Mediation and Moderation of Psychological Pain Treatments: Response Expectancies and Hypnotic Suggestibility

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The mediator role of response expectancies and the moderator role of hypnotic suggestibility were evaluated in the analogue treatment of pain. Approximately 1,000 participants were assessed for hypnotic suggestibility. Later, as part of a seemingly unrelated experiment, 188 of these individuals were randomly assigned to distraction, cognitive–behavioral package, hypnotic cognitive–behavioral package, hypnotic analgesia suggestion, placebo control, or no-treatment control conditions. Response expectancies partially mediated the effects of treatment on pain. Hypnotic suggestibility moderated treatment and was associated with the relief produced only by the hypnotic interventions. The results suggest that response expectancies are an important mechanism of hypnotic and cognitive–behavioral pain treatments and that hypnotic suggestibility is a trait variable that predicts hypnotic responding across situations, including hypnotosis-based pain interventions.

Keywords: response expectancies, hypnotic suggestibility, pain, hypnosis, cognitive–behavioral

Pain is arguably the most universal of medical complaints. A variety of psychological procedures are commonly used to manage acute, chronic, and recurrent pain. For example, cognitive–behavioral interventions have been shown to be very effective in alleviating pain (see Turk & Gatchel, 2002). These interventions span a range of techniques, from simple distraction exercises like controlled breathing to more complex procedures like progressive muscle relaxation and guided imagery. Such techniques have sometimes been combined into sophisticated, multicomponent cognitive–behavioral intervention packages like Stress Inoculation Training (see Turk, Meichenbaum, & Genest, 1983). Hypnosis has also been found to be very effective in relieving pain (see Montgomery, DuHamel, & Redd, 2000; Patterson & Jensen, 2003). Classically, hypnotic pain interventions involve making direct suggestions for symptom reduction (see Chaves, 1993). However, some hypnotherapists now prefer to deliver established cognitive–behavioral pain procedures within the context of hypnosis (see Kirsch, Montgomery, & Sapirstein, 1995) rather than make direct suggestions for pain reduction. The objective of this analogue treatment study is to evaluate the mediator role of response expectancies and the moderator role of hypnotic suggestibility in these common hypnotic and cognitive–behavioral pain treatments. As such, our aim is to help illuminate the mechanisms that explain how these psychological pain treatments work and who might best be helped by them.

Mediator Role of Response Expectancies

Of late, response expectancies have received growing attention in the empirical literature as a possible mechanism of psychological pain treatments. Response expectancies are defined as the expectancy of the occurrence of nonvolitional responses to situational cues (Kirsch, 1990). According to Kirsch (1985), “nonvolitional responses are responses that are experienced as occurring automatically, that is, without volitional effort . . . . They include emotional reactions (e.g., fear, sadness, elation), sexual arousal, conversion symptoms, pain, and so forth” (p. 1189).

Kirsch’s (1985) response expectancy theory is an extension of Rotter’s social learning theory (Rotter, 1954). According to social learning theory, the probability that a behavior will occur is a function of the expectancy that the behavior will lead to reinforcement and the value of that reinforcement. Social learning theory is designed to predict the occurrence of goal-directed or choice (i.e., voluntary) behaviors. In contrast to the social learning theory conception of outcome expectancies that predict voluntary behaviors, response expectancies predict the occurrence of involuntary behaviors (e.g., pain sensations). Response expectancies also may be distinguished from Bandura’s (1977) conception of efficacy expectations, or the expectancy that one will actually be able to perform a behavior that might lead to reinforcement. Like outcome expectancies, efficacy expectations appear to denote expectancies about behaviors that are voluntary in nature. Response expectancies are also distinctive because they are said to be directly self-confirming. That is, expectancies for particular experiences directly generate those experiences. Indeed, Kirsch (1990) has hypothesized that response expectancies are a mechanism through which psychotherapy generates behavior change. As such, re-

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response expectancies are not simply a correlate of treatment outcome, but rather an unmediated cause of change in psychotherapy. In the case of pain treatments, response expectancies may produce analgesia by establishing a cognitive set in which the person expects pain reduction.

Only a few investigations have evaluated the role of response expectancies as a mediator of psychological pain treatments using the Baron and Kenny (1986) analytic strategy. Baker and Kirsch (1993) found that response expectancies fully mediated the effect of one hypnotic and two placebo treatments on experimental pain. In contrast, several other experimental pain studies showed that a variety of hypnotic and cognitive-behavioral interventions were partially mediated by response expectancies (Milling & Breen, 2003; Milling, Kirsch, Meunier, & Levine, 2002; Milling, Levine, & Meunier, 2003). Similarly, Montgomery, Weltz, Seltz, and Bovbjerg (2002) reported that response expectancies partially mediated the effect of hypnosis on breast biopsy pain. Thus, placebo analgesia may be fully mediated by response expectancies (see also Montgomery & Kirsch, 1997), whereas hypnotic and cognitive-behavioral pain interventions may be partially mediated by response expectancies. However, this literature is small and any conclusions should be considered preliminary. In light of the emergent nature of these findings, one purpose of our investigation is to examine the role of response expectancies as a mediator of the relief produced by common hypnotic and cognitive-behavioral pain interventions.

