BASIC AND APPLIED SOCIAL PSYCHOLOGY, 36:329–346, 2014

ISSN: 0197-3533 print/1532-4834 online
DOI: 10.1080/01973533.2014.917975

Routledge
Taylor & Francis Group

When Pain Does Not Heal: The Common Antecedents and Consequences of Chronic Social and Physical Pain

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Researchers find that social and physical pain overlap in acute episodes. In this article, we hypothesize that social and physical pain overlap in chronic conditions as well. To support this hypothesis, we reviewed the literature and introduced the Integrated Chronic Pain Model (ICPM), which posits that chronic social and physical pain overlap in their psychological antecedents and consequences. Specifically, the ICPM proposes several common factors that play a role in the onset and maintenance of both social and physical chronic pain and indicates that both forms of pain persistently impair self-regulatory resources and threaten the same basic psychological needs.

Pain acts as an adaptive mechanism, rapidly and crudely warning an individual either to attend to an injury or to avoid a potential source of further danger. Usually, the individual is able to take proper action, such as treating the damaged part of the body or escaping from the danger, and the pain will disappear rapidly. Therefore, in the short term, physical pain serves as an essential alarm system. However, due to a complex interplay among physiological and psychosocial factors, some painful conditions can persist for years. Unlike acute pain—that constitutes merely a symptom of an injury—chronic physical pain is widely acknowledged to constitute a disease itself: It is one of the biggest health problems that can deeply impair the individual's ability to lead a satisfying and productive life (e.g., Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006).

Recent research finds the function of the pain system is not limited to signaling physical threats. In an fMRI study, Eisenberger, Lieberman, and Williams (2003) found that disruption of social relationships triggers a pain response in the human brain. Subsequent research identified this phenomenon as *social pain* and defined it conceptually as an unpleasant emotional response evoked by the actual, or potential, separation from others persons or social groups (MacDonald & Jensen-Campbell, 2011). This research gave rise to pain overlap theory (Eisenberger & Lieberman, 2004; see also

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MacDonald & Leary, 2005), according to which the detection of social threats—namely, any threat to a person's need to belong—has mapped onto the preexisting neurological circuitry used to signal physical pain. Just as acute physical pain is an alarm system for physical threats to survival, *social* pain is an alarm system for *social* threats to survival. Supporting this assumption, several studies suggest acute experiences of social pain activate brain regions known for their role in processing the unpleasantness of physical pain (e.g., Onoda et al., 2009). Even though acute social pain has not yet been investigated as thoroughly as physical pain, a growing body of research suggests that social pain has several commonalities with physical pain (e.g., DeWall et al., 2010; Riva, Wirth, & Williams, 2011).

THE ADAPTIVE FUNCTION OF ACUTE PAIN

As depicted in Figure 1, the first step toward the onset and maintenance of chronic pain is often an acute pain experience itself (either caused by a social or physical injury; see Figure 1, Step 1). Yet, unlike chronic pain, it must be acknowledged that acute pain has a critical value for survival and the individual's well-being.

Utility of Acute Physical Pain

In the short term, physical pain has a valuable function: By signaling danger, it protects the individual from physical injuries and damages. The crucial adaptive function of physical pain is clear if one considers a living organism with no ability to detect a physical threat (e.g., the proximity to fire). Accordingly, individuals who suffer from congenital analgesia (i.e., a condition in which a person cannot feel physical pain) are at a constant risk of undetected injury or damage that significantly reduces their life expectancy (Nagasako, Oaklander, & Dworkin, 2003). Children with this condition can inadvertently engage in self-injurious behaviors, such as gnawing their own tongue, lips, and fingers to the point of mutilation; they also experience more unnoticed infections and other diseases. Individuals with congenital analgesia need to be constantly monitored by medical professionals because they do not have the pain mechanisms telling them when there is something wrong physically. Thus, physical pain represents an adaptation that protects the individual from physical threats. By rapidly and aversively signaling that something is wrong and, consequently, taking proper action (e.g., fight, flight, freeze), the pain system constitutes an efficient alarm system that may have evolved to also detect threats to inclusionary status.

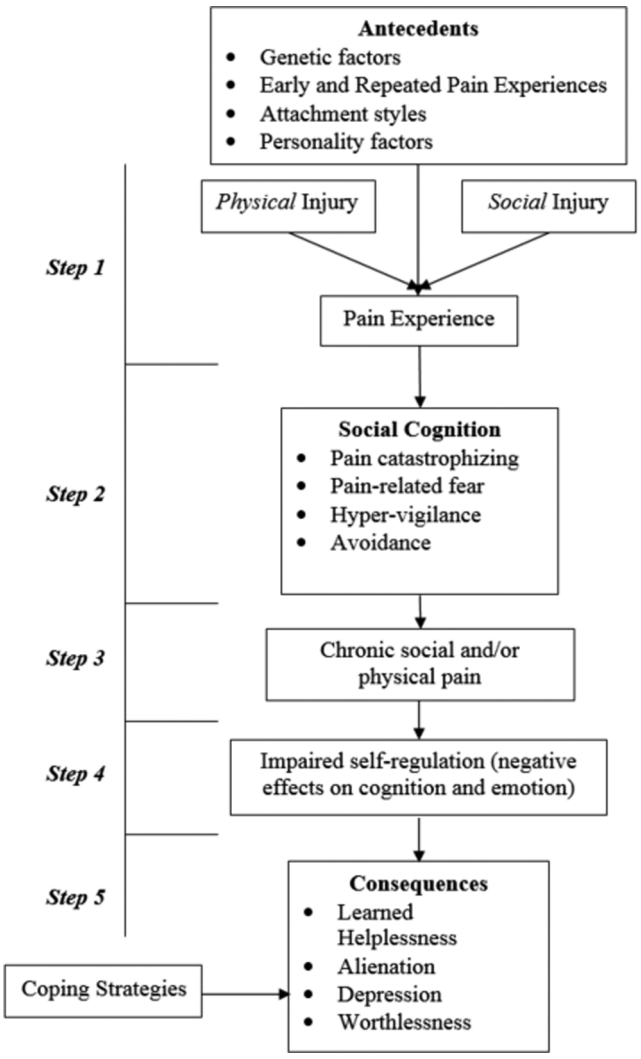

FIGURE 1 The Integrated Chronic Pain Model.

Utility of Acute Social Pain

Similar to physical pain, social pain is hypothesized to be an adaptive mechanism, evolved to facilitate survival and reproduction. Instances of social pain include feelings caused by bereavement, ostracism (being excluded and ignored), rejection, humiliation, and embarrassment (MacDonald & Jensen-Campbell, 2011). Scholars have argued that a system that detects threats to one's inclusionary status (e.g., social pain) would be advantageous for survival for social animals (Leary & Springer, 2001; MacDonald & Leary, 2005). The rationale supporting the concept of social pain is based on the evolutionary advantage of living in a group of social animals. In particular, over the course of evolutionary history, living in supportive and cohesive groups was beneficial for an individual's ability to satisfy basic physiological needs such as food, shelter, and reproduction (Schaller, Park, & Kenrick, 2007).

Thus, being included in a group meant greater chances of survival and reproduction than living in social isolation.

