Comprehensive review

Psychosocial approaches to pain management: An organizational framework

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ABSTRACT

Many different psychosocial treatments for pain have been described in the literature. All of these treatments have at least some evidence supporting their efficacy. However, each treatment is based on a theory or model that is most useful only for that particular intervention. An overarching model or framework that includes all of the factors hypothesized to play a role in the effects of these treatments would be useful for (1) understanding the similarities and differences between existing and future psychosocial pain treatments, (2) guiding the psychosocial evaluation of patients with chronic pain, and (3) giving clinicians greater flexibility for including psychosocial interventions that have proven efficacy, but that may not be explained by their preferred (but perhaps limited) model. This article proposes an initial version of such a framework, with the hope that it will increase our understanding of the role that psychosocial factors play in the experience of pain and its negative effects on functioning, and informs future research seeking to identify the common and specific factors associated with psychosocial pain treatments.

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1. Introduction

A large and steadily growing number of psychosocial treatments have been developed or adapted for helping individuals who have chronic pain. These treatments include: (1) hypnosis, (2) relaxation interventions, (3) mindfulness meditation training (MMT), (4) operant treatment, (5) graded exposure in vivo, (6) motivational interviewing, (7) cognitive therapy and cognitive-behavioral therapy (CBT) interventions, and (8) acceptance-based CBT interventions. Each of the psychosocial interventions has an associated rationale for how it produces positive outcomes; a number are based on more fully developed theoretical models. However, the rationale or theory associated with one treatment is not necessarily useful for understanding the other interventions; no single existing model adequately explains the effects of all of the interventions. Similarly, each treatment focuses on and addresses only a subset of the psychosocial factors that are hypothesized to play a role in patient functioning. As a result, and depending upon a clinician's preferred theoretical model or treatment, certain psychosocial factors that could be playing an important role in the pain or functioning of a particular patient might be ignored, and interventions that could have effectively addressed these factors might not be provided. *If a clinician limits himself or herself to only one of the existing theoretical models or psychosocial treatments, then a subset of that clinician's patients will be unlikely to receive optimum care.*

To address this problem, there is a need for an overarching psychosocial model or framework that (1) incorporates all of the psychosocial components thought to be associated with patient pain and functioning, (2) could be used to explain the effects of all existing (and future) psychosocial pain treatments, and (3) would provide specific hypotheses that could inform research studies examining the similarities and differences in mechanism(s) of action of different psychosocial treatments. The empirical evaluation and ongoing development of such a model could potentially expand our theoretical understanding of pain and could provide clinicians with a theoretical foundation for making treatment decisions, ultimately improving the efficacy of psychosocial pain treatment.

The primary purpose of this article is to propose an initial version of such an overarching model. It begins with a brief overview of the psychosocial interventions that have been used to treat chronic pain, as well as each treatment's underlying theoretical model or rationale.[1] A potential framework for organizing current (and future)

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[1] Word limitations unfortunately preclude providing anything but a brief description of the psychosocial treatments discussed and their accompanying theoretical models. For more detailed information, the reader is referred to the citations associated with each treatment.

psychosocial pain treatment approaches is then proposed. This article ends with a discussion of the implications of the framework for enhancing psychosocial treatment outcomes and increasing our understanding of how and why psychosocial interventions work.

2. Psychosocial pain treatments

2.1. Hypnosis

Hypnosis treatment consists of two components: (1) an induction, usually involving an invitation for the subject to focus his or her attention on a single sensory experience followed by (2) suggestions for changes in thoughts, emotions, sensory experiences, or behaviors [16]. When used to help patients with chronic pain, the suggestions usually also include "post-hypnotic" suggestions that any beneficial changes that occur during the hypnosis session maintain beyond the session [27]. Controlled clinical trials provide consistent support for the efficacy of hypnosis treatments for reducing average daily pain intensity in individuals with various chronic pain conditions [9,27,48]. Research also provides support for the conclusion that adding hypnosis to CBT treatments enhances the efficacy of the latter, arguing for combining hypnosis with CBT to improve clinical outcomes [24,35].

