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Hypnotic Approaches for Chronic Pain Management:

Clinical Implications of Recent Research Findings

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Abstract

The empirical support for hypnosis for chronic pain management has flourished over the past two decades. Clinical trials show that hypnosis is effective for reducing chronic pain, although outcomes vary between individuals. The findings from these clinical trials also show that hypnotic treatments have a number of positive effects beyond pain control. Neurophysiological studies reveal that hypnotic analgesia has clear effects on brain and spinal-cord functioning that differ as a function of the specific hypnotic suggestions made, providing further evidence for the specific effects of hypnosis. The research results have important implications for how clinicians can help their clients experience maximum benefits from hypnosis and treatments that include hypnotic components.

Keywords

hypnosis; chronic pain; hypnotic analgesia

Chronic pain remains a significant burden for both individuals and society. Standard medical treatment for chronic pain is often inadequate (Turk, Wilson, & Cahana, 2011), and it is common for frustrated patients to seek costly treatments from multiple health care professionals without significant relief. Although a number of psychological approaches to the treatment of chronic pain have demonstrated important success over the last few decades (see Jensen & Turk, 2014, this issue), there is a need for additional and robust treatment options that could benefit individuals with chronic pain.

Growing awareness of the limitations of currently available pain treatments make training patients in self-hypnosis an attractive component of pain treatment. For example, there are increasing concerns about the overreliance on analgesic medications, which can have negative side effects, have limited evidence for long-term efficacy, and can result in significant problems associated with addiction or diversion (i.e., nonprescription use) (Manchikanti & Singh, 2008; Maxwell, 2011). There is a corresponding need for effective

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Mark P. Jensen is the author of two books (2011, Oxford University Press) related to the topic of this article (*Hypnosis for Chronic Pain Management: Therapist Guide* and *Hypnosis for Chronic Pain Management: Workbook*), and David R. Patterson is the author of one book (2010, American Psychological Association) related to the topic of this article (*Clinical Hypnosis for Pain Control*). They receive royalties for the sale of these books.

pain treatments that have minimal negative side effects; we are not aware of any pain treatment option with fewer adverse effects than hypnosis (Jensen et al., 2006).

In spite of the promise of this treatment, however, general acceptance of and research on hypnosis continues to be limited. This may be due in part to the lack of a widely accepted definition of hypnosis (Barnier & Nash, 2008). Hypnosis incorporates a number of components, such as relaxation, focused attention, imagery, interpersonal processing, and suggestion. There continue to be differences in expert opinion regarding which of these elements represents the core component(s) of hypnosis, making it difficult to determine if a specific treatment should be classified as hypnosis or not. Despite the lack of consensus, we think it is important for clinicians and researchers to specify the definition they use in their work. Our preferred definition has been that proposed by Kihlstrom (1985, p. 385): "a social interaction in which one person, designated the subject, responds to suggestions offered by another person, designated the hypnotist, for experiences involving alterations in perception, memory, and voluntary action." (For further discussion regarding different definitions of hypnosis that have been proposed, and the theoretical models underlying them, see Barnier & Nash, 2008.)

Hypnosis has been used to treat every type of pain condition imaginable over centuries and across cultures (Pintar & Lynn, 2008). What is new about hypnotic analgesia is the compelling empirical evidence that has emerged in the last two decades regarding its efficacy and mechanistic underpinnings. Much of the earlier research studying hypnotic analgesia focused on acute pain induced in laboratory settings or pain associated with medical procedures (Chaves, 1994; Ewin, 1986). This work continues, and there have also been a number of recent innovative applications of this modality to treat acute procedural pain (e.g., Patterson, Wiechman, Jensen, & Sharar, 2006). Other recent advances in understanding have come from imaging studies examining the brain functions associated with hypnosis and hypnotic analgesia (Barabasz & Barabasz, 2008; Oakley, 2008; Oakley & Halligan, 2010; D. Spiegel, Bierre, & Rootenberg, 1989). In addition, there has been a recent and dramatic increase in research on the efficacy of hypnosis for chronic pain conditions (Montgomery, DuHamel, & Redd, 2000; Stoelb, Molton, Jensen, & Patterson, 2009; Tomé-Pires & Miró, 2012).

Clinical outcome studies on acute and chronic pain as well as neurophysiological studies in the laboratory have demonstrated that hypnosis is effective over and above placebo treatments and that it has measurable effects on activity in brain areas known to be involved in processing pain. Equally important, recent clinical trials provide significant findings useful to the clinical application of hypnosis for the management of chronic pain. The ensuing review and discussion highlight the clinical relevance of these findings to the use of hypnosis for chronic pain and present the issues that we believe should be considered in future clinical and theoretical work.

Findings From Hypnosis Clinical Trials

Two general findings from hypnosis trials have particular clinical and theoretical relevance: (a) There is a high degree of variability in response to hypnotic analgesia, and (b) the benefits of hypnosis treatment go beyond pain relief.