Throughout the course of evolutionary history, enduring a socially painful event (e.g., being ostracized) could be as detrimental to survival as physical injury. Therefore, those organisms that excelled at detecting or foreseeing instances of social pain (e.g., ostracism, rejection) were better able to act in ways that either prevented the loss of group membership, or served to regain membership within the group following ostracism (Spoor & Williams, 2006; Wesselmann, Nairne, & Williams, 2012). Moreover, a detection system for social threats was probably selectively biased to overdetect any sign of ostracism or exclusion, thus creating a system that will lead to more false alarms than misses (Haselton & Buss 2000; Kerr & Levine, 2008). Indeed, missing a threat to the individual's inclusionary status could result in the loss of access to the resources and protection that only inclusion within a group could provide (Williams, 2007); this could lead ultimately to the death of the individual.

THE DETRIMENTAL EFFECTS OF CHRONIC SOCIAL AND PHYSICAL PAIN

Many forms of physical (e.g., back pain, migraine) and social pain (e.g., ostracism, exclusion, humiliation) are acute experiences in origin. However, in some circumstances, the perception of pain that accompanies these experiences can extend over time—even without any further objective injury.

The International Association for the Study of Pain (IASP; 1986) defines chronic physical pain as ''pain which has persisted beyond normal tissue healing time'' (see also Bonica, 1953). The definition includes cases in which pain occurs when no obvious organic pathologies are evident (Turk & Okifuji, 2001). Chronic physical pain is a widespread condition; it is the second most common reason individuals visit physicians, and it affects millions of individuals worldwide, with an estimated 76.5 million adults afflicted in the United States (Johannes, Le, Zhou, Johnston, & Dworkin, 2010), 75 million in Europe (Breivik et al. 2006), and 3.2 million in Australia (Blyth et al. 2001). Chronic physical pain also accounts for substantial healthcare costs; a recent study estimated that low back pain in the United States costs $85.9 billion alone (Martin et al., 2008). Yet, as we already mentioned, the consequences of chronic physical pain go far beyond its economic impact. It has a major detrimental effect on the quality of life and its negative impacts on the individual's well-being are well documented: loss of abilities and roles, relationships, and employment, for example (Walker, Sofaer, & Holloway, 2006).

Likewise, chronic experiences of social pain may be particularly harmful to individuals. As a novel contribution to social pain research, we attempt to define chronic social pain. We adapted the IASP definition and consider *chronic social pain* as pain associated with perceived social separation that persists even in absence of social threats (i.e., a threat to the need to belong). This definition includes cases in which an individual who has experienced one of more instances of social pain (e.g., ostracism, social rejection) continues perceiving the painful feelings of social distance even if the direct causes of the social threat are no longer present. Chronic physical pain exists without any new physically injurious events to evoke it; similarly we argue that chronic social pain can be perceived even in the absence of any new social injury to evoke it. Not only might a person experience a single rejection or loss that hurts after long time has passed (Chen, Williams, Fitness, & Newton, 2008), but she or he can also perceive social separation even when no new instances of rejection are occurring.

Currently, our definition of chronic social pain does not directly include cases in which an individual experience recurrent social ''injuries''—for instance, being ostracized or rejected repeatedly. The latter case would be analogous to a person reinjuring himself every day, which is not how chronic physical pain is described. Thus, we contend that chronic social pain exists without any new injurious events to evoke it; an individual with chronic social pain either has pain all the time or has frequent episodes of pain that are not due to experiencing a new social injury.

However, we believe that the two conditions mentioned here—that is, perceiving social distance even when the social threat is removed (i.e., chronic social pain) and experiencing recurrent acute episodes of social pain are inherently linked. As we highlight next, experiencing repeated acute episodes of social pain might facilitate the onset of chronic feelings of social pain. Furthermore, we believe that similar consequences might occur for both those who perceive social separation even when the social threat is absent as well as those who experience repeated acute episodes of social pain (e.g., ostracism in the workplace on a daily basis). The differences might have implications for social pain management, whereas new, positive, and/or stable episodes of social inclusion would be necessary for those who are experiencing recurring episodes of social pain (Baumeister & Leary, 1995), other strategies (i.e., pain acceptance) would be necessary for people with chronic social pain (i.e., those experiencing social separation even in the absence of social threats).

THE INTEGRATIVE MODEL OF CHRONIC SOCIAL AND PHYSICAL PAIN: EXTENDING THE OVERLAP IN ACUTE FORMS OF SOCIAL AND PHYSICAL PAIN TO CHRONIC FORMS

Moving from the large amount of evidence for common physiological and psychological responses to short-term episodes of social and physical pain (Eisenberger, 2012; Riva et al. 2011), we contend that the overlap between social and physical pain is likely to extend beyond acute threats, including some of the key features that concern the experiences of persistent social and physical pain. However, similar to how existing models of chronic physical pain have little overlap with those dedicated to the experience of acute forms of physical pain (Wall, 1979), we contend that it is essential to develop a new model focused on chronic feelings of social pain, rather than just extending an existing one that are mostly dedicated to acute forms of social pain (e.g., pain overlap theory; Eisenberger & Lieberman, 2004; MacDonald & Leary, 2005).

We argue that chronic social pain shares similar characteristics that are known in the context of chronic physical pain, providing an insight into the initiation and maintenance of chronic social pain. Then we contend that chronic physical pain might cause psychological consequences that have been theorized in the context of chronic social pain (see Williams, 2009). To support our arguments, we present the Integrated Chronic Pain Model (ICPM; Figure 1). Our model begins by outlining how acute social pain may transition into chronic social pain in the same way that acute physical pain can lead to chronic physical pain. More specifically, our model suggests how common antecedents (e.g., attachment styles) and cognitive and motivational mechanisms (e.g., hypervigilance) are involved in the onset and maintenance of social and physical pain. Next, our model suggests common consequences of experiencing the two types of chronic pain, namely, chronically impaired self-regulation and threatened basic psychological human needs (i.e., belonging, control, self-esteem, and meaningful existence; Williams, 2009). In the process, we underscore the usefulness and promise of considering how persistent social and physical pain overlap with each other.

THE ANTECEDENTS OF CHRONIC SOCIAL AND PHYSICAL PAIN

To establish the relevance of extending the overlap between social and physical pain from acute threats to chronic conditions, we first wanted to suggest that similar factors and mechanisms are involved in the onset and maintenance of both types of pain.

Genetic Factors

As we have already noted, social pain is hypothesized to be an adaptive mechanism, evolved to facilitate survival and reproduction (MacDonald & Leary, 2005). Providing support to this evolutionary hypothesis, Way, Taylor, and Eisenberger (2009) showed that a variation of OPRM-1—a gene that is associated to the sensitivity to physical pain and that helps govern the function of mu-opioid receptors—is also linked to the sensitivity of social rejection. Therefore, in acute forms, evidence supports the genetic overlap between social and physical pain.

Crucially for the purposes of the present work, genetic contributions to social and physical pain are not limited to acute forms. Indeed, research found that the abovementioned variant of the human opioid receptor (OPRM-1) is also associated with chronic physical pain (Janicki et al., 2006). Researchers that have tried to estimate the genetic contribution to chronic physical pain state that the heritability coefficients of chronic pelvic pain at 41% and widespread fibromyalgia like pain (i.e., a chronic disorder characterized by widespread musculoskeletal pain, fatigue, and tenderness in specific areas) at roughly 50% (Diatchenko, Nackley, Slade, Fillingim, & Maixner, 2006). Similarly, in the context of social pain, studies on loneliness, which can be considered a key instance of chronic feelings of social pain, estimated that the genetic contribution to individual differences in loneliness is approximately 50% (Boomsma, Willemse, Dolan, Hawkley, & Cacioppo, 2005).