A number of theoretical models of hypnosis have been proposed, and the field has not yet reached consensus regarding which model is the most useful [40]. Two general classes of models have generated the most empirical research: (1) so-called "trait" theories and (2) sociocognitive models. Trait theories argue that patient responses to hypnotic suggestions occur when the patient enters or is in a state (a "hypnotic trance") associated with both (1) a change in executive control associated with more focused attention and dissociation between cognitive systems that are normally associated (e.g., dissociation between subsystems involving conscious awareness and sensory processing or between sensory processes and affective responses) and (2) changes in neurophysiological activity that are presumed to underlie these processes [45]. For example, hypnotic inductions result in changes in cortical networks associated with attention (e.g., prefrontal cortices and insula) and perceived relaxation (e.g., anterior cingulate cortex) [50]. This model argues that a hypnotic induction will increase the chances that a subject will enter the hypnotic state [2]. The suggestions used in hypnosis treatments can target a number of the psychosocial domains that contribute to the experience of pain and its effects on functioning, including beliefs about or the meaning of pain (cognitive content), how the individual processes information (cognitive coping), and/or what the patient does to cope with pain (behavioral coping) [28].

An alternative model of hypnosis, a sociocognitive view, argues that patients respond to hypnotic rituals as a function of their attitudes, beliefs, and expectancies regarding hypnosis and its outcomes [7,60]. When explaining the effects of hypnotic analgesia, specifically, sociocognitive theorists argue that a presumed hypnotic state has little influence on patient responses. Rather, the hypnotic context is thought to elicit expectations, and patients engage in self-generated cognitive strategies to bring their behavior and experience in line with these expectancies [7].

Although the trait and sociocognitive models are sometimes presented as being in conflict, they can also be viewed as being complimentary: patient expectations and motivation might influence response to hypnotic suggestions, and hypnotic states, as reflected by changes in activity in or dissociations between certain areas of the brain may increase patient responsivity to suggestions. Table 1 presents the key domains and target variables used to explain hypnosis from the two primary theoretical models (the trait and sociocognitive), as well as the domains and target variables associated with the theories explaining other psychosocial interventions, described below.

2.2. Relaxation training

A number of procedures have been developed to teach patients how to experience a sense of relaxation, including progressive muscle relaxation (alternating between purposeful tensing and relaxing of various muscle groups to learn the difference between the two, and ultimately be able to relax muscles on command), biofeedback (measuring and presenting information back to the patient about physiological states not usually accessible to them, such as muscle tension or muscle tone, and then teaching patients to use this information to gain control over those physiological states), and autogenic training (asking the patient to concentrate on phrases suggesting changes in body sensations associated with relaxation, such as "limbs heavy and warm"). Research has supported all three of these relaxation training approaches for reducing pain, at least in the short term [47,56]. Currently, relaxation training is most often provided as one treatment component in the context of multidisciplinary/interdisciplinary pain care [51] or cognitive-behavioral therapy regimens [4].

Although the original rationale for using relaxation training was to teach patients how to reduce peripheral muscle tension, under the assumption that this would reduce nociceptive input and subsequently reduce pain severity, research has since shown that changes in objective measures of muscle tension are not related to changes in pain following relaxation treatment [1,21]. Instead, relaxation training appears to work, at least in part, by the changes that it produces in the patient's outcome and self-efficacy beliefs, which are then hypothesized to contribute to reductions in the stress response and experience of pain [22].

In addition, Patterson and Jensen [48] have noted the high degree of similarity between relaxation training and hypnotic inductions; both involve instructions asking the individual to focus his or her attention, followed by or associated with suggestions for changes in one's perceptual experience. The primary difference is that with hypnosis, the suggestions can focus on of a number of different domains (e.g., changes in sensory experience, beliefs, and/or behavior), whereas with relaxation training there is only one primary explicit suggestion: to experience a feeling of relaxation. The high degree of similarity between the structure of relaxation training and hypnosis, combined with evidence that (1) response to relaxation treatment is associated with hypnotizability and (2) outcomes for hypnosis and relaxation training treatments for headache are similar [48], suggests the possibility that the same mechanisms that have been proposed to explain the effects of hypnosis might also explain the effects of relaxation training. For this reason, the factors listed as possible explanations for the effects of relaxation training in Table 1 include the same factors listed for both trait and sociocognitive models of hypnosis.

2.3. Mindfulness meditation training

As described by Kabot-Zinn and colleagues [32], mindfulness meditation training (MMT) teaches patients to increase awareness of their immediate experience through intensive meditative practice. The original MMT procedures also included instruction in Hatha Yoga for those who were physically capable of participating in this aspect of treatment. The primary target psychosocial domain of MMT is a cognitive coping variable. Specifically, the goal is acceptance of one's experience without judgment. As acceptance increases, it is argued that there is a decrease in the struggle to (unsuccessfully) control that which ultimately might not be controllable, and an accompanying increase in general well-being. Research supports the efficacy of treatments that include MMT for pain management [17,18].

Research also supports an association between meditation and certain patterns of activity in specific brain areas. For example,

Table 1
Key components of the models and theories that have been proposed to explain the effects of psychosocial pain treatments.

