2017), and may also influence proneness to shame (Einstein & Lanning, 1998). Further, future research may enhance understanding of social support related to invalidation through a more granular assessment of sources of both invalidation and support. For example, family members or spouses are often the primary source of support for many adults with chronic pain, yet these may also be sources of invalidation. Examining interactions of invalidation and support from specific social sources will help provide a more detailed understanding of both positive and negative influences among individual's social networks. In addition, types of support needed to buffer the effects of invalidation may differ depending on the source of invalidation. For example, instrumental support may be more effective for buffering invalidation from one's employer or social services, while emotional support may be more beneficial for invalidation from one's family. Future research rooted in theories of optimal matching of appropriate types of social support for specific types of stress (Cutrona, 1990; Cutrona & Russell, 1990) may assist with identifying the most effective support for invalidation from different social sources.

Lastly, because only a subset of the sample endorsed having peers with pain in their social network, the reduced sample size for the exploratory model examining perceiving social support from peers with pain also reduced power, which may have limited the ability to detect any moderating effects. Peer support was also primarily informal, with small representation from formal in-person support groups. This low rate of formal peer support may in part be due to ongoing provincial restrictions against in-person gatherings related to the COVID-19 pandemic during the period of data collection. In addition, peer support measured in this study aggregated support across diverse social relationships, such as friends, co-workers, and acquaintances, which may differ in interpersonal closeness with respondents, impacting efficacy of support. Future research on the protective effects of peer support may benefit from focused study within formal support group contexts, as well as examination of whether different sources or types of peer support differentially impact pain-related shame.

3.7 Conclusion

Broadly, this study contributes to existing literature demonstrating the negative health implications of social invalidation in people with chronic pain. Pain-related shame is a prominent emotional experience among chronic pain populations but, to date, has remained relatively understudied (Dolezal & Lyons, 2017; Scheff, 2014). Results from the current study indicate that shame regarding one's pain may be a key mechanism linking social discounting of pain to depressive symptoms among chronic pain patients, which may contribute to previously demonstrated high rates of comorbidity between chronic pain and depression (Bair et al., 2003). Results also show that greater levels of perceived social support were associated with lower pain-related shame and protected against depressive symptoms associated with discounting attitudes

of others, highlighting the benefits of fostering supportive social relationships for patients with chronic pain. Overall, findings suggest that pain-related shame may be a beneficial treatment target for addressing depressive symptoms in this population, in addition to reducing invalidation and stigma of chronic pain systemically in society and healthcare settings.

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Appendices

Appendix A - Measures

Chronic Pain and Emotional Health – Questionnaire

Thank you so much for your time and interest in participating in this study! Please answer these questions to confirm eligibility.

Do you have chronic pain (i.e., pain that has lasted for at least 12 weeks)?

☐ Yes

☐ No

Are you 18 years or older?

☐ Yes

☐ No

Are you fluent in English and able to provide consent in English?

☐ Yes

☐ No

Instructions: *The following survey includes multiple-choice and open-ended questions designed to gain insight into your recent experiences with pain.*

Please answer the questions as openly and honestly as possible. All information obtained during this study will be kept strictly confidential and no identifying information will be attached to your responses. Additionally, you can skip any questions that you feel uncomfortable answering. This survey will take about 25-30 minutes to complete.

Pain History

1. What event(s), if any, led to your present pain? Circle all that apply:
    a. Motor vehicle accident (MVA)
    b. Other accident
    c. Work injury
    d. Following a surgery/operation
    e. Cancer
    f. Other chronic disease
    g. Unknown
    h. Other (please describe): _____
2. What pain treatment clinic(s) do you attend? Circle all that apply
    a. Kelowna – Bill Nelems Pain and Research Centre
    b. Vernon Interventional Pain Clinic
    c. Penticton Regional Hospital Pain Clinic
    d. Salmon Arm Pain Clinic

The following measures were used in this study but are not provided here due to copyright:

- The Multidimensional Scale of Perceived Social Support (Zimet et al., 1988)
- Brief Pain Inventory – Short Form (Cleeland, 1989)
- The Illness Invalidation Inventory (Kool et al., 2010)
- Chronic Illness Related Shame Scale (Trindade et al., 2017)
- Beck Depression Inventory II (Beck et al., 1996)

Pain Network

We are interested in knowing more about your current social network, and specifically about who in your social network also has chronic pain.

*Please indicate who in your social network **also has chronic pain** (circle all that apply):*

- o Significant Other
- o Sibling(s)
- o Parent(s)
- o Child(ren)
- o Extended family (e.g., aunt, uncle, cousin, etc.)
- o Friend
- o Acquaintance
- o Co-worker
- o Pain related support group – online
- o Pain related support group – in person

Demographics

The following questions ask you about your background and life situation.

1. What is your age?_____

2. What was your sex at birth?
    a. Male
    b. Female
    c. Intersex
    d. Prefer to self-describe:
3. What gender do you identify with?
    a. Male
    b. Female
    c. Non-binary
    d. Prefer to self-describe:
4. What is your marital status?
    a. Single
    b. Engaged
    c. Common law (if so, for how many years? ___)
    d. Married (if so, for how many years? ___)
    e. Widowed
    f. Divorced/Separated
    g. Other (please specify: _____)
5. To which of the following ethnic groups do you belong (circle all that apply)?
    a. White or European
    b. Latin, Central, or South American
    c. East Asian (e.g., Chinese, Japanese, Korean, etc.)
    d. Southeast Asian (e.g., Vietnamese, Cambodian, Thai, etc.)
    e. South Asian (e.g., Indian, Pakistani, Sri Lankan, etc.)
    f. West or Central Asian (e.g., Iranian, Afghan, Kazakh, etc.)
    g. Aboriginal/Indigenous
    h. African
    i. Caribbean
    j. Not listed above/Prefer to self-describe: _____
6. What is the highest level of education you have attained?
    a. Less than High School
    b. High School
    c. Some college or university
    d. Bachelor's degree
    e. College diploma
    f. Graduate or Professional degree
    g. Other (please specify):
7. What is your employment status? Circle all that apply.
    a. Employed full-time
    b. Employed part-time

c. Self-employed
d. Stay-at-home parent
e. Full-time student
f. Part-time student
g. Unemployed
h. On medical leave/disability
i. Other (please specify):