Therefore, even though the study of the genetic contribution to chronic physical and social pain is still at its infancy (for physical pain: Edwards, 2006; for social pain: Way & Taylor, 2011) there is now evidence suggesting that the onset of both chronic social and physical pain is at least partially linked to genetic factors. A possible underlying mechanism accounting for the link between genetic substrates and chronic pain experiences might be heightened pain sensitivity, which is already known to be determined (at least partially) by genetic factors both for physical (e.g., Fillngim, Wallace, Herbstman, Ribeiro-Dasilva, & Staud, 2008) and social pain (Way, Taylor, & Eisenberger 2009).

Early and Repeated Pain Experiences

As indicated in the ICPM (Figure 1), the onset of both chronic social and physical pain may be also facilitated by dramatic early and/or repeated experiences of pain.

In the medical literature, research showed that individuals with a greater physical pain history tend to show lower physical pain tolerance (Rollman, Abdel-Shaheed, Gillespie, & Jones, 2004). Extending this finding, animal

studies provide insights supporting the notion that repeated exposure to socially stressful events can also alter sensitivity toward physical pain perception. For example, Coutinho et al. (2002) explored the combined effect of neonatal maternal separation for 180 min daily on physical pain responses in adult rats. The results suggested that early socially stressful events caused adult rats to develop visceral hyperalgesia, a phenomenon considered as latent pain sensitization. In humans, research showed that a relatively high percentage of patients with chronic physical pain have a history of childhood traumas, which include both physical pain (such as physical and sexual abuse; Kendall-Tackett, 2001) and social pain instances (such as being neglected during childhood; Davis, Luecken, & Zautra, 2005). Along this line, previous scholars suggested that early rejection experiences could reduce one's ability to deal with subsequent social interactions (Downey & Feldman, 1996). Rejection sensitivity refers to the tendency to anxiously expect, readily perceive, and overreact to socially painful events. Early work showed that sensitivity to social rejection is linked to childhood negative social experiences, leading credence to the notion that the sensitization to social pain might in part be due to early painful events. For instance, a study found that higher levels of rejection sensitivity were associated with teasing experiences recalled from childhood (Butler, Doherty, & Potter, 2007). Strikingly, rejection sensitivity has been linked also to physical pain perception. A study found that changes in rejection sensitivity predicted the perception of physical pain during depressive states (Ehnvall et al. 2011). These findings are in line with the notion that a greater sensitivity to one type of pain might accompany a greater sensitivity to the other (Eisenberger & Lieberman, 2004). This research suggests the possibility of a pain-distress system that has become sensitized in part, due to early painful (social or physical) experiences.

Enhanced sensitivity toward physical threats. In the context of physical pain, sensitization has been described as an increased response of the pain system to a variety of inputs following noxious stimuli (Baranauskas & Nistri, 1998). After a typical episode of acute physical pain, the pain system becomes temporarily sensitized but then returns to the normal threshold as soon as the individual is able to address the source of pain and recover from the injury (Baron, 2006). When this process fails, the sensitization does not return to normal and results in a lower pain threshold, causing a vicious cycle of hyperdetection and intensification of pain system sensitivity. In other words, early negative social and/or physical painful experience provide prolonged and intense activation of the pain system, which in turn can influence the individual's tendency to detect, interpret, and respond to further experience of pain.

As a case in point, animal studies found that a single painful inflammatory procedure performed on male and female rat pups on the day of birth altered specific brain receptors (i.e., the corticotrophin and glucocorticoid receptors) that affect behavioral sensitivity to stress, anxiety, and pain in adulthood (Victoria, Inoue, Young, & Murphy, 2013). It is relevant to note that alterations in how these receptors function have also been associated with mood disorders (Arborelius, Owens, Plotsky, & Nemeroff, 1999; Yehuda, Boisoneau, Mason, & Giller, 1993). These findings suggest that pain experienced by human infants may also permanently alter future responses to painful stimuli.

Accordingly, brain imaging studies found that the cerebral cortex of patients with chronic pain undergoes structural and functional changes, rather than simply reverting to its normal state after cessation of chronic pain (Apkarian, Sosa, Sonty, et al., 2004). Furthermore, it has been shown that the neural activation patterns observed in chronic pain patients' brains are markedly different than those observed during acute pain events (Apkarian, Bushnell, Treede, & Zubieta, 2005). Thus, chronic pain is associated with structural and functional changes that alter the brain's response to potentially threatening stimuli. This effect is a manifestation of neuroplasticity, that is, the ability of the brain to change both its physical structure and its functional organization in response to internal and external experiences. Although this phenomenon obviously has many advantages (e.g., learning processes), in the context of pain it can contribute to the transition from acute to chronic pain states (for a review in the area of physical pain, see Coderre, Katz, Vaccarino, & Melzack, 1993). Indeed, when the pain is experienced for short periods, it usually just disappears as soon as it has been dealt with, either with treatments or because the source of the pain has been removed. However, over the course of prolonged periods, the repeated activation of the pain system can lead the brain's circuits to reorganize themselves in a stable way, causing the individual to experience pain even when the original injury or disease has resolved (Baron, 2006).

Through this neurological process associated with prolonged periods of pain exposure, the brain alters its ability to perceive pain by becoming more sensitive to the stimuli from the environment. In the end, an individual will detect even a gentle touch as excruciating: In the context of physical pain this phenomenon is manifested in people who have lost a limb because of injuries, who can still perceive that their missing body part hurts (Ramachandran, Rogers-Ramachandran, & Stewart, 1992). Similarly, torture survivors are likely to suffer chronic pain in the regions of the body that were abused

(Thomsen, Eriksen, & Smidt-Nielsen, 1998; A. C. Williams, Peña, & Rice, 2010). Similar findings have been reported in people with chronic pain conditions such as fibromyalgia, who can perceive even mild sensations as extremely painful.

Enhanced sensitivity toward social threats. Based on the aforementioned findings related primarily to the onset of chronic physical pain, it is also possible that the same process in part accounts for the onset of chronic feelings of social pain. In this respect, research is needed to directly test the hypothesis that neuroplasticity and similar shifts in brain structure and activity are also involved in the onset and maintenance of chronic feelings of social pain. For instance, previous research has shown that acute physical pain perception is associated with the so-called pain matrix regions (e.g., anterior cingulate cortex, insular cortex, anterior insula, and primary somatosensory cortex), whereas chronic physical pain engages the prefrontal cortex (Apkarian et al., 2005; Apkarian, Sosa, Krauss, et al., 2004; Apkarian, Sosa, Sonty, et al., 2004). Accordingly, it has been shown that acute instances of social pain activated part of the same pain matrix regions (e.g., ACC and anterior insula; see Eisenberger et al., 2003; Onoda et al., 2009), whereas it is possible that the experience of chronic social pain might be associated with structural (e.g., a reduction in the gray matter of prefrontal regions; see Apkarian, Sosa, Sonty, et al., 2004) and functional neural changes that—similarly to what occurs for people suffering chronic physical pain—are different from the pattern of activations observed for acute social pain.

Providing initial support the notion that early socially painful experiences can lead to functional changes in the brain that then cause an altered sensitivity toward social threat detection, a recent study examined how daily reports of time spent with friends during adolescence related to neural affective responses to social exclusion 2 years later (Masten, Telzer, Fuligni, Lieberman, & Eisenberger, 2012). The results showed that the lack of social support during adolescence was associated with an increased sensitivity to future social exclusion, as evidenced by increased neural activity during an acute episode of social pain 2 years later in regions previously linked with negative affect and pain processing.