Theory or model	Environmental factor(s)	Brain state	Primary pain-related target(s) of intervention		
			Cognitive content	Cognitive coping	Behavior
Trait theory of hypnosis	Induction plus suggestions	Change in executive control; dissociation	Pain-related beliefs	Focus of attention, processing of nociception	Coping responses
Sociocognitive theory of hypnosis	Induction plus suggestions in a social/cultural context		Beliefs and outcome expectancies		
Operant theory	Reinforcers and punishers				Pain and well behaviors
Relaxation training		Change in executive control; dissociation	Beliefs and outcome expectancies		
Mindfulness meditation training	Inviting patients to focus awareness	Change in executive control; dissociation	Beliefs and outcome expectations	Focus of attention on current experience; acceptance of experience	
Cognitive therapy			Adaptive and maladaptive cognitions		
Cognitive-behavioral therapy	Reinforcers, punishers, and social support		Adaptive and maladaptive cognitions	Adaptive and maladaptive cognitive coping	Adaptive and maladaptive coping behaviors
Motivational interviewing	Social reinforcers of "change talk"		Self-efficacy and importance beliefs regarding pain coping	Adaptive and maladaptive cognitive coping	Adaptive and maladaptive coping behaviors
Acceptance-based cognitive-behavioral therapy			Importance beliefs regarding (valued) activities	Adaptive and maladaptive cognitive coping	Engagement in valued activities
Graded exposure in vivo	Reinforcement for engaging in feared behavior		Self-efficacy and outcome expectancies		

meditation practice is associated with a "slowing" of brain activity (decrease in overall activity, and *relative* increases in slow-wave (theta and alpha) activity) [5]. Meditation is also associated with increased activity in the dorsal lateral prefrontal cortex and in the anterior cingulate cortex, perhaps associated with the greater attentional tasks required for meditation [5,54]. Consistent with these findings, meditation practice improves performance in visuospatial processing, working memory, and executive functioning tasks [64], and experienced mediators have thicker prefrontal and insular cortices than individuals who do not practice meditation [36].

Although not always discussed by mindfulness meditation clinicians or researchers, a key factor in mindfulness meditation practice (focused awareness), like that of relaxation training, appears to be very similar to the induction phase of hypnosis [22]. From a hypnosis perspective, MMT can be viewed as an induction followed by a suggestion for an increase in acceptance. Thus, like relaxation training, mindfulness meditation could be viewed as falling under the general class of hypnotic interventions. All three of these interventions might therefore share some of the same underlying mechanisms [15].

2.4. Operant treatment

Behavioral theory posits that behaviors followed by reinforcers will maintain and/or increase in frequency, while behaviors that are ignored or followed by punishers will decrease in frequency. Applying this model to chronic pain, Wilbert Fordyce argued that the mere presence of pain behaviors after the time needed for an injury to heal (usually, no longer than 3 to 6 months following an injury) means that, by definition, any pain behaviors displayed are being reinforced [13]. The task of the clinician is to identify pain behavior reinforcers and intervene to alter them, so that well behaviors (healthy activity, socializing, etc.) are rewarded and pain behaviors (limping, guarding, resting, etc.) are ignored [13]. The increases in well behaviors and decreases in pain behavior that follow this intervention are then thought to be followed by decreases in reports of pain and improvements in other domains of patient functioning. The behavioral model of pain has received consistent empirical support [12,30,53], and treatments that incorporate operant principles have been shown to be effective for reducing pain, disability, and psychosocial dysfunction [10].

2.5. Graded exposure in vivo

Graded exposure in vivo is based on a fear-avoidance model of movement [58], which argues that the fear of pain or fear that physical activity will cause (re)injury will result in patients avoiding activity. This avoidance contributes to overall inactivity, leading to increases in weakness and disability over time. Graded exposure in vivo is designed to directly address this fear of movement and pain by systematically exposing patients to activities and exercises that they report result in pain and/or are otherwise afraid to engage in. Prior to treatment, patients rate the threat level of 98 different physical movements [57]. Following an education session describing chronic pain as a common condition that can be self-managed and a description of the fear-avoidance model, patients are then asked to engage in the activities that were previously rated as fearful (starting with the least feared activities and then systematically performing increasingly feared activities), engaging in these activities until anxiety levels for each decrease. At the end of treatment, patients are encouraged to continue exposing themselves to activities in their everyday life. Randomized clinical trials support the efficacy of graded exposure in vivo as being more effective for reducing pain severity than standard care [62]. This treatment has also been shown to be as effective as other

behavioral pain interventions for reducing pain and disability [14,37]. Research favors graded exposure in vivo, however, over some other psychosocial treatments, for reducing catastrophizing and fear of movement-related cognitions, and increasing self-efficacy beliefs [37,62].