Moderator Role of Hypnotic Suggestibility

Hypnotic suggestibility, defined as the generalized tendency to respond to hypnosis and hypnotic suggestions, is said to be a stable, trait-like individual difference variable (Gur, 1978/1979). It can be assessed with standardized measures consisting of a hypnotic induction and a series of test suggestions. Research with such measures has indicated that there are large individual differences in hypnotic suggestibility (see Gwynn & Spanos, 1996). Moreover, numerous investigations have shown that hypnotic suggestibility moderates the effect of hypnotic pain treatments (see Montgomery et al., 2000).

However, past studies of this association have routinely measured hypnotic suggestibility and pain reduction in the same experimental context, possibly overestimating the correspondence between these variables. Some hypnosis scholars believe that relations among hypnotic behaviors may be a product of a context effect (see Council, Kirsch, & Grant, 1996). That is, participants in hypnosis experiments are said to respond consistently across measures of hypnotic behaviors when the measures are transparent and participants can deduce the hypothesized relationship between them. However, the association between hypnotic behaviors sometimes breaks down when participants are not aware there is a connection between the measures. Indeed, the oft-cited association between hypnotic suggestibility and absorption (i.e., the tendency to become highly involved in sensory and imaginative experiences) has been shown to be weak or even nonexistent when assessed in the guise of separate experiments (Council et al., 1996). Demonstrating a relationship between suggestibility and pain reduction when measured in separate experimental contexts is essential to providing an accurate estimate of the moderator role of hypnotic suggestibility in hypnotic pain treatments.

Recently, Milling and Breen (2003) evaluated the moderator role of hypnotic and nonhypnotic suggestibility in hypnotic and cognitive-behavioral pain reduction. Just as hypnotic suggestibility is the general tendency to respond to imaginative suggestions delivered in hypnosis, nonhypnotic suggestibility is the general tendency to respond to imaginative suggestions delivered outside of hypnosis. These investigators measured hypnotic and nonhypnotic suggestibility using a modified version of a standard measure of hypnotic suggestibility (see Braffman & Kirsch, 1999) and then assessed pain reduction as part of a seemingly unrelated investigation. Consistent with prediction, Milling and Breen reported that nonhypnotic suggestibility moderated the effect of a cognitive-behavioral intervention with a major imaginative component. However, hypnotic suggestibility failed to moderate the effect of the hypnotic interventions. It was unclear whether this failure was due to measuring suggestibility and pain reduction in different experimental contexts or to a demand characteristic in which responding to the nonhypnotic test suggestions somehow affected responding to the hypnotic suggestions administered immediately afterward. A logical extension of Milling and Breen’s study would involve assessing the effects of the same pain interventions after administering a standard measure of hypnotic suggestibility (without nonhypnotic suggestions) as part of a seemingly unrelated experiment. Thus, a second purpose of our study is to evaluate the role of hypnotic suggestibility as a moderator of common hypnotic and cognitive-behavioral treatments when suggestibility and pain reduction are measured in separate experimental contexts.

The Current Study

To evaluate the moderator role of hypnotic suggestibility in hypnotic and cognitive-behavioral pain treatment, we measured hypnotic suggestibility as well as the relief produced by the same treatments featured in Milling and Breen (2003). These treatments consisted of analogue versions of two common cognitive-behavioral interventions (i.e., distraction and a multicomponent cognitive-behavioral intervention), two common hypnotic interventions (i.e., direct hypnotic suggestions for pain reduction and a multicomponent cognitive-behavioral intervention delivered in a hypnotic context), and two control conditions (i.e., placebo and no-treatment). We measured pain reduction and suggestibility in separate experimental contexts and then tested their interaction using regression analysis, according to Baron and Kenny’s (1986) strategy for evaluating moderation. We predicted that hypnotic suggestibility would moderate the effect of the two hypnotic pain interventions. To evaluate the mediator role of response expectancies in these pain treatments, we asked participants to rate the amount of pain they expected to experience while undergoing intervention and then tested mediation using regression analysis, according to the approach described by Baron and Kenny. We predicted that response expectancies would partially mediate the effect of the hypnotic and cognitive-behavioral treatments.

Method

Participants

Participants in the main study were 68 male and 120 female introductory psychology students who volunteered in order to fulfill a course requirement. The mean age of participants was 18.87 years (SD = 3.31, range =
17–61). Sixty-four percent of the sample described themselves as Caucasian, 14% as African American, 5% as Hispanic, 2% as Asian or Pacific Islander, 0.5% as American Indian or Alaskan native, 4% as other, and 10% did not respond to the question. Participants were not significantly different in age, sex, or race from all students who took introductory psychology during the semesters in which the study was conducted.