Response to Hypnosis Treatment Is Highly Variable

In hypnosis/pain clinical trials, the standard primary analysis compares *group average* differences in pain reduction between patients who receive treatment and patients in a control condition (e.g., relaxation training, standard care, attention). However, it is unwise to draw conclusions regarding the efficacy of any treatment based only on the statistical significance of averaged results. Statistically significant group differences can emerge even when there are very small (i.e., essentially meaningless) improvements in outcome in all or nearly all study participants. More important, perhaps, nonsignificant results can emerge for treatments that have large and meaningful effects in many study participants if the study sample is too small or if the treatment is highly effective for a small subset of patients. In short, average group differences tell us little about the variability of treatment response among the individuals who receive the treatment.

Responder analyses have been recommended as an alternative strategy for determining the meaningfulness of treatment effects in pain clinical trials once a significant treatment effect has been established (Dworkin et al., 2008). In a responder analysis, the investigator identifies the amount of improvement in the outcome variable needed to determine that an improvement is clinically meaningful and then reports the proportion of “responders” in the different treatment conditions. For example, one early clinical trial of hypnosis for migraine headache (Anderson, Basker, & Dalton, 1975) used “complete remission” as a criterion indicating a meaningful treatment response. More recent studies use a 30% reduction in average daily pain intensity to represent a clinically meaningful improvement in chronic pain conditions (Dworkin et al., 2005).

We were able to identify four hypnosis studies that reported the results of responder analyses in addition to group average results. In the first of these (Anderson et al., 1975), 47 patients with migraine headache were randomly assigned to receive 12 months of either (a) six or more sessions of hypnosis (with instructions to practice self-hypnosis daily) or (b) medication management (administration of the prophylactic drug Stemetil 5 mg four times per day for the first month and two times per day for the remaining 11 months of the trial). A responder analysis indicated that “complete remission” of headaches during the last three months of treatment was achieved by 44% of the participants in the hypnosis condition and 13% of the participants in the medication-management condition.

In an early uncontrolled case series and two follow-up controlled trials, we examined response to 10 sessions of self-hypnosis training in a combined total of 82 individuals with various diagnoses associated with physical disability who also had chronic pain (Jensen, Barber, Romano, Hanley, et al., 2009; Jensen, Barber, Romano, Molton, et al., 2009; Jensen et al., 2005). A 30% or more reduction in average pain identified treatment responders, and analyses showed treatment-response rates varied from a low of 22% for individuals with spinal cord injury to 60% for persons with acquired amputation. Moreover, in one of these studies, a significant Time × Treatment Condition × Pain Type (neuropathic vs. nonneuropathic) interaction also emerged, explained by the fact that *all* of the participants who reported a clinically meaningful decrease in pain intensity had neuropathic pain, but *none* of the participants with nonneuropathic pain reported a meaningful pain reduction following hypnosis treatment (Jensen, Barber, Romano, Molton, et al., 2009).

When discussing variability in response to hypnosis treatment, it is important to consider the issue of hypnotizability. Hypnotizability reflects a person's tendency (or, as some investigators in the field view it, a trait, talent, or ability) to respond positively to a variety of different suggestions following a hypnotic induction. A number of standardized measures of hypnotizability exist (e.g., the Hypnotic Induction Profile, H. Spiegel & Spiegel, 2004; the Stanford Hypnotic Susceptibility Scale, Weitzenhoffer & Hilgard, 1962; the Harvard Group Scale of Hypnotic Susceptibility, Shor & Ome, 1962; and the Stanford Hypnotic Clinical Scale, Morgan & Hilgard, 1978–1979). Each of these measures consists of a standardized hypnotic induction followed by a series of suggestions (for changes in sensory experiences, amnesia, etc.), and the subject's hypnotizability score is the simple sum of positive responses to the suggestions.

One of the most consistent research findings is that hypnotizability scores are very stable, even across decades (Morgan, Johnson, & Hilgard, 1974). Another consistent finding is that general hypnotizability (i.e., response to suggestions *not* involving analgesia) predicts response to hypnotic analgesia in the laboratory setting (Hilgard & Hilgard, 1975). This has led to speculations that hypnotizability might explain the variability in response to hypnotic treatments of chronic pain. However, a growing body of evidence indicates that general hypnotizability demonstrates weak and inconsistent associations with hypnotic treatment of chronic pain in the clinical setting (Patterson & Jensen, 2003). The weak associations with clinical pain and the fact that the majority of patients show at least some benefits of hypnotic treatment (Montgomery et al., 2000) partially account for the fact that hypnotizability screenings are seldom used in clinical approaches to hypnotic pain control.