Recent research has also focused on the structural changes associated with perceived lack of social support and loneliness. One study showed that lonely individuals have a reduction in the gray matter volume of the left posterior superior temporal sulcus, a region known to be involved in early stages of social perception, including eye gaze processing, hand action, and body movements coordination (Kanai et al. 2012). Furthermore, another study found that showing unpleasant social stimuli (e.g., a man slapping a woman) caused a greater activation in the visual cortex of lonely compared to nonlonely individuals (Cacioppo, Norris, Decety, Monteleone, & Nusbaum, 2009), suggesting increased visual processing toward social threats by lonely versus nonlonely individuals. These findings are in keeping with those of Garner, Mogg, and Bradley (2006) from the cognitive literature, which showed that people who chronically feel a lack of social connection tend to be more vigilant to social threats (thus increasing the likelihood of social threat detection).

Summary. Overall, these studies demonstrate that repeated exposure to social threats are associated with functional and structural changes in the brain that differ from the pattern of activity observed in acute social pain studies (Eisenberger et al., 2003). We argue that such changes in the brain might cause an increased response of the pain system to a variety of inputs following social threats (i.e., sensitization). Therefore, it is plausible to expect that repeated exposure to socially stressful events can alter human brain sensitivity toward social threat detection.

Attachment Styles

Intriguingly, the onset of chronic social and physical pain can also be facilitated by the lack of satisfactory attachment with primary caregivers. Attachment style is a psychological representation of self and others, formed during early childhood experiences of relationships with primary caregivers that can ultimately influence individuals' relationships across their lifespan. According to Weiss (1973), insecure attached individuals tend to feel devalued by others and are uncomfortable developing close relationships, whereas secure individuals tend to feel valued by others and are comfortable developing close relationships. Furthermore, attachment styles tend to operate automatically and unconsciously, and they seem to be resistant to change (Bartholomew & Horowitz, 1991).

Previous research in the context of physical pain finds that individuals with an insecure attachment style are more likely to develop chronic physical pain disorders than individuals with secure attachments (for a review, see Porter, Davis, & Keefe, 2007). Specifically, chronic pain individuals who have a more anxious attachment style have been found to experience physical pain as more distressing and with greater pain disability than those with more secure attachment (Davies, Macfarlane, McBeth, Morriss, & Dickens, 2009; Mikulincer & Florian, 1998). Germane to our model, past research found that insecure attachment is also positively associated with reports of physical pain-related fear,

hypervigilance, and catastrophizing (i.e., focusing on the worst possible outcome; McWilliams & Asmundson, 2007), variables known to be involved in the perpetuation of chronic pain.

Similarly, individuals with insecure attachments are more likely to report persistent perceived social separation (DiTommaso, Brannen-McNulty, Ross, & Burgess, 2003; Rokach & Neto, 2000), lending credence to the relation between attachment style and chronic social pain. This relationship seems to hold true for individuals at all stages of the lifespan. For instance, previous research found that insecurely attached adolescents are more likely to experience higher levels of parent-related loneliness, and this effect extends to a perceived lack of feelings of social connections in relationships with peers (Goossens, Marcoen, Van Hees, & Vandewoestyne, 1998; see also Chester, Pond, Richman, & DeWall, 2012). According to attachment theory, the lack of satisfactory attachment with primary caregivers should influence all subsequent relationships, eventually framing them with the constant feeling of relationship insecurity (Weiss, 1973).

Summary. These results lend support to the notion that insecurely attached individuals are more prone to feelings of both chronic social and physical pain.

Personality Factors

Personality traits have also been implicated in the onset and maintenance of both social and physical chronic pain. In the context of physical pain, the identification of specific personality traits that may predispose individuals to develop chronic physical pain has been largely taken into account in psychosomatic medicine. Engel (1959) first described a model of a ''pain-prone'' personality. His model included variables such as sense of guilt, unsatisfied aggressive impulses, and history of defeat as risk factors for the development of chronic pain. Subsequent models focused more on a clustered taxonomy of personality traits of chronic pain patients (e.g., Sternbach, 1984), but none of these conceptual models have received solid empirical support (Simmons, Kumar, & Lechelt, 1996). Nevertheless, out of the five personality dimensions identified by Costa and McCrae (1987), research has repeatedly found that neuroticism—a personality trait associated with increased psychological reactivity to stressors, negative appraisal, negative affect, and sensitivity to negative information—is associated with the presence of chronic physical pain (e.g., Wade, Dougherty, Hart, Rafii, & Price, 1992; Wade & Price, 2000).

Neuroticism also seems to be associated with acute and long-term experiences of social pain. Previous research showed that high levels of neuroticism were associated with the tendency to experience hurt feelings and negative emotional reactions to social separation (Leary & Springer, 2001). Furthermore, Eisenberger, Lieberman, and Satpute (2005) found that neuroticism was associated with increased neural activity in the dACC, a region involved in the detection of both social and physical pain. Finally, early research showed that neuroticism correlates with loneliness (Stokes, 1985), suggesting a link between such a personality trait and long-term experiences of perceived social separation.

It is likely that personality traits may facilitate the onset of chronic pain by influencing cognitive and emotional variables. Supporting this assumption, a structural equation analysis of chronic physical pain patients found that cognitive variables (such as pain catastrophizing) and affective state (such as pain-related fear) mediated the relationship between neuroticism and vigilance to pain (Goubert, Crombez, & Van Damme, 2004). Therefore, personality traits such as neuroticism are likely to be related to the ways in which people cognitively and emotionally process the social or physical threats.

Summary. Taken together, these findings suggest that similar personality traits can affect both types of pain and that a common sensitivity regulates them. Specifically, neuroticism constitutes a personality factor associated with long-term vulnerability toward social and physical pain.

Social Cognition

The second step depicted in Figure 1 (see Figure 1, Step 2) concerns the socio-cognitive factors involved in the maintenance of the experience of pain. It is now widely accepted that top-down psychological processes intervene in regulating or potentiating the amount and the duration of physical pain that an individual experiences (Wiech, Ploner, & Tracey, 2008). Recent fear-avoidance models of pain (Asmundson, Norton, & Vlaeyen 2004) accounted for the process by which cognitive and emotional factors affect pain perception contributing to the maintenance of physical pain. We contend that the same cognitive, emotional, and behavioral processes are involved in the maintenance of both chronic social and physical pain. Thus we outline a schema (which has been adapted from Vlaeyen & Linton, 2000) that accounts for the emotional and cognitive factors involved in the perpetuation of both social and physical pain (Figure 2). This schema is meant to focus on and expand the social cognition section of the ICPM to incorporate

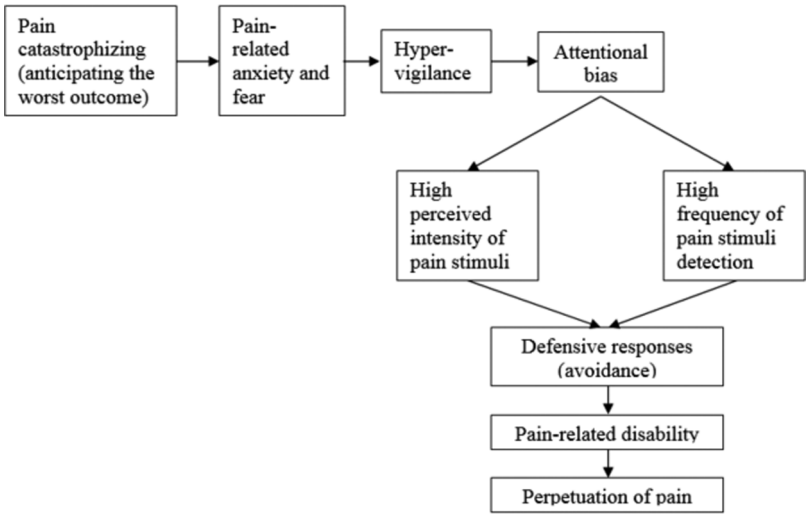

FIGURE 2 Cognitive and emotional factors that facilitate the perpetuation of pain: The fear-avoidance cycle of social and physical pain.

the socio-cognitive factors involved in the maintenance of both social and physical pain.