2.6. Motivational interviewing

Motivational interviewing consists of a general therapeutic approach (a patient-centered stance encouraging patient choice and empowerment) and a set of specific strategies (e.g., seeding of motivational ideas, targeted reflective listening) designed to increase beliefs about the importance (positive consequences) of adaptive behavior, and beliefs that it is possible for the patient to engage in adaptive behavior (i.e., self-efficacy beliefs) [43]. Motivational interviewing is similar to the operant approach, in that the clinician closely monitors patient responses, and then provides social reinforcement to increase targeted behaviors. However, the behavior targeted for increased frequency in motivational interviewing is "change talk" or motivational statements; that is, verbal expressions that a targeted behavior change is both desirable ("I think that it might be a good idea if I look into getting back to work") and possible ("With help, I think I could get my old job back"). By increasing the frequency of such motivational statements, clinicians nurture patients' beliefs about the importance of and self-efficacy for adaptive behavior change, which are both hypothesized to increase the probability that the patient will, in fact, make that adaptive change.

A growing body of research supports the efficacy of motivational interviewing for helping individuals decrease and eliminate problem behaviors and increase adaptive healthy behaviors [39]. Because adaptive pain management involves behavior change, various authors have suggested that motivational interviewing might be useful for helping patients with chronic pain increase their use of adaptive pain coping strategies [23,46], and preliminary evidence for its efficacy for this purpose is promising [19,52].

2.7. Cognitive therapy and cognitive-behavioral therapies

Cognitive therapy (also known as cognitive restructuring) is based on the hypothesis that the content of one's cognitions has a direct influence on mood and behavior; adaptive cognitions contribute to positive mood and behavior, and maladaptive cognitions contribute to negative mood and behavior. It involves teaching patients to be aware of what they are thinking, judge those thoughts with respect to their positive or negative effects, and replace any maladaptive or unhelpful thoughts with thoughts that are more beneficial. Note an important difference between mindfulness and cognitive therapy: mindfulness tends to emphasize cognitive *coping* focusing on patient acceptance, whereas cognitive therapy tends to emphasize cognitive *content* and seeks to maximize the frequency that patients think adaptive thoughts. However, cognitive therapy approaches also teach patients that thoughts are not necessarily "the truth;" rather, that they are "just thoughts." Thus, traditional cognitive therapy also encourages acceptance, although perhaps with less emphasis than acceptance-based approaches do.

Cognitive-behavioral therapy (CBT) is not a single therapy or even a single set of standardized interventions. Rather, CBT is a broad category of different treatment regimens. Almost always, however, CBT regimens include cognitive therapy (the "C" of CBT) as a core component. However, CBT also usually includes interventions that are designed to alter behavior (the "B" of CBT), and usually include some combination of operant treatment, coping skills training, relaxation strategies, pacing/activity-rest cycling, exercise and activity management, and/or pleasant activity scheduling [4,33]. CBT can also take into account environmental

factors and can include interventions to increase general social support [11,61], which is associated with positive psychological functioning in pain populations [6,38]. As a multi-component intervention, CBT protocols often differ in content from one CBT research study to the next, complicating our ability to compare the efficacy of CBT interventions between studies. Despite this limitation, however, research shows consistent support for CBT interventions for reducing pain, disability, and psychological distress in a large number of chronic pain populations [10,34].

2.8. Acceptance-based cognitive behavior therapy

In the last decade, modifications of CBT pain treatment programs have been made that de-emphasize the use cognitive therapy as a core strategy for altering cognitive content, and emphasize instead of the use of acceptance techniques (often, MMT) to facilitate a separation between "self" and one's thoughts, feelings, and pain experience [8,42]. In addition, and perhaps even more than operant and other CBT interventions, acceptance-based CBT treatments encourage patients to base their actions on their most important values, as opposed to their immediate feelings, thoughts, and pain. Three examples of acceptance-based treatments for chronic pain include acceptance and commitment therapy [8], contextual cognitive-behavioral therapy [42], and mindfulness-based cognitive therapy [63]. Because these approaches are relatively new, there is not yet a strong empirical basis supporting their efficacy, although preliminary findings are promising [49]. Given the high degree of overlap between acceptance-based CBT interventions and more traditional CBT interventions, however, it would be very surprising if acceptance-based CBT treatments were not found to be effective.