Individuals who took part in the main study were recruited from a group of approximately 1,000 introductory psychology students who had previously been screened for hypnotic suggestibility using the Carleton University Responsiveness to Suggestion Scale (CURSS; Spanos, Radtke, Hodgin, Stam, & Bertrand, 1983). Participants were randomly assigned in blocks to one of the six experimental conditions such that each condition had equal proportions of men and women.

Experimenters were blind to participants' suggestibility scores. Before beginning the experiment, participants provided written informed consent and read magazines during a waiting period. Therefore, participants assigned to all conditions spent 90 min taking part in the experiment. A flow diagram depicting the experimental procedure is shown in Figure 1.

**Procedure**

Individuals previously screened for hypnotic suggestibility using the CURSS were contacted by telephone and invited to participate in a study comparing an experimental topical analgesic with several different psychological pain control techniques. No selection criteria were used in recruiting participants for the main study. A sample of at least 168 participants was targeted because cell sizes of 28 have been shown to produce sufficient statistical power to detect differences in pain reduction among the treatments in question (Milling & Breen, 2003). Participants were randomly assigned in blocks to one of the six experimental conditions such that each condition had equal proportions of men and women. Experimenters were blind to participants' suggestibility scores. Before beginning the experiment, participants provided written informed consent and completed a medical screening form. Eligible participants could not have a medical condition that affected the sensitivity of their left index finger. The study was conducted in compliance with the university human subjects committee.

Individuals assigned to the hypnotic analgesia suggestion and hypnotic cognitive–behavioral conditions were not told the experiment involved hypnosis until after the baseline assessment to prevent a hold-back effect (Zamansky, Scharf, & Brightbill, 1964). In a hold-back effect, participants hold back their responses (e.g., exaggerate the pain) during the baseline assessment to leave room for improvement on the postassessment due to the effects of hypnosis. Individuals in the cognitive–behavioral, distraction, placebo control, and no-treatment control conditions were not told that other conditions involved hypnosis until the debriefing to prevent them from mistakenly concluding that they were somehow being hypnotized.

To further reduce the possibility that participants might erroneously assume they were being hypnotized unless and until they actually received a hypnotic treatment, we removed all cues associated with hypnosis (e.g., books, journals) from the treatment room. Furthermore, in the cognitive–behavioral condition, experimenters delivered the relaxation and imagery instructions with a soothing voice quality, but without the unique cadence and tone associated with hypnosis. Consequently, these participants had no more reason to suspect they were being hypnotized than any person taking part in a study involving progressive muscle relaxation and guided imagery.

Although the analogue treatments were constructed to be similar in length, there were some inherent differences due to the nature of specific techniques. For example, the progressive muscle relaxation procedure used in the cognitive–behavioral and hypnotic cognitive–behavioral conditions is quite lengthy, whereas the glove analgesia suggestion used in the hypnotic analgesia suggestion is fairly brief. To equalize the amount of time involved in participation, individuals assigned to the hypnotic cognitive–behavioral condition began the preparation phase immediately after making baseline expectancy ratings, whereas individuals assigned to the other conditions completed filler questionnaires and read magazines during a waiting period. Therefore, participants assigned to all conditions spent 90 min taking part in the experiment. A flow diagram depicting the experimental procedure is shown in Figure 1.

**Apparatus**

Finger pressure pain was administered using a Forgione–Barber strain gauge pain stimulating unit. The stimulator consists of a doughnut-shaped weight (900 g) attached to a bar (231 g) that pivots from a hinged support stand at the far end. The index finger is placed on top of a 5-cm stand in the middle of the device, and the other fingers rest on a platform between the finger stand and the support stand. The moveable bar is about 2 mm wide where it contacts the index finger. When the bar is lowered onto the index finger, it produces 2,041 g of force at the contact point.

**Analogue Treatments**

The five analogue treatments were delivered in two phases. During the preparation phase, participants listened to information about pain management and were provided with an opportunity to experience a pain control technique without placing their finger in the stimulator. Then, participants made an expectancy rating reflecting what they thought the pain would be like if they were to use the pain control technique they had just experienced while placing their finger in the stimulator. Thereafter, during the intervention phase, experimenters worked live from a script in a treatment manual to administer the pain control technique to participants while they placed their finger in the stimulator and made intensity ratings. The analogue treatments were directly adapted from published materials describing each procedure and were designed to be as ecologically valid as practical based on the first author’s experience providing pain management in a variety of settings (e.g., burn unit, hematology/oncology clinic). The experimenters consisted of three advanced graduate students and three master’s level graduate students who were trained and monitored by the senior author.

