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Gender role expectations of pain: relationship to experimental pain perception

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Abstract

The primary purpose of this study was to investigate the influence of an individual's Gender Role Expectations of Pain (GREP) on experimental pain report. One hundred and forty-eight subjects (87 females and 61 males) subjects underwent thermal testing and were asked to report pain threshold, pain tolerance, VAS ratings of pain intensity and unpleasantness, and a computerized visual analogue scales (VAS) rating of pain intensity during the procedure. Subjects completed the GREP questionnaire to assess sex-related stereotypic attributions of pain sensitivity, pain endurance, and willingness to report pain. Consistent with previous research, significant sex differences emerged for measures of pain threshold, pain tolerance, and pain unpleasantness. After statistically controlling for age, GREP scores were significant predictors of threshold, tolerance, and pain unpleasantness, accounting for an additional 7, 11, and 21% of the variance, respectively. Sex remained a significant predictor of pain tolerance in hierarchical regression analyses after controlling for GREP scores. Results provide support for two competing but not mutually exclusive hypotheses related to the sex differences in experimental pain. Both psychosocial factors and first-order, biological sex differences remain as viable explanations for differences in experimental pain report between the sexes. It appears that GREP do play a part in determining an individual's pain report and may be contributing to the sex differences in the laboratory setting.

Keywords

Pain; Gender; Sex differences; Experimental pain; Thermal pain

1. Introduction

Extensive research has demonstrated that the variability in experimental pain perception results from a variety of sources (Zatzick and Dimsdale, 1990; Fillingim and Maixner, 1995; Riley et al., 1999). Psychosocial factors, such as expectations, emotions, and an individual's unique

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learning history are present. Biological variables, including hormonal status and cardiovascular reactivity, may add further differences. Experimental variables include type of pain induction method, pain measures used, environmental cues, experimenter appearance, and possible personal biases. Given these multiple sources of variability, it is remarkable that consistent patterns of pain responsiveness exist in the pain literature. One consistent finding is that of sex differences in response to experimentally induced pain. These differences account for a moderate to large portion of the variance in pain responses, as measured by mean sex effect sizes (defined as the difference between the group means divided by the pooled standard deviation) of 0.55 for pain threshold and 0.57 for pain tolerance (Riley et al., 1998). These findings have indicated that women generally have an increased sensitivity to experimental pain when compared to men.

However, sex differences have not been found consistently in clinical settings. Further, when statistically significant sex differences in clinical pain report are found, subsequent effect size calculations are small (Robinson et al., 1998). What may account for this discrepancy? It is hypothesized that the moderate to large differences in men and women's experimental pain report result from an influence of the laboratory setting, where psychosocial constructs are differentially activated between the sexes. The differences may be primarily stemming from gender-specific socialization patterns with regard to pain beliefs, expectations, and subsequent behaviors. Based on gender specific pain beliefs, expectations, and behaviors, men adhering to a male gender role would be expected to under-report pain. Conversely, following a female gender role would allow women to verbalize their pain report. However, these accounts are mainly speculative and the uncontrolled nature of the clinical pain stimulus further complicates conclusions about differences between sexes.

Myers et al. (2001) noted that a useful distinction can be made between the terms *sex* and *gender* in this line of research. Here, the term *sex* will denote the 'biological distinction of being male or female', the term *gender* will refer to 'learned femininity and masculinity', and the term *gender role* will refer to 'learned feminine and masculine gender roles' (Lips, 1993; Myers et al., 2001).

A number of authors have suggested various social learning influences on sex differences in pain behavior. These influences include social models (Koutanji et al., 1998), and early learning experiences from such social sources as family, and culture McGrath (1993) that differentially shape the behavior of girls and boys. There is some empirical support for these social influences. Klonoff et al. (1993) found that males were less apt to disclose pain to others and associated feelings of embarrassment with having to admit pain. Further, women rated their response to pain as entailing more irritability and worrying when compared to men, and a high likelihood of disclosing it. Koutanji et al. (1998) posit that social roles for women are more supportive of pain expression and pain awareness, making them more cognizant of their own and others' pain, thus learning to model their behavior after those in their environment. It may be that the familial models that women are often exposed to transmit to them a greater acceptance to disclose pain or engage in pain-related behaviors.