Hypnosis Treatment Has Significant Benefits Beyond Pain Relief

Clinicians in our hypnosis clinical trials anecdotally noted that the overwhelming majority of participants reported high levels of treatment satisfaction whether or not they experienced clinically meaningful pain relief. Moreover, we also found that a large proportion of patients —including many who did not report clinically meaningful decreases in average or characteristic pain with treatment— reported at follow-up that they continued to practice the self-hypnosis skills taught (Jensen, Barber, Romano, Hanley, et al., 2009; Jensen, Barber, Romano, Molton, et al., 2009). To help understand what appeared to be an anomalous finding, we contacted a cohort of patients who received self-hypnosis training to determine their reasons for continued use of self-hypnosis skills despite an apparent lack of benefit on average daily pain intensity. Consistent with what the study clinicians reported, almost all of the study participants reported high levels of treatment satisfaction (Jensen et al., 2006). In addition, the great majority of those who continued to practice self-hypnosis reported that they experienced *temporary* pain relief when they listened to audio recordings of the treatment sessions or practiced self-hypnosis on their own without the recordings.

In short, we have found that hypnosis treatment has two potential effects on chronic pain. First, as described above, the treatment can result in substantial reductions in average pain intensity that is maintained for up to 12 months in some—but not all—patients. We interpret this finding as support for the hypothesis that hypnosis treatment can result in sustained changes in how the brain processes sensory information in subgroups of patients (larger or smaller subsets, depending on the specific pain condition studied). However, for greater numbers of patients, hypnosis treatment teaches self-management skills that patients can (and most do) continue to use regularly and that can result in temporary pain relief.

We also asked our sample to describe the positive and negative effects of hypnosis, and of the 40 different effects elicited, only three were negative (Jensen et al., 2006). Moreover, and to our surprise, only nine (23%) of the positive descriptions of hypnosis were pain-related. Non-pain-related beneficial treatment effects included improved positive affect, relaxation, and increased energy. These non-pain-related benefits were reported despite the fact that the hypnotic intervention was script driven and focused exclusively on pain management.

These results are consistent with qualitative comments in the literature regarding the beneficial "side effects" of hypnosis (Crawford et al., 1998; Stewart, 2005). They also reflect another important finding in the pain literature: People who report positive changes and satisfaction with treatment do not always report substantial reductions in pain intensity (Turk, Okifuji, Sinclair, & Starz, 1998). As we discuss in greater detail below, the use of hypnosis to improve quality of life in people with chronic pain often involves focusing on outcome variables other than just pain relief.

Clinical Implications of Findings From Hypnosis Clinical Trials

The key findings from the hypnosis clinical trials reviewed above have three important implications for maximizing the benefits of hypnotic pain treatment. Specifically, they indicate that clinicians should (a) include suggestions for both immediate and long-term pain relief, (b) include suggestions for benefits in addition to pain reduction, and (c) use the knowledge about the multiple benefits of hypnosis to enhance treatment outcome expectancies.

Immediate and long-term pain relief with self-hypnosis—Given the evidence that hypnotic analgesia treatment can result in both (a) long-term pain relief and (b) learning skills that produce immediate but shorter lasting (i.e., a matter of hours) relief, clinicians providing hypnosis treatment should ensure that they take full advantage of both of these outcomes. Specifically, they should include hypnotic suggestions for "automatic" and long-term reductions in pain and related distress. They should also provide suggestions, such as the following, that can facilitate the regular use and practice of self-hypnosis:

> And when you practice self-hypnosis, your mind can easily enter this state of comfort, and the comfort will stay with you for minutes and hours … the more you

> practice, the easier and more automatic this will be … and the longer the beneficial effects will last.

Addressing issues beyond pain reduction—Given the established beneficial effects of hypnosis on other outcome domains, hypnotic suggestions for addressing additional pain-related issues should also be included in the hypnotic treatment (Jensen, 2011; Patterson, 2010). In chronic pain, there are almost always associated symptoms that deserve attention. For example, between 50% and 88% of patients with chronic pain report problems with sleep (Smith & Haythornthwaite, 2004). For such patients, hypnotic suggestions can be provided for an increased ability to fall asleep, to return to sleep if they awaken, and to feel rested in the morning (Jensen, 2011).

Effective chronic pain treatments also often target increased activity and adaptive coping responses. Patients who are involved in physical therapy or who are maintaining a regular exercise program can be given suggestions that they will feel confident in their ability to engage in and maintain exercise. Those who experience fatigue might be given suggestions such as being able to draw on an inner strength and experience reserves of energy when needed and appropriate (Jensen, 2011).

It is also important to remember that people with chronic pain often suffer from clinically significant depression and anxiety (Patterson, 2010), and mood states can be addressed by hypnosis (Alladin, 2010; Yapko, 2001). Hypnosis can also include suggestions for improving activity levels, adaptive coping responses, adaptive pain-related cognitions, and sleep quality (Jensen, 2011). Thus, clinicians should take full advantage of all potential hypnotic effects to help patients achieve a number of treatment goals; suggestions should rarely, if ever, focus exclusively on pain reduction.