**Distraction condition.** This treatment was adapted from an external distraction task in which participants shadowed monosyllabic words to divert their attention away from a painful stimulus (Spanos, McNeil, Gwynn, & Stam, 1984). During the preparation phase, the 10 male and 21 female participants assigned to this condition listened to an audiotape
offering instruction and practice in external distraction. The tape first presented information describing how distraction can be used to reduce pain. Thereafter, participants were trained to use an external distraction technique in which they shadowed words presented on tape. One-syllable words were presented at the rate of 74 words/min and participants had approximately one half second to repeat back each word. A total of 74 words were shadowed during practice. After practice, a postexpectancy rating was made.

During the intervention phase, participants again shadowed words presented on tape. Participants shadowed 148 words for 2 min and then placed their finger in the stimulator. They immediately resumed word shadowing and made postintensity ratings. Word shadowing continued throughout the time the participant’s finger was in the stimulator. After the third rating, the participant’s finger was removed from the finger press and word shadowing ended. The distraction treatment lasted about 15 min.

Cognitive–behavioral condition. This treatment was closely adapted from Stress Inoculation Training (SIT), a multicomponent cognitive–behavioral intervention package for pain (Turk et al., 1983). With some minor exceptions, the wording and organization of this analogue treatment were taken verbatim from Turk et al. During the preparation phase, the 12 male and 19 female participants assigned to this condition listened to an audiotape providing instruction and practice in SIT. To begin, the tape explained the Melzack and Wall gate-control theory of pain perception (Melzack & Wall, 1965). Then, the tape presented information about progressive muscle relaxation, followed by an opportunity to practice Jacobsonian muscle relaxation. Using instructions adapted from Goldfried and Davison (1976), participants were coached to progressively tense and relax each muscle group in their bodies. Thereafter, the tape presented information about guided imagery, followed by an opportunity to practice imagery, in which participants were coached to imagine themselves at a scenic lake on a pleasant summer day. Finally, participants were instructed in the use of coping self-statements (e.g., “The pain is there, but I don’t notice it as much when I’m concentrating on something else”). When the tape ended, participants were told to sit with their eyes closed and to remain relaxed. At this point, a postexpectancy rating was obtained.

During the intervention phase, the experimenter instructed the participant to become even more relaxed and to generate a coping self-statement that he or she could use during the postassessment. Next, working live from the treatment manual, the experimenter delivered the same progressive muscle relaxation and guided imagery instructions that the participant had practiced during training. After undergoing muscle relaxation and while engaged in the imagery, the participant’s index finger was guided into the stimulator and postintensity ratings were obtained. The imagery instructions were continued throughout the time the participant’s finger was in the stimulator. The participant’s finger was then removed from the stimulator and the imagery was concluded. The cognitive–behavioral treatment lasted about 62 min.

Figure 1. Flow diagram of experimental procedure.
Hypnotic cognitive–behavioral condition. This treatment was identical to the cognitive–behavioral treatment, except that it was presented in a hypnotic context. That is, this treatment was delivered almost entirely while participants were in hypnosis, and each of the techniques was described as being hypnotic in nature. During the training phase, the 12 male and 19 female participants assigned to this condition listened to an audiotape presenting the information from Kirsch, Lynn, and Rhue (1993) designed to produce a positive attitude toward hypnosis, followed by the hypnotic induction from the CURSS. The tape then presented information about the Melzack and Wall gate control theory, progressive muscle relaxation, guided imagery, and coping self-statements. These techniques were framed as hypnotic relaxation, hypnotic imagery, and hypnotic self-suggestions (e.g., “Worries can fade...becoming smaller and smaller...and as worries disappear, they can be replaced by thoughts of some of the helpful things that can be done instead...”). The tape described each technique and then provided an opportunity to practice that technique. When the tape ended, participants were told to remain in hypnosis with their eyes closed. At this point, participants made a postexpectancy rating.

Next, during the intervention phase, the experimenter instructed the participant to go deeper into hypnosis and to generate a coping self-suggestion. Thereafter, working live from the treatment manual, the experimenter gave instructions for hypnotic relaxation and imagery. While engaged in the imagery, the participant placed his or her index finger in the stimulator and made postintensity ratings. The imagery was continued throughout the time the participant’s finger was in the stimulator. Then, the finger was removed from the stimulator, the imagery was concluded, and the participant was brought out of hypnosis. The hypnotic cognitive–behavioral treatment lasted approximately 71 min.

Hypnotic analgesia suggestion condition. During the preparation phase, the 10 male and 21 female participants assigned to this condition listened to an audiotape providing instruction and practice in hypnotic analgesia. First, the tape presented information from Kirsch et al. (1993) intended to correct misconceptions about hypnosis and to engender a positive attitude toward it. Participants then heard the hypnotic induction from the CURSS (Spanos, Radtke, Hodgins, Stam, & Bertrand, 1983), followed by educational information about hypnotic analgesia. Thereafter, participants experienced a 45-s glove analgesia suggestion adapted from Spanos, Perlini, and Robertson (1989). The tape ended with cancellation of the glove analgesia suggestion, but participants were instructed to remain in hypnosis and to sit with their eyes closed. At this point, participants made a postexpectancy rating.