The schema (see Figure 2) shows that cognitive tendencies—such as pain catastrophizing—influence emotional states that in turn affect social or physical pain vigilance. The increased vigilance toward threats raises the likelihood of perceiving an injury (either social or physical), giving rise to a vicious cycle of catastrophic cognitions, fearful emotional states, increased pain perception, and avoidance behaviors.

Social cognition and chronic physical pain. In the context of physical pain, the aforementioned model (Asmundson et al., 2004) shares the assumption that when an injury is perceived, an individual appraises the meaning of the experience. Usually, physical pain is perceived as unpleasant but not as an overwhelming, insurmountable, or ultimately a destructive experience. However, under some circumstance an individual might develop beliefs or thoughts that pain equates to harm or damage, and thus appraise the physical pain in a catastrophic way (i.e., impossible to tolerate or overcome). Pain catastrophizing affects the individual's emotional response (Sullivan, Bishop, & Pivik, 1995); that is, a distorted cognitive appraisal is thought to induce greater affective responses of fear. More specifically, catastrophic cognitions of pain are known to increase fear of physical pain, namely, the negative emotional response evoked by elements or events associated with pain (Asmundson et al., 2004; Vlaeyen & Linton, 2000). Scholars argued that fear of pain, compared with other potential variables (such as pain intensity), is a primary factor in physical pain-related disability and chronicity (Vlaeyen & Linton, 2000).

Typical fear of pain levels are crucial to protecting the individual from engaging in behaviors that will result in painful experiences, but disproportionate or chronically excessive fear of pain levels can increase the likelihood of painful experiences by promoting a state of hypervigilance (i.e., continuously scanning the environment) toward pain-related stimuli (Asmundson et al., 2004). Indeed, compared to individuals classified as low in fear of pain, those with a high fear of pain tend to exhibit a selective attentional bias toward pain-related stimuli (Keogh, Ellery, Hunt, & Hannent, 2001). Hypervigilance concerns the cognitive tendency to selectively attend to physical pain-related stimuli, thereby fueling a cycle of selective attention and increased likelihood that an actual or potential threat will be detected (Asmundson, Kuperos, & Norton, 1998; for a review, see Pincus & Morley, 2001). As a result of this cycle of catastrophic cognitions, fear of pain, and increased physical pain detection, the individual is likely to develop avoidant behavioral responses (avoidance of physical activity, physical movements, or situations associated with threat).

Avoidant behavioral responses include avoidance of movements and physical activity for fear of reinjury and typically lead an individual to withdrawal from rewarding pursuits such as physical activities, work, leisure, and family activities (Vlaeyen & Linton, 2000). Avoiding movement might minimize the discomfort in the short term, but it is detrimental in the long run because the reduced physical activity increases the individual's disability and perpetuates pain (Vlaeyen & Crombez, 1999). Thus, the onset of a vicious cycle of growing fears, pain perception, and avoidance may be highly dysfunctional, especially because it can extend the pain perception over a prolonged period (Crombez, Vlaeyen, Heuts, & Lysens, 1999).

Thus, in the context of physical pain, fear-avoidance models of pain provide a general account for variability in individual pain perception. This is why some people experience the same aversive stimuli as more painful than others, and why they develop long-term pain and disabilities (i.e., chronic physical pain) when others can recover from it faster.

Social cognition and chronic social pain. As we already noted, contemporary fear-avoidance models of chronic pain have been developed in the context of physical pain (e.g., Vlaeyen & Linton, 2000). Yet a review of the literature on social exclusion, ostracism, and loneliness suggests that the same cognitive and emotional processes also could be involved in the perpetuation of social pain (see Figure 2).

In the context of social pain, a clear distinction among constructs such as social pain catastrophizing and fear of social pain has yet to be made. Accordingly, we argue that an acute episode of social pain (e.g., social rejection) is usually perceived as unpleasant but not as an overwhelming, insurmountable, or ultimately a destructive experience. However—similar to what can happen in the context of physical pain with pain catastrophizing—it is possible that an individual develops beliefs or thoughts that social pain equates to harm or damage, appraising the social pain in a catastrophic way (i.e., impossible to tolerate or overcome). Such distorted cognitive appraisal (i.e., *social pain catastrophizing*) is likely to influence the individual's emotional response to social threats by inducing greater affective responses. Such affective responses refer to *fear of social threat*. Recently, we conceptualized fear of social threat as the negative emotional response triggered by instances of social pain such as ostracism, rejection, exclusion, and other forms of social separation (Riva, Williams, & Gallucci, 2014).

Accordingly, several studies indicate that emotional states (including social anxiety and fear) might affect the individual's vigilance toward the environment for cues that signal possible social exclusion. In turn, hypervigilance to social threats should result in an attentional bias that influences an individual's expectancies (Stinson, Cameron, Wood, Gaucher, & Holmes, 2009), and increases the likelihood that an actual or potential social threat will be detected (see Figure 2). As a case in point, studies demonstrate social anxiety might be associated with a greater attentional bias toward social threat cues. Mattia, Heimberg, and Hope (1993) found that social phobic individuals had greater interference with color-naming social threat words compared to non–social phobic individuals, supporting the hypothesis that some individuals' attention can be automatically captured to a greater extent by social threat cues. A study by Mogg and Bradley (2002) examined the relationship between measures of social anxiety and attentional bias toward threatening faces. This study showed that highly anxious individuals were faster to respond to probes occurring in the spatial location of a threatening faces rather than in the location of a neutral face. Garner et al. (2006) provided further evidence of the relationship between social anxiety and vigilant-avoidant tendencies. The authors found that individuals high in social anxiety, compared to those low in social anxiety, were faster at orienting and maintaining their gaze on emotional faces than neutral faces. However, they also looked at emotional faces for a shorter duration than individuals low in social anxiety.

Riva et al. (2014) expanded on this finding, testing the hypothesis that fear of social threat could predict social pain perception. Participants' levels of fear of social threat were assessed adopting a new 15-item self-report scale that incorporated a variety of instances of socially threatening events. Then participants were either ostracized or included in a subsequent ball-tossing game (i.e., *Cyberball*; Williams, Cheung, & Choi, 2000). Consistent with early findings in the physical pain literature, we found that people with higher levels of fear of social threat were more likely to report social pain when ostracized. The analyses showed that fear of social threat significantly predicted the self-reported social pain experienced during *Cyberball*.