Good practice involves giving patients with chronic pain realistic hope—It is clear, based on research findings, that not all patients with chronic pain are going to experience pain relief with hypnosis. This brings up the question of how expectations for treatment can be enhanced, given that outcome expectancy is an important factor that can enhance any clinical intervention. Because of our finding that the great majority of the participants in our clinical trials report *some* benefits through learning hypnosis, even when those benefits do not necessarily include pain relief, we now tell patients something along the lines of the following to enhance outcome expectancies without giving unrealistic expectations:

> Many patients find that they experience meaningful reductions in their pain that maintain for a year or more after treatment. Others report that they use the skills they learn to experience pain relief for a few hours at a time when they use self-hypnosis for just a minute or two. Even when the treatment does not result in significant pain relief, almost everyone reports some benefit, such as improved sleep, an increased sense of overall calmness and well-being, or reduced stress. I don't know at this point which of these benefits you would experience if you choose to learn self-hypnosis … want to find out?

The Effects of Hypnotic Analgesia on Pain-Related Brain Activity

To date, the primary imaging techniques used to study the neurophysiological effects of hypnosis include positron emission tomography (PET; cortical metabolic activity), functional magnetic resonance imaging (fMRI; changes in blood flow in the brain and spinal cord), and electroencephalography (EEG; cortical electrical activity). PET and fMRI are most useful for identifying *locations* of brain activity, and EEG is most useful for assessing brain *states*. Rather than repeating what has been reported in a number of reviews on cortical responses to hypnotic analgesia (Barabasz & Barabasz, 2008; Oakley, 2008; Oakley & Halligan, 2010; D. Spiegel et al., 1989), we discuss four key findings from this body of research that have important clinical implications for applying hypnosis to chronic pain management.

Hypnotic Analgesia Influences Pain Processing at Multiple Sites

One of the most important findings from recent neurophysiological studies of pain is that there is no single "pain center" in the brain that is responsible for the processing of pain. We now know that pain is associated with activity in and interaction between a number of different areas of the peripheral and central nervous systems, each of which contributes to the overall experience of pain (Apkarian, Hashmi, & Baliki, 2011). The cortical areas most often activated during pain are the thalamus, anterior cingulate cortex (ACC), insular cortex, primary and secondary sensory cortices, and prefrontal cortex. The relative contribution of each of these areas to the experience of pain varies as a function of the nature of the pain stimuli (Apkarian et al., 2011).

Some of the earliest research on the cortical effects of hypnotic analgesia was reported by D. Spiegel and colleagues (1989), and this body of research has gained substantial momentum over the last decade (Abrahamsen et al., 2010; Derbyshire, Whalley, & Oakley, 2009; Derbyshire, Whalley, Stenger, & Oakley, 2004; Faymonville, Boly, & Laureys, 2006; Raij, Numminen, Narvanen, Hiltunen, & Hari, 2005; Vanhaudenhuyse et al., 2009). Each of the brain areas involved in pain processing has been shown to respond to hypnosis in more than one study: insula (Abrahamsen et al., 2010; Derbyshire et al., 2004), prefrontal cortex (Derbyshire et al., 2009; Derbyshire et al., 2004; Raij et al., 2005), thalamus (Derbyshire et al., 2009; Derbyshire et al., 2004; Vanhaudenhuyse et al., 2009; Wik, Fischer, Bragee, Finer, & Fredrikson, 1999), primary or secondary cortex (Derbyshire et al., 2009; Hofbauer, Rainville, Duncan, & Bushnell, 2001), and cingulate cortex (Derbyshire et al., 2009; Derbyshire et al., 2004; Faymonville et al., 2000, 2006; Raij et al., 2005; Rainville, Duncan, Price, Carrier, & Bushnell, 1997; Vanhaudenhuyse et al., 2009; Wik et al., 1999). Moreover, hypnosis has also been shown to influence the processing of aversive stimulation at the level of the spinal cord (see review by Jensen, 2008). Thus, hypnotic analgesia appears to influence different areas of the nervous system that are involved in the processing of pain rather than having a single, unilateral mechanism.

Hypnotic Suggestions Can Target Specific Brain Areas

In a hallmark study, Rainville and colleagues (1997) demonstrated that hypnotic suggestions for reduced pain *unpleasantness* influenced activity in the corresponding area of the brain expected (ACC) but not in other brain areas, including the sensory cortex. Subsequently, this research group demonstrated that hypnotic suggestions for less pain *intensity* influenced activity in the primary sensory cortex but did not influence activity in the ACC (Hofbauer et al., 2001). Together, these studies indicate that hypnotic suggestions can be targeted to specific effects in brain activity. Thus, not only the hypnotic induction but the content of the specific hypnotic suggestions is of critical importance to the benefits derived from hypnosis.