Subsequently, during the intervention phase, an experimenter, working live from the treatment manual, instructed the participant to go deeper into hypnosis and then administered the glove analgesia suggestion. Next, the experimenter guided the participant’s finger into the stimulator and postintensity ratings were made. The experimenter continued the glove analgesia suggestion throughout the time the participant’s finger was in the pain stimulator. The participant’s finger was then withdrawn from the stimulator, the analgesia suggestion was cancelled, and the participant was brought out of hypnosis. The hypnotic analgesia treatment lasted approximately 22 min.

Placebo control condition. The placebo treatment consisted of an inert solution described as an experimental, local, topical analgesic. The solution was composed of povo-iodine and oil of thyme. This mixture produced a brown liquid with a medicinal smell that was placed in a pharmaceutical bottle labeled “Trivaricaine: Approved for Research Purposes Only.” This solution has been shown in several investigations to be a credible topical solution described as an experimental, local, topical analgesic. The solution was composed of povo-iodine and oil of thyme. This mixture produced a brown liquid with a medicinal smell that was placed in a pharmaceutical bottle labeled “Trivaricaine: Approved for Research Purposes Only.” This solution has been shown in several investigations to be a credible topical analgesic placebo capable of reducing experimental pain (e.g., Montgomery & Kirsch, 1996).

During the preparation phase, the 12 male and 20 female participants assigned to this condition first listened to the experimenter present information about the nature of medical analgesics. The placebo solution was then applied to the top of the middle digit of the participant’s index finger (i.e., the area where the bar of the stimulator contacts the finger) with a cotton swab and allowed to “work” for 30 s. At this point, a postexpectancy rating was obtained. During the intervention phase, the participant placed his or her index finger, now covered with the placebo solution, in the stimulator and made intensity ratings. After the third intensity rating, the participant withdrew the finger, and the solution was removed with alcohol. The placebo treatment lasted approximately 12 min.

No-treatment control condition. The 12 male and 20 female participants assigned to the no-treatment control condition waited 60 min after making baseline intensity and expectancy ratings. Then, these participants provided a second (i.e., post) expectancy rating reflecting what they expected the pain would be like if they placed their finger in the stimulator, again without pain reduction techniques. Afterward, these participants placed their finger in the stimulator for 1 min and made postintensity ratings.

**Instruments**

*Pain intensity rating.* Pain intensity was measured on an 11-point visual analog scale ranging from 0 (no pain at all) to 10 (pain as intense as one can imagine). An 18-cm line displaying the verbal anchors and 11 numbers was affixed to the wall in front of participants. These individuals placed their finger in the stimulator and an audiotape prompted them to report an integer reflecting pain intensity every 20 s for 1 min (Milling et al., 2002). The sum of these reports yielded an index of overall intensity ranging from 0 to 30. Baseline intensity ratings were obtained before treatment, and postintensity ratings were made while participants were helped to use the pain control techniques they had experienced during the preparation phase of treatment. Cronbach’s alpha was .93 for baseline intensity ratings and .95 for postintensity ratings.

*Pain expectancy rating.* Expected pain intensity was measured using the same 11-point scale as in the pain intensity ratings. A single numerical rating ranging from 0 to 10 was made. The baseline expectancy rating was made immediately after the baseline intensity rating and reflected what participants expected the pain would be like if they were again to place their finger in the stimulator for 1 min without pain control techniques. The postexpectancy rating was made immediately after training in a pain control technique (but without placing a finger in the stimulator) and indicated what participants believed the pain would be like while using the technique they had just experienced. Participants in the no-treatment control condition made baseline and post expectancy ratings reflecting expected pain without pain reduction techniques.

**Results**

**Preliminary Analyses**

On the CURSS, the mean suggestibility score was 2.35 ($SD = 1.87$; range $= 0–7$). The frequency of suggestibility scores was 0 (21%), 1 (13%), 2 (23%), 3 (20%), 4 (7%), 5 (7%), 6 (7%), and 7 (2%). This distribution is comparable to normative information for a large sample of unselected participants on the CURSS (Spanos, Radtke, Hodgins, Stam, & Bertrand, 1983). Pain expectancy ratings produced mean scores of 5.78 ($SD = 2.38$; range $= 1–10$) at baseline and 3.87 ($SD = 2.00$; range $= 0–9$) at posttreatment. Pain intensity ratings yielded mean scores of 13.87 ($SD = 6.06$; range $= 2–30$) at baseline and 11.45 ($SD = 6.06$; range $= 0–28$) at posttreatment. Means and standard deviations for baseline and post ratings of pain intensity and expectancy by treatment condition are shown in Table 1.