3. An organizing framework

Although there are a number of different psychosocial pain treatments, each with its own rationale or theoretical model, it is possible to classify the key hypothesized explanatory domains and treatment targets of these interventions into five general factors: environmental factors, brain states, cognitive content, cognitive coping, and patient behavior (see Table 1). Similarly, it is possible to combine the components of each explanatory model or theory into a single model with a limited set of specific hypotheses. This section presents a description of the five general psychosocial factors that are proposed to include all of the key domains that are the targets of, and that can be used to explain the effects of, each existing psychosocial treatment. It ends with a list of three specific hypotheses that are proposed to describe the effects of all psychosocial treatments.

3.1. Environmental factors

Environmental factors include the responses of people in the patient's immediate environment (including both health care providers and family members) that are hypothesized to influence the other factors in the model (brain states, cognitive content, cognitive coping, and patient behaviors) and that can directly influence pain and functioning, or indirectly affect pain and functioning via the effects that environmental factors can have on the other four psychosocial factors. The most important environmental factors identified by different psychosocial theories include: (1) social reinforcers and punishers for pain and well behavior; (2) clinician-led hypnotic inductions, mindfulness meditation exercises, or relaxation training exercises that teach patients to alter brain states; (3) clinician's (or family members') verbal statements or suggestions that influence what the patient might or should

believe about pain (cognitive content), how they might process pain information (cognitive coping), or what they might do to manage pain (behavioral coping); and (4) global social support. Table 2 lists the specific environmental psychosocial domains that are hypothesized to influence other psychosocial factors and patient pain and functioning.

3.2. Brain state

The model hypothesizes a role for brain states that are associated with: (1) more responsivity to suggestions; (2) a sense of physical and emotional relaxation and calm; and (3) an increased tolerance for pain and suffering. A number of the existing psychosocial interventions (hypnosis, relaxation training, MMT) include procedures that may help patients achieve these brain states, and the procedures which do so appear remarkably similar, despite the fact that they were developed independently. Partial support for this hypothesis comes from studies that demonstrate a similarity in brain activity and brain states associated with hypnosis and meditation [15,20], although no study has yet directly compared neurophysiological measures of brain states between these two interventions and relaxation training, or between these three interventions and other psychosocial treatments.

The brain states facilitated by hypnosis, relaxation training, and MMT are generally hypothesized to be adaptive, given the positive affect and increased tolerance of pain and suffering associated with them. Moreover, including procedures that facilitates such brain states with CBT treatment increases the efficacy of the latter [35], perhaps due to the increased cognitive flexibility associated with them. However, it is also theoretically possible that such brain states could contribute to worse functioning in some situations; for example, if they were accompanied by environmental suggestions for increased pain and dysfunction (e.g., a spouse saying, "You might hurt yourself!" or "You are never going to get better" when the patient is in one of these states).

3.3. Cognitive content

The model hypothesizes that cognitive content – what patients believe about their pain – influences other factors in the model, and also has direct effects on pain and its effects. Cognitive content can be classified as being adaptive (content contributing to less pain and improved functioning) and maladaptive (content contributing to more pain and dysfunction over time). Correlational research provides preliminary evidence regarding the beliefs that may be most adaptive and maladaptive, although final determination of the causal influence of beliefs will need to be based on experimental research (which is lacking in the field, see research implications section, below). Based on the available research, cognitive content that is most likely to be adaptive includes beliefs related to control over pain and its effects (e.g., self-efficacy beliefs regarding one's ability to engage in valued activities despite pain) [25,26,59]. Maladaptive cognitive content includes beliefs that pain is a signal for physical damage that one is necessarily disabled by and unable to function due to pain, and that one must first experience a decrease in pain before it is possible to function well [25,26,59].

3.4. Cognitive coping

Whereas pain-related cognitive content refers to the frequency with which the patient thinks certain thoughts about pain, pain-related cognitive coping refers to the *use* of cognitive strategies for managing mood (e.g., focusing on pleasant memories), behavior (e.g., setting behavioral goals), and pain (e.g., ignoring pain). The research that has examined the associations between cognitive

coping and outcome measures suggests that adaptive cognitive coping responses include (1) ignoring pain and (2) developing and then focusing on positive beliefs (i.e., coping self-statements) [3,29]. Awareness of one's experience without judgment ("acceptance") has been proposed as a cognitive coping variable that is central to the beneficial effects of acceptance-based cognitive-behavioral therapies [8,42]. However, the most common measure of pain-related acceptance, the Chronic Pain Acceptance Questionnaire [41,59] actually assesses two cognitive content (belief) domains (one reflecting the belief that it is possible to lead a full life even with chronic pain and the other reflecting the belief that one must control pain before one can improve one's life [59]). In the model proposed in this paper, "acceptance" does not refer to these two beliefs. Rather, it is proposed to reflect what patients *do* with these and other pain-related beliefs and experience of pain – specifically, simply being aware of those beliefs and pain without judgment – and is viewed as being adaptive [32]. Maladaptive cognitive coping responses include focusing on pain and focusing on, or ruminating about, negative beliefs (also known as catastrophizing) [55].