Finally, similar to the negative loop between physical pain detection and avoidance of physical activity, previous research has shed light on behavioral responses to social threats, which may in turn lead to avoidance of social connections. Individuals with high levels of fear and anxiety can experience higher levels of pain during social separations; given the degree of pain they feel after social exclusion, they may be more likely to avoid, rather than seek, novel social connections. Indeed, similar to behavioral tendencies for chronic physical pain, the increased sensitivity to social threats has been linked with defensive responses such as escape, avoidance, and more hypervigilance (MacDonald & Leary, 2005), which may alleviate the occurrence of pain in the short term but exacerbate the experience of it in the long term. Failure to address a dispute with a significant other may ease the pain at the moment but also increase the odds of a long-term relational disruption, in the same way that avoiding physical movements may temporarily ease acute physical pain while increasing long-term chronic pain and disabilities.

Several empirical studies have supported this hypothesis. One study showed that people with high levels of social anxiety tend to avoid rather than seek new social encounters for fear of being negatively evaluated (Heimberg, Lebowitz, Hope, & Schneier, 1995). Maner, DeWall, Baumeister, and Schaller (2007) found that people who tended to fear the sting of negative social

evaluation did not respond to social exclusion with increased interest in reconnecting with new sources of affiliation and restoring social bonds, as did people who tend not to worry about negative social evaluation. Compared to those low in fear of negative evaluation, socially rejected participants who scored high in fear of negative evaluation were less inclined to perceive a new interaction partner as positive and sociable (Maner et al., 2007).

Thus, rather than pursue novel potential sources of social acceptance, socially anxious individuals or people who fear the sting of negative social evaluation might tend to avoid new social encounters, further perpetuating their social isolation and pain.

Summary. In sum, as shown in Figure 2, the evidence we reviewed here suggest the overlap of the cognitive (i.e., catastrophizing and threat vigilance), emotional (i.e., anxiety and fear) and behavioral (i.e., avoidance) factors involved in the perpetuation of social and physical pain.

Summary of Antecedents of Chronic Social and Physical Pain

Overall, in this section we reviewed evidence showing that similar antecedents—ranging from genetics to personality to social cognition—contribute to the onset and maintenance of persistent social and physical pain (see Figure 1, Step 3). Showing that similar factors contribute to the onset and maintenance of persistent social and physical pain lays the foundation for contending that the overlap between social and physical pain extends beyond acute threats, including the experiences of persistent pain.

THE CONSEQUENCES OF CHRONIC SOCIAL AND PHYSICAL PAIN

What are the consequences of chronic social pain, and to what extent do they overlap with those of chronic physical pain? To further support our hypothesis that social and physical pain overlap in their chronic versions, we reviewed evidence suggesting that prolonged experiences of social or physical pain cause common psychological consequences. Indeed, as indicated by the ICPM (Figure 1), people who experience prolonged experience of physical pain report negative outcomes similar to those who endure chronic social pain.

Self-Regulation

We argue that individuals who experience chronic social and physical pain tend to overtax the resources responsible for alleviating the pain. Therefore, the immediate result of prolonged experiences of pain is an impaired self-regulation (see Figure 1, Step 4). Self-regulation is considered the ability to exert control over the self (Baumeister, Heatherton, & Tice, 1994). Self-regulation is a key feature for living successfully in human culture and has implications in myriad domains, including mood and emotional control, thought suppression, impulse control, and task performance (Baumeister & Vohs, 2007). Higher capacities for self-regulation increase adaptive health outcomes by managing domains such as social and physical activity (Hagger, Wood, Stiff, & Chatzisarantis, 2009). Self-regulation appears to depend on limited resources that are rapidly consumed by any attempt to exert control over unwanted urges, and once these resources are depleted they result in a reduced capacity to further self-regulate.

Pain—either social or physical—represents a strong tax on self-regulatory resources because of its high attentional demand (Hamilton, Karoly, & Kitzman, 2004; Solberg Nes, Roach, & Segerstrom, 2009). Furthermore, chronic social and physical pain, unlike other more temporary depleting sources (e.g., acute pain, highly cognitive demanded task), does not allow for the recuperation that has been shown as an effective condition for replenishment of self-control reserves (for physical pain, see Hamilton et al., 2004; for social pain, see Oaten, Williams, Jones, & Zadro, 2008).

In our view, research on the harmful effects of chronic pain on self-regulation can be summarized at least across two main domains—cognition and emotion.

Self-regulation and cognition. First, there is consistent evidence that a lack of self-regulation skills is associated with poor cognitive performance. For instance, a longitudinal study found that children who were most successful at delaying gratification at age 4 went on to become adults with higher SAT scores (a measure of cognitive performance; Shoda, Mischel, & Peake, 1990). Following this study, research found that people in a higher self-regulation state have better outcomes on several cognitive tasks (e.g., Stroop task, thought suppression, attention control; see Gailliot et al., 2007).

As we previously mentioned, pain can be one of the most common factors that reduce the ability of self-control (Hamilton et al., 2004; Solberg Nes et al., 2009). In line with this assumption, one study showed that chronic pain patients are impaired on tasks requiring self-regulation, such as the Iowa Gambling Task, which is designed to evaluate the ability to postpone immediate reward for a longer term successful outcome (Apkarian, Sosa, Krauss, et al. 2004). Moreover, research found that patients with chronic

physical pain commonly report cognitive impairments such as diminished concentration, poor memory performance, and slower cognitive processing (Kewman, Vaishampayan, Zald, & Han, 1991; Lee et al., 2010). These findings support brain imaging studies that suggest the preferential involvement of the prefrontal cortex in chronic pain (Apkarian, Sosa, Sonty, et al., 2004). Indeed, Apkarian, Sosa, Sonty, et al. (2004) demonstrated that patients with chronic back pain had less neocortical gray matter in the bilateral dorsolateral prefrontal cortex and right thalamus than control subjects, and the decreased volume of these regions was related to pain duration.

Similarly, chronic social pain might have a negative impact on cognitive abilities. First, experimental research showed that acute forms of social exclusion decrease cognitive self-regulatory processes at both the neural and behavioral levels (Themanson, Ball, Khatcherian, & Rosen, 2014; Themanson, Khatcherian, Ball, & Rosen, 2013). Second, correlational studies indicated that feeling socially isolated is associated with cognitive decline and dementia (e.g., Gow, Pattie, Whiteman, Whalley, & Deary, 2007; Wilson et al., 2007). Furthermore, early experimental work on social exclusion demonstrated that people who received false feedback that they would have a lonely future (i.e., a premonition of long-term social exclusion) performed worse on several cognitive tasks, including an intelligence test, a recall of complex passages, and an answering of complex analytical questions (Baumeister, Twenge, & Nuss, 2002).

We suggest two potential cognitive mechanisms to explain the link between the experience of chronic pain and poor cognitive outcomes. The first refers to the detrimental effect of pain on the working memory (i.e., the maintenance of the memory trace) that in turn affects cognitive performance (Dick & Rashiq, 2007). The second focuses on the attentional demands that physical pain puts on the cognitive system: Pain requires attention, making it harder for the individual to focus on anything but the presence of pain (Eccleston & Crombez, 1999). Future research is needed to investigate other potential mechanisms, and whether these same mechanisms also account for poor cognitive performance in individuals experiencing chronic social pain.

Self-regulation and emotions. Regulation of positive and negative emotion is itself a common, well-recognized form of self-regulation. Previous research found that inducing an ego depletion state (i.e., the state in which the self does not have all the resources it has normally; Baumeister & Vohs, 2007) caused impaired emotion regulation. Specifically, asking people to suppress their thoughts impairs subsequent efforts to control the expression of emotions (Muraven, Tice, & Baumeister, 1998).