A series of one-way analyses of variance on suggestibility scores, baseline intensity ratings, and baseline expectancy ratings did not yield a significant effect for treatment condition, thereby suggesting the comparability of the treatment groups on these variables.
Reduction of Pain Intensity

A one-way analysis of covariance on postintensity ratings, with baseline intensity ratings as the covariate, produced a significant main effect for treatment condition, \( F(5, 181) = 12.47, p < .001, \eta^2 = .26 \). A least significant difference test on estimated marginal means with a Bonferroni adjustment for the number of statistical comparisons revealed that participants in the no-treatment control condition reported more intense pain (adjusted \( M = 14.29, SD = 3.17 \)) than those in the cognitive–behavioral (adjusted \( M = 9.17, SD = 3.24 \)), hypnotic cognitive–behavioral (adjusted \( M = 9.64, SD = 3.18 \), and hypnotic analgesia suggestion (adjusted \( M = 10.51, SD = 3.18 \)) conditions. Additionally, participants in the placebo control condition (adjusted \( M = 12.83, SD = 3.17 \)) and distraction condition (adjusted \( M = 12.13, SD = 3.18 \)) reported significantly more intense pain than those in cognitive–behavioral and hypnotic cognitive–behavioral conditions. All of the other pairwise comparisons were nonsignificant.

Reduction of Expected Pain

A one-way analysis of covariance on postexpectancy ratings, with baseline expectancy ratings as the covariate, produced a significant main effect for treatment condition, \( F(5, 181) = 6.10, p < .001, \eta^2 = .14 \). A least significant difference test on estimated marginal means with a Bonferroni adjustment for the number of statistical comparisons revealed that participants in the no-treatment control condition (adjusted \( M = 5.02, SD = 1.30 \)) expected more pain than those in the hypnotic analgesia (adjusted \( M = 3.50, SD = 1.34 \)), placebo control (adjusted \( M = 3.60, SD = 1.30 \)), distraction (adjusted \( M = 3.67, SD = 1.34 \), cognitive–behavioral (adjusted \( M = 3.68, SD = 1.34 \), and hypnotic cognitive–behavioral (adjusted \( M = 3.71, SD = 1.34 \)) conditions. All of the other pairwise comparisons were nonsignificant.

Mediator Analysis of Response Expectancies

Response expectancies were hypothesized to mediate the effects of treatment on pain intensity. Using Baron and Kenny’s (1986) method of testing mediation, we estimated three regression equations. In these regressions, we compared the effects of a cluster of our four psychological interventions (i.e., hypnotic cognitive–behavioral package, hypnotic analgesia suggestion, cognitive–behavioral package, and distraction conditions) with that of our two control conditions (i.e., no-treatment control and placebo control). The results of these hierarchical regressions are shown in Table 2.

In the first regression, postexpectancy was regressed on baseline expectancy and treatment cluster. After baseline expectancy was controlled, treatment cluster significantly predicted postexpectancy. This result shows that treatment cluster was associated with changes in response expectancy, thus demonstrating a link between the independent variable and the hypothesized mediator.

In the second regression, postintensity was regressed on baseline intensity and treatment cluster. After controlling for the effect of baseline intensity, treatment cluster predicted postintensity. This finding shows that cluster was associated with changes in pain intensity, thereby demonstrating a link between the independent variable and the dependent variable.

In the third regression, baseline intensity, baseline expectancy, postexpectancy, and treatment cluster were regressed on postintensity. After controlling for baseline intensity and baseline expectancy, postexpectancy and treatment cluster predicted postintensity. This result shows that changes in pain intensity were associated with changes in response expectancy and treatment cluster. Reduction of expected pain was directly related to reduction of pain intensity (\( \beta = .32, p < .001 \)). A Sobel test revealed that the indirect effect of treatment on pain intensity via response expectancy was not significant.

### Table 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Baseline M</th>
<th>Baseline SD</th>
<th>Post M</th>
<th>Post SD</th>
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<td>No-treatment control</td>
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<table>
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<th>Post SD</th>
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*a = 31. b = 32.*
significant ($z = 2.75, p = .006$). At the same time, the effect of treatment on intensity remained significant despite the inclusion of response expectancy in the third regression equation. These results indicate that the effects of treatment on intensity were partially mediated by response expectancy.