3.5. Behavior

Behavior refers to what patients do. This includes behaviors used to cope with or manage pain. Adaptive behaviors include engaging in well behaviors (e.g., activities not usually associated with pain, such engaging in hobbies, work, socializing, or other valued activities) as well as coping behaviors hypothesized to contribute to less pain and functioning over time [3,29]. Maladaptive behaviors include pain behaviors (behaviors associated pain and that communicate pain to others) and pain coping responses hypothesized to contribute to increased pain and disability over time [3,29].

3.6. Three overarching hypotheses

The effects of all psychosocial pain treatments can potentially be explained by three hypotheses regarding the relationships between the five psychosocial factors of the model. These relationships are illustrated in Fig. 1:

1. Environmental factors can influence (1) brain states, (2) the content of cognitions (what patients think), (3) cognitive coping (cognitive strategies for influencing mood, behavior, and pain), and (4) behavior (what patients do). Environmental factors also influence pain and functioning, both directly and indirectly via their effects on brain states, cognitive content, cognitive coping, and behavior.
2. Certain brain states, in particular brain states associated with increases in executive control and dissociation, can result in positive affect and also enhance the efficacy of psychosocial treatments. Hypnotic inductions, mindfulness meditation, and relaxation training may all facilitate brain states that contribute to treatment efficacy.
3. Cognitive content, cognitive coping and behavior domains influence each other, and also directly influence a patient's experience of pain, psychological functioning, and physical functioning.

4. Clinical and research implications of the model

4.1. Clinical implications

4.1.1. Assessment and evaluation
Assessment of basic social history, psychological history and status, and drug use history and status, should all be included in

Table 2
Key psychosocial domains of the five psychosocial factors.

Psychosocial factor	Key psychosocial domain	Hypothesized effects
Environmental factors	Reinforcement of pain behavior	Maladaptive
	Punishment of well behavior	Maladaptive
	Reinforcement of well behavior	Adaptive
	Punishment of pain behavior	Mixed (may reduce pain behavior but increase depression)
	General social support	Adaptive
	Clinician-led exercises that teach patients to alter brain states (hypnotic inductions, relaxation training, mindfulness meditation)	Adaptive
	Suggestions made by clinicians and spouses/ family members	Mixed (depends on the content of suggestions)
Brain state factors	Change in executive functions	Usually adaptive (see text)
	Dissociation	Usually adaptive (see text)
Cognitive content	Belief that one can control pain	Adaptive
	Self-efficacy for functioning despite pain	Adaptive
	Belief that hurt signals physical damage	Maladaptive
	Belief that one is disabled by pain	Maladaptive
	Belief that pain must decrease before one can function well	Maladaptive
Cognitive coping	Ignoring pain	Adaptive
	Focusing on pain	Maladaptive
	Ruminating about negative beliefs (catastrophizing)	Maladaptive
	Developing and focusing on positive beliefs (coping self-statements)	Adaptive
	Awareness of experience without judgment (acceptance)	Adaptive
Behaviors	Guarding	Maladaptive
	Resting	Maladaptive
	Asking for assistance when in pain	Maladaptive
	Task persistence	Adaptive

Note: All of the research performed to date regarding the associations between psychosocial domains and patient pain and functioning has been correlational; no studies have been performed that confirm a casual impact of the specific psychosocial domains on pain, psychological functioning, or physical functioning. The relative adaptiveness/maladaptiveness of each psychosocial domain as indicated here should therefore be considered as a hypothesized effect in need of confirmation by experimental research.

any psychological evaluation, as these provide important contextual information for understanding the patient, and for the development of treatment recommendations. The proposed model, including all of the psychosocial domains listed in Table 2, provides a guide for identifying the additional psychosocial domains that should be assessed to ensure that the evaluation is thorough.

It is possible, even likely, that clinicians who use a limited theoretical approach or model might not assess one or more of these psychosocial domains. For example, a clinician who only offers hypnosis may not assess or consider how much general social support is available to the patient in the patient's immediate environment, or how those other individuals respond to the patient's pain and well behaviors. On the other hand, a clinician who is able to "step back" and who considers all of the psychosocial factors and domains listed in Table 2, would likely have a more thorough understanding of the patient – and where to intervene to have the most positive effects – than a clinician who uses a more restricted psychosocial model.