Hypnotic Inductions Are Associated With Changes in Brain States Consistent With Pain Relief

Cortical neurons fire at different frequencies, and the speed at which they fire is associated with different brain states. Moreover, the experience of pain is associated with more neurons firing at relatively fast (beta, 13–30 Hz) frequencies and fewer neurons firing at slower (alpha, 8–13 Hz) frequencies (Bromm & Lorenz, 1998; Chen, 2001). Importantly, hypnotic suggestions result in changes in brain activity consistent with those observed in individuals who experience pain relief; with hypnosis, there is a decrease in relative beta activity and an increase in relative alpha activity (Crawford, 1990; Williams & Gruzelier, 2001). Thus, the neurophysiological processes associated with pain perception appear to be related not only to the site of activity but also to general activity levels that likely transcend specific areas of functions. Therefore, hypnotic analgesia may influence pain both by altering activity in specific areas and by facilitating shifts in general brain states.

Hypnosis Is More Than Simple Imagination

In 2004, Derbyshire and colleagues published an important study comparing the subjective and neurophysiological effects of (a) noxious stimulation (painful heat applied to the palm), (b) imagined pain (asking participants to imagine the pain they experienced during the noxious stimulation "as vividly as possible"), and (c) hypnotic pain (providing a hypnotic induction followed by suggestions to reexperience the pain experienced during the noxious stimulation) (Derbyshire et al., 2004). The fMRI results for the noxious stimulation condition were consistent with those of many other fMRI pain studies, showing activation in the thalamus, ACC, secondary sensory cortex, insula, and prefrontal cortex (as well as, in this case, activity in the cerebellum and parietal cortex). Moreover, the pattern of brain activity during the hypnotic pain condition was similar to that observed during the noxious stimulation condition, with overlap of activity in the ACC, insula, prefrontal cortex, and parietal cortex. However, the intensity of this activity in the stimulation condition tended to be stronger than that in the hypnotic pain condition, and activation of the primary sensory cortex occurred only in the hypnotic pain condition. In the imagined pain condition, there was some (but much less than either of the other two conditions) activation in the ACC, insula, and secondary sensory cortex. The findings add support to the aforementioned notion that hypnotic suggestions are localized to specific areas of the brain but also add important support for the conclusion that such effects involve more than a process of simple imagination.

Clinical Implications of the Findings From Hypnosis Imaging Studies

The key findings from the studies on the effects of hypnotic analgesia on neurophysiological processes discussed above have two important clinical implications. First, to maximize efficacy, hypnotic treatment should target multiple specific pain domains. Second, clinicians should take full advantage of the calming effects of hypnosis on brain activity and processes.

Hypnotic suggestions should target multiple pain domains—We have already discussed the importance of providing suggestions to improve outcomes other than just pain relief (sleep quality, well-being, activity level, etc.) when treating chronic pain with hypnosis. This same principle applies when treatment targets pain relief, because pain is a multidimensional construct with sensory, affective, and evaluative components. Each of these domains can be influenced by hypnotic suggestions.

It follows that clinicians using hypnosis for pain management should target their suggestions to the different brain areas that process pain. In fact, clinicians will likely be more effective if they are guided by knowledge of the specific brain areas that are linked to pain (Jensen, 2008). Some of the pain-related domains that appear to have specific cortical associations include intensity and quality (sensory cortices), bothersomeness or unpleasantness (ACC), a sense of comfort and physical integrity (insula), reduced threat value and negative implications of the pain (prefrontal cortex), and the ability to "screen out" discomfort and "let in" comfortable sensations (spinothalamic tract). Current thinking in pain physiology suggests that hypnotic suggestions should target several of these domains rather than any one of them (Jensen, 2011; Patterson, 2010).

Taking advantage of the cortical calming effects of hypnosis—The hypnotic induction itself— even before any suggestions are made for pain relief— results in a shift of brain activity in a direction consistent with that of someone experiencing pain relief. Hypnosis is certainly not necessarily the only technique that can be used to shift brain states. Some clinical trials comparing hypnosis to relaxation training have failed to detect differences in outcome for these two treatments, at least for headache pain relief (Patterson & Jensen, 2003). Importantly, response to relaxation training appears to be associated with hypnotizability (Patterson & Jensen, 2003). Many meditation strategies have also has been shown to result in shifts in EEG bandwidth activity consistent with those that follow hypnosis (i.e., an increase in the slower alpha rhythms; Fell, Axmacher, & Haupt, 2010). Like these other "hypnotic-like" treatments, the induction phase of hypnosis may have analgesic effects in and of itself for some patients.