One study investigated the effect of sex of experimenter on pain report between subjects of both sexes, with experimenters asked to dress in an attractive manner, in order to 'evoke gender-related cues' (Levine and De Simone, 1991). Males reported significantly less experimentally induced pain (cold pressor task) in the presence of a female experimenter than when interacting with a male experimenter. No such difference was found for females. However, when experimenters' appearance is not purposely highlighted for gender cues, an interaction has not been observed (Otto and Dougher, 1985; Feine et al., 1991). Although these studies indicate an influence of gender-role on pain, they do not directly assess gender role-related constructs.

Otto and Dougher (1985) investigated the relationships between gender role and experimental pain report in men and women. Results indicated that for men, but not women, a significant correlation between masculinity–femininity and pain existed, such that higher masculinity was associated with higher pressure pain thresholds. More recently, Myers et al. (2001) found that gender role was related to cold pressor pain tolerance but not to pain threshold. By contrast, Fillingim et al. (1999) reported no relationship between gender role and experimental pain report. However, femininity did correlate with self-report of clinical pain experienced by subjects during the month prior to the experimental pain session.

More recently, Robinson et al. (2001) investigated sex-related stereotypic attributions of pain sensitivity, pain endurance, and willingness to report pain using a new measure, the GREP questionnaire. Results revealed that men were perceived to be less willing to report pain than women, women were perceived to be more sensitive and less enduring of pain than men, and men rated their endurance as higher than average. Sex accounted for 46% of the variance in willingness to report pain. These results suggest that women may respond with less bias in laboratory studies and conversely, that men may perceive more of a ‘response cost’ associated with admitting pain. However, this preliminary study did not address responses to the GREP in a pain-related context (i.e. experimental or clinical setting). Taken together, there is accumulating evidence that suggests that sex differences in pain report may be significantly influenced by individuals’ perceptions of gender-role stereotypes.

The purpose of this study was to examine the role of GREP in the laboratory setting and to determine if these constructs have an influence on men and women’s experimental pain report. This will provide support for a social learning model of pain behaviors, with psychosocial factors accounting for differences in experimental pain report between the sexes, and a lesser emphasis on first-order biological sex differences.

2. Methods

2.1. Subjects

Subjects were recruited from undergraduate classes at the University of Florida. The sample consisted of 148 subjects, 87 (58.8%) females and 61 (41.2%) males. The mean age of the sample was 20.9 years ($SD = 3.7$ years; age range, 18–35 years), of whom 92.9% were single and 7.1% were married. Most of the samples reported their race as Caucasian (67.3%), with 10.2% reporting their race as Hispanic, 10.2% as Asian, 6.8% as African American, and 5.4% as other. Mean years of formal education were 14.2 ($SD = 2.5$; range, 12–20). Approximately 65% of the subjects were recruited from undergraduate psychology courses, 31.8% were recruited from business management classes, and 3.4% were from exercise science courses. The data presented in this article are part of a larger data set, from a broader study examining gender role aspects of pain in general. These subjects represent a unique sample not previously employed in gender role related studies (Robinson et al., 2001).

2.2. Procedures

Upon arrival, all subjects read and signed a consent form acknowledging that the experimental procedures had been explained and that they could withdraw, without prejudice, from the experiment at any time. Next they completed a health history questionnaire to rule out medical contraindications, including pain complaints, use of centrally acting prescription medications, use of over-the-counter medications, and pregnancy. Subjects then completed a battery of psychological questionnaires. Following the completion of the questionnaires, subjects were escorted to a small laboratory and seated in front of a television monitor to watch a standardized presentation on videotape. Based on these taped instructions, all subjects learned that they were

to participate in a thermal pain testing procedure to determine their TPT_h and TPT_o. The subjects learned that they would undergo two trials of thermal testing.

In the videotapes, the experimenter explained to a male or female model that they would be delivering a series of heat stimuli of increasing temperatures that are below, at, and above an individual's pain threshold. The experimenter showed the model the thermal probe used to deliver the stimuli. Next, the experimenter explained that to determine TPT_h, subjects were instructed to say 'pain' when the thermal percept first becomes painful. To determine tolerance, subjects were instructed to say 'stop' when they no longer feel able to tolerate the pain. The experimenter then presented the model with two trials of thermal testing.

After viewing the videotape, subjects were asked to complete a series of visual analogue scales (VAS) measuring anticipated pain intensity and pain unpleasantness, and anticipated negative feelings associated with the pain experience. Next, subjects underwent two trials of thermal pain testing. Further, they were asked to provide pain intensity ratings during the thermal pain procedure with the use of a computerized VAS. After testing, the subjects completed a second series of VAS, including ratings of pain intensity and pain unpleasantness of the stimuli and present negative feelings associated with the pain experience.