4.1.2. Tailoring treatment

Each patient's pain problem, and his or her response to that pain problem, is unique. Not all patients need or will benefit from cognitive restructuring. Not all patients will benefit from self-hypnosis training or mindfulness meditation training. In addition, although the 10-session CBT protocols that are manualized and used in clinical trials are important for helping to determine the efficacy of those interventions, strict adherence to those protocols with every patient could, at best, waste some patients' time (by providing some treatment components that may not be needed) and, at worst, limit efficacy (by not providing interventions that would be beneficial but may not be included in the protocol).

Clinicians should therefore be flexible (and knowledgeable) enough to provide treatments that have demonstrated efficacy for influencing *each* of the model's treatment targets – cognitive content, cognitive coping, and behavior – as needed and appropriate, based on the evaluation. Cognitive therapy combined with hypnosis [24] and Motivational Interviewing, for example, might be con-

sidered when the patient endorses a great deal of maladaptive cognitive content, a dearth of adaptive cognitive content, or both. Mindfulness meditation training and acceptance-based CBT facilitating acceptance might be considered for patients evidencing significant maladaptive cognitive coping responses, such as focusing on pain and basing choices regarding activity on pain severity instead of their most valued goals. Operant therapy, CBT, and/or motivational interviewing might be considered to help patients switch from the use of pain-focused maladaptive pain-coping strategies to adaptive pain-coping strategies, at least among those patients who are found to be using many maladaptive (illness-focused) coping strategies.

Note that none of the psychosocial treatments are necessarily mutually exclusive; they can, and often should, be provided in conjunction with one another. By using an overarching model that incorporates all existing psychosocial interventions, but does not require that all interventions be provided to all patients, individual treatment programs can be tailored to patients based on an evaluation that has identified the environmental, cognitive content,
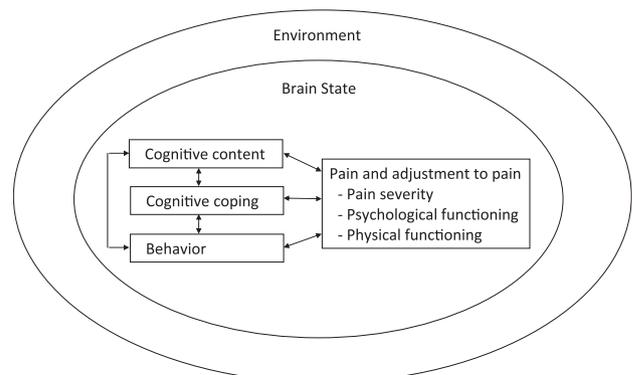

Fig. 1. An organizing framework for understanding the key factors involved in psychosocial pain treatments.

cognitive coping, and behavior variables that require the most attention. The most effective clinicians may be those who are well-versed in the use of all the treatments described here, rather than just a subset of them.

4.2. Research implications: evaluation and development of an overarching psychosocial model of pain

4.2.1. The need to identify causal associations

The pain psychology research literature includes many studies examining the concurrent associations among various psychosocial factors. This research shows that, more often than not, pain-related cognitive content, cognitive coping, and behavior factors are significantly associated with pain and measures of patient psychological and physical functioning. Because a significant association is a necessary, but not sufficient, reason for determining that one variable has a causal influence on another, this research advances the field by identifying the psychosocial factors that are more or less *likely* to influence patient pain and functioning. However, the correlational nature of this research does not allow for definitive conclusions regarding causality.

What the field needs are process analysis studies performed in the context of randomized clinical trials, which can provide more direct tests of causal associations [31]. Such studies not only provide a test of the hypothesis central to the proposed psychosocial model – i.e., that psychosocial factors influence pain and functioning – but can also be used to identify those specific domains within each psychosocial factor that should be retained in the model as having the strongest causal influences on patient functioning, and therefore represent the most important treatment targets. The proposed model would ideally be modified as the findings from such studies are published.

4.2.2. Component analysis

One research strategy that has been under utilized in the field of pain management is component analysis (see, for example [21]). If cognitive therapy that targets changes in cognitions and hypnosis treatment that targets ability to alter brain states operate through different mechanisms, as hypothesized in the proposed model, and if each is effective, then each treatment should contribute independently to positive outcomes; patients who receive both treatments would be expected to obtain more benefits than patients who receive only one treatment. On the other hand, relaxation training and meditation, which are hypothesized to operate through similar mechanisms, would be expected to have similar effects; patients who receive one would not necessarily be expected to benefit further from receiving the other. Researchers could test these and other hypotheses using component analysis designs.