It can sometimes be difficult to distinguish among hypnosis, relaxation/autogenic training, and guided imagery interventions. Certainly, relaxation training and guided imagery often contain elements that look very much like a hypnotic induction, and hypnosis often includes suggestions for relaxation and use of imagery. However, clinical hypnosis usually involves suggestions not only for perceptual changes but also for other clinical benefits (Jensen, 2011; Patterson, 2010), while these other techniques tend to focus on just a single outcome (e.g., relaxation training focuses mostly on perceived relaxation). Understanding that it is often difficult to distinguish among hypnosis, relaxation training, and guided imagery in a clinical situation, we would argue that hypnosis allows clinicians to target a much larger variety of outcomes (i.e., changes in sensory experiences, thoughts, emotions, and behavior) than many other treatments do.

We have cited the important finding that hypnosis has larger effects on pain than does simple imagination (Derbyshire et al., 2004). The implication is that hypnosis is more powerful than simple imagery; however, it is important to acknowledge the potential beneficial impact of imagery in changing perceptual processes. For many patients, including imagery for pain reduction can be a powerful component of the hypnotic intervention. The possibilities for using imagery in this way are endless ("Imagine that your pain has a color. That color is now changing" or "Notice that you are lying with your low back in a stream of healing water … cool and comfortable"). Many patients will benefit from the inclusion of imagery as long as it does not bring up unpleasant or irritating memories. However, clinicians should realize that not all patients enjoy imagery or find visual processing easy and that a variety of other components of hypnosis should also be typically included (e.g., enhanced relaxation, changing the focus of attention, altering negative cognitions; Jensen, 2011; Patterson, 2010).

Unresolved Clinical and Theoretical Questions

Our understanding of hypnotic analgesia has increased substantially in the past two decades. An important review in the early 1980s (Turner & Chapman, 1982) noted that there were no randomized, controlled trials to support its utility as a viable treatment for chronic pain. Based on the findings from the clinical trials and neurophysiological studies cited in this article, we can conclude that hypnosis and hypnotic analgesia have specific effects beyond those attributable solely to placebos. Yet, as we discussed in our introduction, there remains a lack of consensus on what hypnosis is, and there are significant unanswered questions regarding the mechanisms and best clinical use of this approach to pain management. We conclude this article with a brief discussion of four of these critical questions: (a) What is/are the mechanism/s of hypnotic analgesia? (b) How can hypnosis best be combined with other therapies? (c) What is the best dose of hypnosis, and does ongoing hypnosis practice improve outcome? and (d) Can hypnosis enhance acceptance of pain?

What Is/Are the Mechanism/s of Hypnotic Analgesia?

We cannot address possible mechanisms of hypnotic analgesia without at least introducing some of the different theoretical perspectives of hypnosis. During much of the latter part of the 20th century, a substantial amount of effort was put into arguing the relative merits of two primary theoretical models of hypnosis: neodissociation and sociocognitive models. However, despite significant debate and decades of research, neither perspective has been universally adopted by experts in the field. In the last decade, there has been a growing call to view hypnosis from multiple perspectives (e.g., Holroyd, 2003; Kihlstrom, 2003). Some preliminary work to develop more integrative models has also been published (e.g., Barnier, Dienes, & Mitchell, 2008; Pekala et al., 2010b). Despite the fact that the field is beginning to move beyond these two narrow (and conflicting) notions of hypnosis, it is still useful to understand the original models, because each will likely contribute important ideas to an overarching biopsychosocial model of hypnotic analgesia.

Neodissociation and dissociated control models—The neodissociation theory of hypnosis proposed by Ernest Hilgard (Hilgard & Hilgard, 1975) and the dissociated control theories offered by Bowers (1990) and Woody and Sadler (2008) stress the sense of automaticity and effortlessness with respect to behavioral and perceptual changes that often occur with hypnosis. The perceived effortlessness is thought to be associated with a shift in the control of responses from higher executive functions (evaluative and more effortful responding) to those cognitive subsystems that have a direct influence on the behavioral responses without the (usual) layer of judgment or critical screening. In short, dissociation theories hypothesize that hypnosis involves a qualitative shift in the nature of cognitive processes. Dissociation models of hypnosis are also consistent with the views of a number of researchers studying the brain processes associated with hypnotic analgesia. Rainville and Price (2004), for example, argued that hypnosis creates a shift from an active to a passive form of attention and noted that these attentional shifts are associated with a reduction in the monitoring of control and the censoring of experience. Because dissociation theories hypothesize a qualitative shift in neurophysiological states during hypnosis, these models are often referred to as *state* models of hypnosis.

As mentioned above, hypnotizability is a trait-like capability that remains highly stable across decades (Morgan et al., 1974). Moreover, an individual's baseline hypnotizability score is a much more powerful predictor of subsequent response to hypnotic suggestions than is any one of a number of interventions designed to boost hypnotic responding (Frischholz, Blumstein, & Spiegel, 1982). State theorists have argued that hypnotizability is a genetically loaded characteristic that helps predict which subjects are more likely to respond to suggestions. This may explain the consistent associations found between measures of hypnotizability and response to hypnotic analgesia in laboratory settings, although, as we have noted, general hypnotizability is less able to predict response to hypnosis in the clinical context (Jensen, 2011; Montgomery, Schnur, & David, 2011; Patterson & Jensen, 2003).