**Moderator Analysis of Hypnotic Suggestibility**

Hypnotic suggestibility was hypothesized to moderate the effects of treatment on pain. Theoretically, it would be expected that hypnotic suggestibility would be more strongly related to the relief produced by a hypnotic pain intervention, such as our hypnotic cognitive–behavioral package or our hypnotic analgesia suggestion, than to the effect of a nonhypnotic pain intervention, such as our cognitive–behavioral package or our distraction technique. Baron and Kenny’s (1986) analytic strategy for testing moderation involves evaluating whether there is an interaction between the hypothesized moderator and the independent variable. Accordingly, we performed two hierarchical regressions and tested the interaction of hypnotic suggestibility and treatment in predicting pain reduction. In the first regression, we compared the effects of a cluster of our hypnotic interventions (i.e., hypnotic cognitive–behavioral package and hypnotic analgesia suggestion conditions) with that of a cluster of our cognitive–behavioral interventions (i.e., cognitive–behavioral package and distraction conditions). In the second regression, we compared the effects of a cluster of our hypnotic interventions (i.e., hypnotic cognitive–behavioral package and hypnotic analgesia suggestion conditions) with a cluster of our control conditions (i.e., no-treatment control and placebo control).

Table 3 presents the results of these two hierarchical regressions. In each analysis, we regressed postintensity on baseline intensity, hypnotic suggestibility, treatment cluster, and the interaction of suggestibility and treatment cluster. The first regression comparing the hypnotic and cognitive–behavioral clusters shows that after controlling for baseline intensity, postintensity was predicted only by the two-way interaction of treatment cluster and hypnotic suggestibility. This finding suggests that the effect of the hypnotic and cognitive–behavioral treatments was moderated by suggestibility. The second regression comparing the hypnotic and control clusters shows that after controlling for baseline intensity, postintensity was predicted only by the main effects of treatment cluster and suggestibility.

Figure 2 summarizes the interaction of hypnotic suggestibility and treatment cluster in the two regressions. Residualized change scores in pain intensity were generated by regressing postintensity on baseline intensity. A scatter plot of residualized change scores and hypnotic suggestibility was created, and a regression line was generated for each of the three treatment clusters. Figure 2 shows that higher levels of suggestibility were associated with more pain reduction in the hypnotic cluster but not in the cognitive–behavioral cluster.

**Discussion**

Consistent with prediction, our findings showed that hypnotic suggestibility moderated the effect of the hypnotic and cognitive–behavioral pain treatments when suggestibility and pain reduction were measured in separate experimental contexts. As expected, higher levels of hypnotic suggestibility were associated with more relief from our hypnotic interventions but not from our cognitive–behavioral interventions. Also consistent with prediction, response expectancies partially mediated the effect of our psychological treatments on pain.

Very few studies have evaluated the role of response expectancies as a mediator of hypnotic and cognitive–behavioral pain treatments using Baron and Kenny’s (1986) analytic approach. We showed that response expectancies partially mediated the relief produced by analogue versions of common hypnotic and cognitive–behavioral interventions for pain. This result is similar to those of several recent experimental pain studies comparing various hypnotic and cognitive–behavioral interventions (Milling & Breen, 2003; Milling et al., 2002, 2003). This finding is also similar to that of Montgomery et al. (2002) in an investigation of the effect of hypnotis on breast biopsy pain. In each of these studies, response expectancies partially mediated the effects of treatment on pain.

In his influential work on common factors, Frank (1971) identified six features that he believed are shared by all forms of successful psychotherapy: (a) a therapeutic relationship, (b) a treatment rationale, (c) provision of new information concerning the problem and alternative ways of dealing with it, (d) strengthening expectations of change, (e) provision of success experiences, and (f) emotional arousal. A review of 50 publications on proposed therapeutic common factors revealed that the most frequently mentioned common factors were a therapeutic relationship, opportunities for catharsis, acquisition and practice of new behaviors, and expectancies (Grencavage & Norcross, 1990). Indeed, extrapolating from an extensive review of empirical research on the effectiveness of general psychotherapy, Lambert (1992) estimated that expectancy accounted for 15% of improvement, whereas 30% of improvement was attributable to other common factors and only 15% to specific techniques.

Our findings, in concert with those of other investigations in this area, argue that response expectancies are an important common factor in various psychological pain treatments. At the same time, most studies have demonstrated a pattern of partial rather than full mediation of pain relief. Consequently, the results of this body of research suggest that other common factors, or factors specific to at least some of the interventions, partly account for the success of psychological pain treatments. Although response expectancies do not seem to be the final common pathway through which pain
treatments operate, they clearly appear to constitute one important pathway to relief. Little is known about the relative contribution of response expectancies and other common factors in the psychological treatment of pain. Recently, several reports indicated that therapeutic alliance mediated the effect of expectancies on outcome in individual psychotherapy for a range of problems (Joyce, Ogrodniczuk, Piper, & McCallum, 2003) and in treatment for depression (Meyer et al., 2002). More research is needed on the interplay of response expectancies and other common factors in treating pain.