5. Limitations of the proposed model

The model presented in this paper can be considered as an initial attempt at a framework for organizing the existing (and future) psychosocial pain treatments. Such a model has the potential to be useful to the field, by (1) showing where some psychosocial pain treatments may be limited in scope, (2) providing clinicians with a larger framework that can be used to organize patient evaluation and treatment plan development, and (3) providing researchers with specific hypotheses that can be used to examine the common and unique mechanisms associated with the different psychosocial pain treatments.

No theoretical model can ever be truly complete; every working model must necessarily be limited in some respects in order to be useful. Therefore, every model, including the one proposed, will have omissions and limitations. The most glaring omission in the

proposed model is a biological factor. Clearly, the presence (vs. absence) of nociception and neuropathy, as well as other biological pain-related variables, can influence pain and adjustment to pain. Biological factors also have the potential to mediate the effects of psychosocial pain treatments. Given the acknowledged influence of biological, psychological, and social factors on pain, there is a consensus in the field that biopsychosocial models are to be preferred over the more limited biological or, in this case, psychosocial, models for having a complete understanding of pain [44]. The lack of a biological factor in the model could be easily addressed by adding a third circle around the entire model presented in Fig. 1, and labeling this circle "Biology." However, the biological factor was left out in this presentation because the goal was to propose a framework for organizing the *psychosocial* factors that are most important to consider, as well as how the numerous psychosocial treatments might be understood with respect to the key psychosocial factors they address. Adding a third "biology" circle would not have contributed to this goal.

Similarly, there are other contextual factors that influence pain and adjustment to pain that are not currently part of the model, such as a patient's social and psychiatric history. In fact, evidence suggests that the latter variable (specifically, in this case, history of depression) interacts with psychosocial treatment in the prediction of treatment outcome, such that a mindfulness-based cognitive therapy intervention may be particularly helpful with patients who are at risk for depression, but that a CBT intervention may be effective for all individuals, regardless of depression history [63]. Inclusion of these and other potential moderating factors would likely and more accurately reflect the complexity of relationships among the model's variables. It might therefore be reasonable to include an additional circle that represents these contextual variables that could be labeled "social and psychological history and status." Again, however, this factor was left out of the model presented here in order to help keep the model as straightforward as possible, and to emphasize the five key psychosocial factors that are hypothesized to have direct effects (as opposed to moderating effects) on pain and functioning. Future versions of the model could include a list of contextual/moderating factors such social and psychological history and status for the sake of thoroughness.

It might be argued that it is premature to propose a unifying model for psychosocial pain treatments, since we have not yet identified all of the mechanisms involved in each treatment. However, theory about mechanisms and empirical findings regarding those mechanisms should inform each other; theory should influence the design of studies (to test the hypotheses associated with theory), and the results from those studies should then be used to either support or modify the theoretical model. We need not wait until we have all of the answers before developing theoretical models. In fact, doing so could slow progress, because the models are important for identifying the questions that need to be addressed in empirical studies. The primary purpose this article was to present a model based on what is now known or has been hypothesized from the diverse theories that have been proposed to explain the effects of psychosocial pain treatments. It is hoped that the proposed model will be useful for generating future research questions that can then be used to support or modify the model, making it more useful over time.

6. Summary and conclusions

Many different psychosocial treatments for pain have been described, and each one has at least some evidence supporting its efficacy. However, each psychosocial pain treatment is based on a theory or rationale that is most useful only for that particular

treatment. An overarching model or framework that includes all of the factors hypothesized to be important in one or more of the existing models can be envisioned. The model hypothesizes that all psychosocial treatments are effective because they influence one or more of five target factors: environmental factors, brain state, cognitive content, cognitive coping, and/or behavior. Each of these factors is hypothesized to influence pain and adjustment to pain directly, as well as indirectly via their effects on the other factors (which can then influence pain and functioning). It is hoped that the model will be found useful for (1) understanding the similarities and differences between existing and future psychosocial treatments, (2) guiding the psychosocial evaluation of patients, and (3) giving clinicians greater flexibility for including treatments that have proven efficacy, but that may not be explained by their preferred (but perhaps limited) models. It is also hoped that as the model is tested and modified, it may prove useful for improving our understanding of the psychosocial factors that influence pain and guiding treatment decisions, ultimately improving the efficacy of our interventions.

Conflicts of interest statement

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