2.2.1. Thermal pain threshold and tolerance—TPT_h and TPT_o were determined on the left volar forearm using a contact thermal probe. Thermal stimuli were delivered via a Peltier device thermode ($9 \times 9 \text{ mm}^2$ surface). This device (developed by J.F. Hogan, Yale University Medical Instrumentation Facility) is capable of delivering warming and cooling stimuli at a rate of 19°C/s (in the -10° to $+60^\circ\text{C}$ range) with relatively high precision and control. The temperature is monitored by a thermocouple (Omega model COCO-002) that is glued to the surface of the ther-mode. The stimuli were delivered from an adapting temperature of 33°C . The temperature increased 0.5°C/s until it reached 51°C or until the subject reported TPT_o. To determine TPT_h, subjects were instructed to say pain when the thermal percept first became painful. To determine tolerance, subjects were instructed to say stop when they no longer felt able to tolerate the pain. The time (s) at both threshold and tolerance was recorded. This procedure was conducted twice, at adjacent sites on the left volar forearm. The site was changed for each trial, approximately 1 in. to the right of the initial site. The average of the two trials was calculated to determine TPT_h and tolerance.

2.2.2. Pain intensity ratings—Subjects were asked to provide pain intensity ratings while undergoing the thermal pain procedure using a computerized VAS (0–100), with anchors of 'no pain' and 'worst pain imaginable' (Price et al., 1994).

2.2.3. Psychological questionnaires—The *State-Trait Anxiety Inventory* (STAI; Spielberger et al., 1983). The STAI is a 40-item, 4-point rating scale used to assess both situational (i.e. state) anxiety symptoms and more generalized (i.e. trait) anxiety symptoms. We administered the state portion of the STAI, as it measures the construct we were most interested in examining.

The *Beck Depression Inventory* (BDI; Beck and Steer, 1987). The BDI is a self-report measure of depression. It comprises 21 items that assess the extent to which individuals currently exhibit or experience each of 21 cognitive, affective, or neurovegetative symptoms of depression. The BDI is a well-validated instrument and has been used extensively in experimental pain research.

The *Pennebaker Inventory of Limbic Languidness* (PILL; Pennebaker, 1982). The PILL is a self-report measure of the occurrence and frequency of common physical symptoms and sensations. This trait-like symptom scale is used to assess somatization or a general tendency for reporting physical symptoms (Pennebaker, 1982).

Pain Experience VAS: The Pain Experience VAS consists of a series of 10 cm lines with different anchors. The first five scales are measures of negative feelings associated with pain experience and are labeled depression, anxiety, frustration, fear, and anger, with end points designated as 'none' and as 'the most severe imaginable.' The sixth scale is labeled pain unpleasantness with anchor points labeled as 'not bad at all' and as 'the most intense bad feeling imaginable.' The seventh VAS is labeled pain intensity with anchor points labeled as 'none at all' and as 'the most intense imaginable'. VAS of pain have been demonstrated to be reliable, internally consistent measures of experimental pain sensation intensity, and can separately assess pain sensation intensity and pain unpleasantness (as cited in Price and Harkins, 1992; Price et al., 1994). The scales were used twice during the protocol. First, the subject was asked to place a mark along each scale reflecting the intensity of the feeling they anticipated experiencing as a concomitant of the pain testing after viewing the videotape. After undergoing the thermal pain testing, subjects were asked to, retrospectively, rate their global experience of the procedure, in terms of pain intensity pain unpleasantness and emotional feelings associated with the pain testing.

The *GREP* questionnaire (Robinson et al., 2001). The GREP comprises 12 VASs that assess a subject's view of the typical man and woman with respect to pain sensitivity, pain endurance, and willingness to report pain. It also assesses the subject's personal attribution of his or her pain sensitivity, pain endurance, and willingness to report pain relative to the typical man and woman. Psychometric properties of the GREP are sound with the factor structure closely mirroring the theoretical formulation of the scales and accounting for 76% of the variance in scores. Test-retest reliability was good with individual item correlations ranging from 0.53 to 0.93. Internal consistency was demonstrated by showing high correlations (-0.71 to -0.81) between individual items reflecting the opposite gender role (i.e. typical male endurance of pain correlated with typical female endurance). Finally, there were large sex differences in the endorsement of items on the GREP with the largest differences (46% of variance) apparent for 'Willingness to report pain' items. These differences were taken to represent the first step toward construct validity for the measure. For the present study, we chose to use the willingness to report pain scales in statistical analyses because they represented the scales with the greatest sex differences and potentially the highest validity.