In keeping with this finding, the ability to regulate positive and negative emotions might be constantly and increasingly challenged by the presence of chronic pain. Accordingly, several studies have linked chronic physical pain with lack of emotional regulation (Solberg Nes et al., 2009). For instance, a representative survey of the American population found that individuals suffering persistent physical pain report higher levels of anxiety and panic disorders, even when adjusting for a wide range of medical conditions and sociodemographic variables (McWilliams, Cox, & Enns, 2003). Further, reports of patients' chronic physical pain related significantly to their tendency for proneness to hurt feelings, and both of these factors were related to higher levels of anxiety (MacDonald, Kingsbury, & Shaw, 2005). Research also showed that chronic physical pain is associated with abnormal brain anatomy and function, including a reduction in cortical gray matter in the bilateral dorsolateral prefrontal cortex (DLPFC; Buckalew, Haut, Morrow, & Weiner, 2008), a brain region known for its role in regulating negative emotions and the emotional component of pain. Reductions in cortical gray matter of DLPFC may contribute to exaggerated activity in the medial frontal cortex, augmenting the emotional dimension of chronic pain.

In a similar manner, individuals suffering social pain have been shown to engage in dysfunctional emotion regulation. Early theorizing by Leary (1990) suggested that excluded individuals often experience a paradox; they crave social inclusion but tend to feel anxious and distressed about social situations. Laboratory studies have established that ostracism and social exclusion result in emotional distress (Riva et al., 2011; Zadro, Williams, & Richardson, 2004) or emotional numbness (Baumeister, DeWall, Ciarocco, & Twenge, 2006; DeWall, & Baumeister, 2006). Either way, this research suggests that the lack of social connections impairs emotion regulation. Finally, research on prolonged experiences of social disconnection indicates that lonely people apply less effort to the maintenance and optimization of positive emotions (Hawkley, Thisted, & Cacioppo, 2009).

Summary. In sum, we reviewed evidence that both chronic social and physical pain are associated with deficits in self-regulation. Usually, ego depletion represents a temporary state; after an individual is able to rest, sleep, or eat, he or she can fully replenish self-regulation (Baumeister et al., 1994). However, chronic pain (either social or physical) may be an exception, representing a long-term tax that constantly undermines people's ability to self-regulate. Overall, the distress of pain interferes with all domains of executive function.

Human Basic Needs Satisfaction and the Pain Resignation Stage

Williams (2009) argued that a single episode of ostracism (being excluded and ignored)—a specific type of social pain—threatens four fundamental human needs: control, self-esteem, belonging, and meaningful existence. Human beings desire some degree of control over their environment, whether it is real or illusory (Rothbaum, Weisz, & Snyder, 1982). Humans are also motivated to have a reasonably positive view of themselves (Alicke & Govorun, 2005). In addition, humans are inherently social animals, and thus they desire meaningful interpersonal relationships, the lack of which can be detrimental to well-being (Baumeister & Leary, 1995). Finally, humans have a strong need to know that their existence matters to other individuals (Solomon, Greenberg, & Pyszczynski, 1991). Currently, nearly 150 publications reporting experimentally induced instances of ostracism reveal that ostracism consistently threatens satisfaction of these four basic needs, often with effect sizes within the range of $d = 1.0$ to 2.0 (Gerber & Wheeler, 2009; van Beest, Hartgerink, & Williams, 2013).

It must be noted that social pain is not the only threat to basic psychological needs. We recently found that even one short-term episode of physical pain can threaten need satisfaction (i.e., belonging, control, meaningful existence, self-esteem; Riva et al., 2011). Participants were randomly assigned to be ostracized or included, a manipulation of social pain, or to submerge their hand in cold or room temperature water, a manipulation of physical pain. After completing each task, participants' need satisfaction was assessed. The results showed that both social and physical pain lead to less basic need satisfaction than the control conditions.

Unlike an acute episode of social pain, chronic social and physical pain is likely to persistently threaten these basic psychological needs. According to the ICPM (see Figure 1, Step 5), an individual who has a chronically impaired ability to self-regulate may find it difficult to fortify her or his threatened basic psychological needs. Indeed, experiencing pain requires self-regulation, and this is known to impair subsequent self-regulatory attempts. According to Williams's (2009) temporal need threat model of ostracism, ostracized individuals should feel, think, and act in ways that will fortify their threatened needs, that is, belonging, self-esteem, control, and meaningful existence. Thus, after an acute episode of social pain, individuals should have a higher desire for belonging and should behave in ways that elevate their chances for inclusion. Therefore, it is possible that because pain impairs self-regulation, and because self-regulation is necessary to fortify the threatened needs, those who experience chronic social and physical pain will be unable to put forth the additional effort necessary to recover their threatened needs.

Research on the psychological consequences of chronic social pain provides evidence of the long-term negative health outcomes of the persistence of pain. Zadro (2004) analyzed qualitative interviews from more than 50 individuals who reported having suffered from chronic ostracism. The general trends suggested that chronic experiences of social pain exacerbate need threat, facilitating long-lasting feelings of alienation, depression, helplessness, and unworthiness in these individuals (Williams, 2009). Rather than embracing control, these individuals expressed helplessness; rather than looking for self-esteem enhancement, they accepted low self-worth; rather than seeking belonging, they consented to alienation and isolation; and rather than searching for recognition by others of their existence, they became depressed and avoided further painful rejection. Consistent with these findings, research on loneliness has repeatedly found individuals reporting similar long-tem negative psychological outcomes (Cacioppo & Patrick, 2008). Providing further evidence of the negative psychological consequences associated with chronic social pain, a recent study found that—compared to those who did not live alone—people who did live alone had 80% higher risk of using antidepressant medication during a 7-year period (Pulkki-Raback, et al. 2012). Among the factors that were associated with living alone and antidepressant use were a hostile personality, a lack of social support, and poor job climate. Germane to the ICPM, a recent study demonstrated that impaired self-regulation mediated the relation between long-term experiences of ostracism and depression in an adolescent sample (DeWall, Gilman, Sharif, Carboni, & Rice, 2012).

Similar negative outcomes can be found in the accounts of patients who endure chronic physical pain. Chronic physical pain can have a profound impact on sufferers' sense of self. Patients living with chronic pain often experience a loss of control and feelings of helplessness (Campbell & Cramb, 2008). In striving to conceive the relation between the self and the physical pain, individuals are likely to generate self-denigrating and self-destructive thoughts (Aldrich, Eccleston, & Crombez, 2000). Chronic physical pain is often associated with loss of confidence and self-esteem, and patients can often feel that they have lost the meaning of their lives (Charmaz, 1983). Furthermore, chronic physical pain and depression often co-occur (Banks & Kernes, 1996). Finally, Walker et al. (2006) reported that patients with chronic back pain feel lonely, worthless, and pessimistic; they also have difficulty maintaining social relationships.

Summary. In sum, there is evidence to suggest that both chronic social and physical pain can lead the

individual to a "pain resignation stage" (Williams, 2009), characterized by constant feelings of learned helplessness, alienation, depression, and worthlessness.

Similar Coping Strategies and Neuromodulation Techniques Can Be Adopted to Reduce the Negative Effects of Social and Physical Chronic Pain

Coping strategies represent the last kind of evidence we present to support our theoretical model of the overlap between chronic social and physical pain (Figure 1). Pain researchers classify coping strategies according to an active/passive dimension. Active coping (e.g., problem solving, aiming to temper or control pain, pain acceptance) requires self-regulation to achieve outcomes such as goal setting, controlling thoughts and impulses, and planning and executing strategies and actions. Passive coping (e.g., worrying, catastrophizing, withdrawal, disuse, retreating) involves inactivity, avoidance, and disengagement. Solberg Nes et al. (2009) linked passive coping to diminished psychological adjustment and increased disability and pain.