Sociocognitive models—Researchers who espouse sociocognitive models of hypnosis argue that the concept of an altered state is not needed to understand or explain hypnosis. Rather, they maintain that hypnosis is best explained by the same sociopsychological factors that explain all behaviors whether or not they involve hypnosis: subject expectancy, subject motivation, contextual cues in the social environment, demand characteristics, and role enactment (Kirsch & Lynn, 1995; Lynn, Kirsch, & Hallquist, 2008).

In support of this line of reasoning, Montgomery and colleagues (2010) have shown that measures of outcome expectancies partially mediate the benefits of hypnotic analgesia. In addition, the clinical approach of such theorists working with chronic pain (Chaves, 1993) will often appear very similar to conventional cognitive-behavioral interventions that have been popular for the past three decades (Holzman, Turk, & Kerns, 1986; see also Ehde, Dillworth, & Turner, 2014, this issue).

Understanding the effects of hypnosis on pain from the perspective of more integrated theories—We anticipate that in the same way that biopsychosocial models have replaced more restrictive psychological or biological models of pain (Novy, Nelson, Francis, & Turk, 1995; see also Gatchel, McGeary, McGeary, & Lippe, 2014, this issue), models of hypnotic analgesia that take into account both neurophysiological states (Oakley, 2008; Oakley & Halligan, 2010) *and* traditional psychological factors (such as expectancies, motivation, social cues, etc.) may ultimately prove to have more explanatory power than models that exclude either category of factors. We can envision at least two directions that such theories might take in understanding hypnotic analgesia.

First, it is possible that state and nonstate theories explain different components of hypnotic analgesia; each model may ultimately prove to be most useful with different subsets of patients. For example, patients who score high on tests of hypnotizability may respond better to hypnotic analgesia interventions based on a state approach (e.g., hypnotic inductions and suggestions that focus on dissociation), whereas those who score in the medium or low range on hypnotizability measures may respond better to hypnotic treatments based on sociocognitive hypnotic protocols or at least may be less influenced by their general hypnotizability (e.g., Martínez-Valero et al., 2008).

Alternatively, some investigators have hypothesized that hypnotizability is not a trait that lies on a single continuum but rather that there may be different *types* of hypnotic responding. For example, T. X. Barber (2000) proposed three basic types of hypnotic responders: fantasy-prone, amnesia-prone, and positive-set responders (see also Pekala et al., 2010a). To the extent that people can be reliably classified into different types of responders, hypnotic interventions might be developed that could best match each individual, ultimately resulting in more positive outcomes for more people. Research examining these questions would be very useful.

Which potential mechanisms of hypnosis might be considered in the development of a more complete model? Several mechanisms have been postulated as important elements of hypnosis (Barnier & Nash, 2008), and all of these have been hypothesized to be associated with pain reduction. These include relaxation (Edmonston, 1991), the use of distracting imagery (Chaves, 1994), focused attention (Barabasz & Barabasz, 2008), and expectancy (Wagstaff, David, Kirsch, & Lynn, 2010). The field has also gained an understanding of some potential mechanisms that do *not* contribute to the effects of hypnotic analgesia; we know, for example, that although hypnotic responding can be influenced by outcome expectancies, hypnosis has specific effects over and above those associated with placebos (Hilgard & Hilgard, 1975). Research suggests that the effects of hypnotic analgesia are not mediated by endogenous opioids (J. Barber & Mayer, 1977) or distraction mechanisms such as those produced by immersive virtual reality (Patterson, Hoffman, Palacios, & Jensen, 2006).

We have discussed how hypnotic suggestions can affect specific areas of the brain that process pain depending on the wording of the hypnotic suggestions. One important next step is to investigate how hypnosis allows subjects to better access and impact those areas of the brain. We speculate that subjects experiencing hypnosis suspend critical monitoring and judgment and, as a result, have more direct access to and influence over critical areas of the central nervous system. This process may be enhanced by any number of factors: focused attention, deep relaxation, and disruption of linear (i.e., critical) thinking.

Neurophysiological research provides preliminary support for these ideas in that individuals who score high on tests of hypnotizability (*highs*) clearly process information differently from those who score low on hypnotizability tests (*lows*) and that many of the differences in processing are associated with those (frontal) areas of the brain associated with executive control (Jensen et al., 2013). Research is needed to further examine the potential role of frontal/ executive brain areas in response to hypnotic analgesia and other hypnotic treatments.

What Are the Additive Effects of Hypnosis?