3. Statistical analyses

Independent sample *t*-tests and chi-square analyses were performed on demographic variables and the psychological questionnaire scores (PILL, GREP, BDI, STAI) to determine if group differences existed. Given previous findings in the psychological literature (Gijsbers van Wijk and Kolk, 1996), it was hypothesized that when compared to males, females would report higher scores on the PILL. Hierarchical regression analyses were performed to test theoretically based predictions regarding GREP and relationships with an individual's sex and experimental pain report. Further, as independent sample *t*-tests revealed significant sex differences on several dependent variables, (including age and psychological questionnaire scores), regression analyses were also performed to (1) control for age and (2) to determine if any of these variables were significant predictors of pain threshold, pain tolerance, and pain unpleasantness ratings.

4. Results

4.1. Demographic variables and questionnaire scores

Independent sample *t*-tests and chi-square analyses were performed on pertinent variables, which revealed significant differences in age, education, PILL scores, and BDI scores between men and women. The males in the sample were older when compared to the females and had more years of formal education. Compared to females, males had lower scores on

questionnaires measuring depression and somatization (i.e. tendency to report physical symptoms). Table 1 presents means and standard deviations of significantly different demographic variables and questionnaire scores.

4.2. Sex differences in pain responses

Analyses of variance (ANOVAs) revealed significant differences between men and women on average threshold ($F = 16.44, P < 0.001$), average tolerance ($F = 38.91, P < 0.001$), and VAS ratings of pain unpleasantness ($F = 4.90, P < 0.05$). Men reported higher average threshold and average tolerance times and lower global pain unpleasantness ratings of thermal stimuli when compared to women. Significant differences were not indicated for peak computerized VAS ratings of pain intensity ($F = 3.08, P = 0.08$) or for retrospective global VAS ratings of pain intensity ($F = 2.52, P = 0.12$). Table 2 presents means and standard deviations for each of the pain measures for men and women.

Effect sizes are reported to show the relative magnitude of the relationships between individuals' sex and the pain measures in standard deviation units (Cohen, 1992). Effect size was defined as the mean for males minus the mean for females, divided by the pooled SD: $[(\text{male} - \text{female}) / \text{pooled SD}]$.

A range of effect sizes was revealed, with the magnitude differing by type of pain measure. The largest differences in pain report were demonstrated for average threshold (0.70) and average tolerance (1.05). The effect sizes for pain intensity (0.28), pain unpleasantness (0.37), and computerized VAS of pain intensity (0.27) were smaller in comparison and in the moderate range. The effect sizes for each pain measure are displayed in Table 3.

Age was a confounding variable, with the group of men being significantly older than the group of women. After statistically controlling for age, PILL, and BDI scores, significant sex differences remained for measures of pain threshold ($F = 3.9, P = 0.05$) and pain tolerance ($F = 19.8, P < 0.01$) whereas the ratings for pain unpleasantness were no longer significant ($F = 1.4, P = 0.23$).

Independent sample *t*-tests revealed significant sex differences on several GREP scores, including one's rating of their pain endurance compared to the typical woman ($t = 3.6, P < 0.01$) and typical man ($t = 4.3, P < 0.01$) and one's willingness to report pain compared to the typical man ($t = -4.7, P < 0.01$) and typical woman ($t = -4.6, P < 0.01$). These results were significant after applying a Bonferroni correction for multiple comparisons. Male subjects indicated that they had greater pain endurance than the typical woman when compared to female subjects. Male subjects also indicated that they had greater pain endurance than the typical man when compared to female subjects. Further, female subjects reported that they had a greater willingness to report pain than that of the typical man when compared to the male subjects. Female subjects reported that they had a willingness to report pain that was slightly less than that of the typical woman. Conversely, male subjects indicated that they had a willingness to report pain that was far less than that of the typical woman.