We found that hypnotic suggestibility moderated the effect of our hypnotic interventions, when suggestibility and pain reduction were measured in separate experimental contexts. This has very important theoretical implications. One of the long-standing controversies in the field of hypnosis is whether there is a stable trait accounting for differences in hypnotic responding (see Kirsch & Lynn, 1995). Hypnotic suggestibility has been advanced as such a trait (see Gwynn & Spanos, 1996), although this position remains controversial (Kirsch & Lynn, 1995). If suggestibility were able to predict individual differences in responding to hypnotic treatments for various problems, it would provide compelling support for the construct validity of this trait. However, in a review of research on relations between hypnotic suggestibility and response to the hypnotic treatment of a range of problems, Lynn, Shindler, and Meyer (2003) concluded that evidence of associations between suggestibility and treatment outcome was mixed at best. According to these authors, the single exception is the hypnotic treatment of pain, which has consistently been shown to be related to hypnotic suggestibility.

However, studies of hypnotic treatments for pain have typically measured hypnotic suggestibility and pain reduction in the same experimental context, possibly inflating the correspondence between these variables. Research has shown that a context effect occurs when participants can deduce the relationship between measures of various hypnotic behaviors and begin to respond consistently across measures (Council et al., 1996). In the case of pain treatment studies, if hypnotic suggestibility is assessed before treatment, participants’ impression of their performance on the suggestibility measure could influence responding to treatment. Conversely, if hypnotic suggestibility is assessed after treatment, participants’ experience of pain reduction might affect responding to the measure of suggestibility. However, in this study, suggestibility and pain reduction were measured in separate experimental contexts. Consequently, it seems unlikely that a context effect could have influenced the behavior of our participants. Nevertheless, suggestibility strongly predicted responding to our hypnotic pain interventions. We generally think of a personality trait as an individual’s characteristic thoughts, feelings, and behaviors that distinguish one person from another and that persist across situations. Our findings seem inconsistent with the position that relations between suggestibility and other hypnotic behaviors are simply a product of a context effect and instead suggest that hypnotic suggestibility is a trait variable that predicts hypnotic responding across situations, including hypnotic pain treatments.

Our results also have important clinical implications. Patients scoring high on hypnotic suggestibility may be good candidates for hypnotic pain interventions. Thus, clinicians may find it helpful to assess suggestibility when planning treatments for pain patients. Also, clinicians may wish to structure pain interventions so as to target response expectancies. Providing persuasive information about the effectiveness of psychological procedures and enabling patients to observe others successfully using these techniques is likely to have some benefit. However, direct experience seems to be more impactful than verbal persuasion in altering response expectancies (Wickless & Kirsch, 1989). Consequently, pain response expectancies may be most readily modified via personal experience using a technique to obtain relief. In the hospital or clinic, treatment can be structured so that a patient is likely to reduce pain when first using a psychological technique. Introducing a procedure when patients are experiencing less rather than

![Figure 2. Interaction of hypnotic suggestibility and treatment cluster on residualized pain intensity change scores.](image-url)
more pain would seem to maximize the likelihood of success. Also, clinicians may wish to avoid acquainting patients with new techniques in settings that contain cues for aversive pain response expectancies. For example, in a burn unit, initial exposure to a particular psychological procedure should not come during debridement (see Patterson & Ptacek, 1997). Rather, the clinician might familiarize a patient with a technique when there is less discomfort (e.g., in the hospital room) and first implement the procedure with a less invasive procedure such as a venipuncture (see Harmon, Hynan, & Tyre, 1990). These initial positive experiences can set into motion a cycle of therapeutic response expectancies and increasing relief.

It is unclear to what extent our findings, which are based on the analogue treatment of experimental pain, apply to treatment of clinical pain. Our sample, drawn from the population of introductory psychology students, overrepresented women and younger people relative to their frequency in the general population. Moreover, experimental pain is characteristically mild in intensity, whereas clinical pain is usually more intense and has health implications. However, in an analogue treatment study, the pain stimulus and experimental treatments can be standardized to a greater degree than is usually feasible in a clinical setting. In their landmark review of psychotherapy research, Nathan, Stuart, and Dolan (2000) elaborated distinctions between studies of treatment efficacy and treatment effectiveness. According to these scholars, research on efficacy involves outcome assessment under conditions of high internal validity, whereas research on effectiveness involves outcome assessment under conditions of high external validity. Accordingly, efficacy studies, such as ours, are carried out under rigorous laboratory conditions, whereas effectiveness studies are conducted in real-world settings. Integrating the findings of studies of efficacy and effectiveness is described by Nathan et al. as a useful strategy for appraising the value of a treatment. Our analogue treatments were constructed to have a high level of ecological validity and to be readily employed in clinical situations. Consequently, a logical progression in this area of inquiry would involve integrating our findings with research on the mediator role of response expectancies and the moderator role of hypnotic suggestibility in the relief produced by these analogue hypnotic and cognitive–behavioral interventions in treating acute clinical pain.

References