In 1995, Irving Kirsch and colleagues published an important meta-analysis of the additive effects of hypnosis when combined with other treatments (Kirsch, Montgomery, & Sapirstein, 1995). These authors reviewed 18 studies in which cognitive-behavioral psychotherapy was provided in a hypnotic context and compared with the same therapy without hypnosis. They reported that adding hypnosis to cognitive-behavioral psychotherapy enhanced the average study effect size by 0.5 standard deviation units. Further, "the average client receiving cognitive-behavioral hypnotherapy benefitted more than at least 70% of clients receiving the same treatment without hypnosis" (Kirsch et al., 1995, p. 218). However, only one of the studies reviewed by Kirsch and colleagues studied chronic pain.

To our knowledge, there has been only one study published since Kirsch and colleagues' (1995) review that examined the effects of combining hypnosis with another intervention in the treatment of chronic pain (Jensen et al., 2011). Although the findings from this study were positive—a "hypnotic cognitive therapy" intervention resulted in additional reductions in pain intensity, catastrophizing cognitions, and pain interference, over and above the effects of either hypnotic analgesia or cognitive therapy alone—it was essentially a pilot study. More research examining the effects of combining hypnosis with other established pain treatments is clearly warranted.

A related issue is whether adding hypnosis to treatment results in health care cost offsets. Two significant studies have addressed this question. Lang and colleagues (2000) randomly assigned 241 patients undergoing cutaneous vascular and renal procedures to groups receiving self-hypnotic relaxation ($n = 82$) or standard care ($n = 79$). Patients who received hypnosis used less procedure room time, had more hemodynamic stability, used fewer sedating/analgesic medications, and reported less pain and anxiety than those who did not receive hypnosis. In a secondary analysis using data from this study, Lang and Rosen (2002) reported that the participants in the hypnosis group incurred medical care costs that were less than half those incurred by the participants in the control group. Montgomery and colleagues (2007) reported even more dramatic cost savings in 200 patients who were scheduled to undergo breast cancer procedures. Patients in the hypnosis group received fewer sedating or analgesic drugs (propofol and lidocaine) and reported less pain, fatigue, nausea, discomfort, and emotional upset than patients in the control group. In a cost analysis, the authors reported that care of the hypnosis group cost the institution an average of $772.71 less per patient than did care of the control group, a difference that was accounted for largely by reduced surgery time and personnel and equipment costs for the hypnosis group.

Can Hypnosis Enhance Acceptance of Pain?

The notion of enabling patients to manage their chronic pain through such approaches as mindfulness meditation training (and therapies that incorporate mindfulness) is becoming increasingly popular (McCracken & Vowles, 2014, this issue). In such approaches, efforts to directly resist or reduce chronic pain are thought to contribute to suffering. Put another way, having a goal of a direct reduction in chronic pain might *decrease* the quality of life for some patients.

Clearly, as discussed in this review, hypnosis can be used to reduce pain intensity or otherwise change the experience of pain for some individuals. However, without going into an extensive discussion of mindfulness, hypnosis could potentially serve some patients well as a tool for helping them to accept rather than seek to change their experience of pain. For example, during the hypnotic process, patients can be encouraged to examine pain from a distance or to accept the notion that all perceptual experiences are temporary (Patterson, 2010). Fordyce (1988) taught us long ago that the primary problem many patients face is suffering rather than pain. Accordingly, he counseled patients to focus away from pain with the understanding that dwelling on it only enhanced pain-related suffering. There are parallels to this thinking in some Eastern philosophies that view suffering as a direct result of a person's resisting or seeking to change his or her experience, as opposed to accepting it. In any case, it is possible that hypnosis can not only facilitate the ability of patients to reduce their pain but can also increase their acceptance of their experience of pain, which would ultimately result in a decrease in suffering (Patterson, 2010).

Summary and Conclusions

Chronic pain management remains one of the largest challenges in health care, and hypnosis is an undeveloped but highly promising intervention that can help to address this problem. Findings from controlled trials indicate that hypnosis is effective for reducing chronic pain intensity on average but that there is also substantial individual variation in outcome. Importantly, hypnosis for chronic pain has few negative side effects. In fact, with hypnotic treatment, most patients report positive side effects, such as an improved sense of well-being, a greater sense of control, improved sleep, and increased satisfaction with life, independent of whether they report reductions in pain. A burgeoning literature on the neurophysiological impact of hypnotic analgesia has guided both theoretical and clinical work. We have learned that hypnosis has a measureable impact on neurophysiological activity and functioning of pain. Importantly, depending on the specific wording, hypnotic suggestions can target specific pain domains and outcomes, as well as activity in specific brain areas.

Our theoretical understanding of hypnotic pain relief is plagued by a lack of consensus on a basic definition of hypnosis as well as by the lack of a comprehensive biopsychosocial theory that explains its impact. Although it appears that the various components that often constitute hypnosis (e.g., focused attention, relaxation, imagery) have beneficial effects on their own, we have yet to fully understand how the sum of these parts has beneficial effects. We look forward to the increased understanding that will come with further research and theoretical developments.

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