Therefore, we suggest that optimal interventions for coping with chronic pain should be focused on the replenishment of individual self-regulatory resources. Baumeister and Vohs (2007) argued that self-regulation is similar to a muscle; an individual's ability to override incipient responses can be strengthened through regular exercise. This process can be supported by allowing the individual a period of rest from the pain. In this sense, one of the promising treatments for people suffering from chronic pain is *attentional management* (e.g., distraction; see McCaul & Malott, 1984), a treatment that effectively helps people to direct less attention to their pain, thus freeing up cognitive resources for self-regulation. Moreover, cognitive therapy should be employed to challenge maladaptive forms of overdetection, catastrophizing, as should reinforcing positive pain self-efficacy beliefs (i.e., pain-related fear reduction, i.e., the individual's confidence that he or she can function successfully despite ongoing pain).

Mindfulness relates to a self-directed, nonreactive, and present-focused awareness. Several studies exemplify the effectiveness of mindfulness-based interventions in the context of chronic physical pain. For instance, a recent study found that increases in mindfulness led to significantly less physical pain intensity, negative affect, pain catastrophizing, pain-related fear, pain hypervigilance, and functional disability (accounting for 17–41% of their variance; Schutze, Rees, Preece, & Schutze, 2010). Yet, to our knowledge, no published study to date has investigated the effect of mindfulness on chronic experiences of social pain. Of interest, Masicampo and Baumeister (2007) suggested that mindfulness interventions may qualify as one example of a self-regulation exercise. This argument fits nicely with our model, which posits that chronically impaired self-regulation is the main mechanism by which people move from a physical or social pain injury to the "pain resignation stage." In this sense, our model suggests that the most successful coping strategy is the one that most increases the capacity for self-control.

Furthermore, pain acceptance is considered an effective strategy for coping with chronic physical pain (McCracken, 1998). Acceptance of pain is defined as acknowledging that one has pain, giving up ineffective attempts to control pain, acting as if pain does not necessarily imply disability (impairments in the individual's physical and psychological health), and being able to commit one's efforts toward living a satisfying life despite pain. To our knowledge, no one has tested whether this strategy can be also effective in chronic social pain, but this represents a fertile area for future research.

On a related side, another promising way to reduce the negative psychological consequences of chronic pain may relate to neuromodulation techniques. Previous research has found that noninvasive brain stimulation techniques, such as transcranical direct current stimulation (tDCS) and transcranial magnetic stimulation, can be successfully used to treat both acute and long-term experiences of physical pain (Fregni, Freedman, & Pascual-Leone, 2007). In a similar vein, a recent study (Riva, Romero Lauro, DeWall, & Bushman, 2012) found that anodal tDCS applied over the right ventrolateral prefrontal cortex reduced feelings of social pain after social exclusion. At this regard, future studies should investigate whether tDCS stimulation over the right ventrolateral prefrontal cortex may also aid in treatments to reduce the negative consequences of chronic feelings of social exclusion.

Summary of Consequences of Chronic Social and Physical Pain

Our ICPM applies conceptualizations developed in the social sciences (e.g., self-regulation theory, need-threat model) to understand the potential impact of both chronic social and physical pain on the self. Fulfillment of fundamental human needs constitutes a crucial condition for the motivation, well-being, and ultimately for the survival of the individual (Deci & Ryan, 1985). The notion that physical pain threatens psychological equilibrium should direct more attention to psychosocial aspects of pain management (Riva et al., 2011).

The present integrated framework can support the development and application of tools that can be adopted by therapists to assist individuals who endure long-term social pain. Therapists who work with patients suffering physical pain have already developed

and tested a series of techniques (e.g., pain-related fear reduction) that have been successful in reducing the distress and disability caused by physical pain. In this sense, the usefulness of these tools can be tested to help individual who are suffering chronic social pain, to prevent them from entering into the resignation stage (Williams, 2009). Further, the understanding of the psychological consequences of chronic suffering for the self has important implications for care and management of physical pain. In Western society, physical pain still tends to be considered within the bio-medical paradigm. This perspective focuses on the organic origin of pain, regarding it mostly as a potential diagnostic tool and therefore undervaluing its psychological and psychosocial consequences (Bendelow & Williams, 1995; Kugelmann, 2003). By contrast, understanding that pain has consequences that go beyond an overwhelming physical discomfort would encourage observers to take into account the psychological vulnerability of people in pain.

CONCLUSION

Social and physical pain overlap in acute episodes. In this article, we argued that social and physical pain overlap in chronic conditions as well. We reviewed the literature and found evidence that the chronic conditions of social and physical pain overlap in their psychological antecedents and consequences. We generated an integrative model (ICPM) that integrates the findings reviewed in the literature on chronic social and physical pain and produced a series of testable hypotheses.

Nevertheless, our model does not imply a perfect match between the mechanisms underlying the onset and maintenance of the two types of pain. First, social and physical pain are qualitatively different experiences (from the phenomenological point of view) and people are able to easily distinguish between them. Second, physical pain has a sensory component (e.g., is based on pain receptors and afferent pathways) that social pain lacks. Therefore, there are likely a number of mechanisms that must be unique to each type of pain, and research is needed to identify such mechanisms.

Furthermore, considering the current state of knowledge on the topic, factors such as genetics, past experiences of pain, attachment styles, and personality are likely to play a role both as antecedents and as moderators of the onset and maintenance of social and physical pain. For example, at higher levels of neuroticism, it is likely that the same pain experience will be perceived as more lasting and intense, making this personality factor a moderator of the relationship between an injury and the subjective pain perception. However, the same factors might also facilitate in a more direct way the onset of persistent experiences of social and/or physical pain, thus making it a more direct predictor of chronic pain. For instance, as we mentioned earlier, experiencing recurrent acute episodes of social pain might facilitate the onset of chronic feelings of social pain. Future research should investigate whether a specific factor causes (or facilitates) the onset of chronic pain rather than intervenes in regulating or potentiating the amount and the duration of physical pain that an individual experiences.

Yet remarkably few studies have tackled experiences of chronic social pain, and our model provides the basis for a systematic investigation of the commonalities between chronic social and physical pain. We contend that this unified framework will provide scholars and practitioners with new ways for understanding and managing chronic social pain and provide evidence to legitimize the psychosocial impacts of chronic social pain. On one hand, a better understanding of the commonalities between chronic social and physical pain may help to grant chronic experiences of social pain the same relevance that chronic experiences of social pain have received in the last few decades. Chronic physical pain is often harder to treat than acute forms of physical pain (Wall, 1979). We argue that the same applies for people that live chronic social pain. Although the pain caused by a single episode of romantic rejection can dissipate as the individual finds new sources of social acceptance and support with friends and potential partners, the perceived social separation that continues even in absence of social threats might be much harder to manage. On the other hand, having a better understanding of the common consequences of social and physical pain in chronic conditions may help those who suffer long-term experiences of physical pain better understand its psychological impacts. By arguing that chronic physical pain can lead to feelings of alienation, depression, helplessness, and unworthiness, our model could help healthcare professionals appreciate why and how they can take the social needs of their patients into consideration.

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