4.3. Regression analyses

Hierarchical regression analyses were performed to test theoretically based predictions regarding GREP and relationships with an individual's sex and experimental pain report, focusing only on those variables that showed significant sex effects when tested with ANOVA (i.e. pain threshold, pain tolerance, and pain unpleasantness ratings). The first model was used to determine the role that gender-role expectations of pain may play in determining the variance in subjects' pain report. Subjects' age was entered in the first block, followed by gender-role expectations of pain (sex-stereotyped willingness to report pain) in the second block, and sex

entered into the third and final block. Age was entered first into the equation to control for potential sampling confounds. The gender role variable (stereotypical willingness to report pain) was entered before sex because sex is a multidimensional variable that includes both gender role and biological aspects. Based on the original sex comparisons of the GREP scores, we chose a priori to use only the Willingness to report pain dimension of the GREP in subsequent analyses. This variable had the largest differences between sexes in the original sample used in the development of the measure. Using only one variable from the GREP also reduced the number of variables in the regressions and allowed for the retention of a favorable subject to variable ratio. The dichotomous variable of sex would therefore potentially obscure (because of its multidimensional nature) the contribution of gender role to pain report were sex to be entered before gender role. Analyses were conducted for measures of pain threshold, pain tolerance, and pain unpleasantness. The results of the regression analyses are summarized in Tables 4–6.

Analyses indicated that age and GREP scores were significant predictors of the variance in pain threshold while sex was not a significant predictor. Age accounted for 12% of the variance ($\Delta R^2 = 0.12$) and was positively related to threshold ($\beta = 0.34, P < 0.01$). Gender role expectations of pain predicted an additional 7.0% of the variance in threshold ($\Delta R^2 = 0.07$) and was negatively associated with threshold ($\beta = -0.26, P < 0.01$). This suggests that when subjects indicated that their willingness to report pain was greater than the typical man's willingness to report pain, they reported lower threshold times. Conversely, subjects who had indicated that their willingness to report pain was less than the typical man's willingness to report pain reported higher threshold times, allowing the thermal probe to be applied to their forearm for a longer time period.

When examining pain tolerance, results of regression analyses indicated age, GREP scores, and an individual's sex to be significant predictors. Age accounted for 10% of the variance ($\Delta R^2 = 0.10$) and was positively related to tolerance ($\beta = 0.32, P < 0.01$). After controlling for age, GREP scores predicted an additional 11% of the variance ($\Delta R^2 = 0.11$) and demonstrated a negative relationship with tolerance ($\beta = -0.30, P < 0.01$). Thus, when examining pain tolerance, the more willing a subject was to report pain, the lower their pain tolerance time to the thermal stimuli. Conversely, the less willing they were to report pain, the higher their pain tolerance time. When subjects' sex is entered into the equation, this variable predicts an additional 6% of the variance in pain tolerance ($\Delta R^2 = 0.06, \beta = -0.30, P < 0.01$).

Finally, regression equations indicated age and GREP scores to be significant predictors of pain unpleasantness. Notably, while age accounted for only 4% of the variance ($\Delta R^2 = 0.04$) in pain unpleasantness ratings, GREP scores accounted for an additional 21% of the variance ($\Delta R^2 = 0.21$). An individual's sex was not a significant predictor of pain tolerance after controlling for age and GREP scores. See Tables 4–6.

Significant differences between men and women were revealed on ratings of anticipatory emotions (i.e. depression, anxiety, and fear) related to the pain task. Further, sex differences were found in PILL and BDI scores. Therefore, these variables were used in constructing a second regression model. The second model constructed examined the relationship between age, sex, emotions (i.e. depression, anxiety, fear), and the following pain measures: pain threshold, pain tolerance, and pain unpleasantness ratings. Specifically, this model was used to determine the role that psychological factors and emotions related to anticipation of the pain task played in determining the variance in subjects' pain report. Subjects' age was forced into the first block, psychological questionnaire scores (PILL, BDI, anticipatory VASs) were entered into the second block, and sex was entered into the third and final block.

For ratings of pain unpleasantness and for pain threshold, only one variable – age was a significant predictor of the variance in these two pain measures (pain unpleasantness: $\Delta R^2 = 0.04$, $\beta = -0.19$, $P < 0.05$; pain threshold: $\Delta R^2 = 0.12$, $\beta = -0.34$, $P < 0.01$). Thus, after controlling for age and the above noted psychological factors, sex was no longer a significant predictor of the variance in pain unpleasantness or pain threshold. However, results revealed that age ($\Delta R^2 = 0.10$, $\beta = 0.32$, $P < 0.01$) and sex ($\Delta R^2 = 0.09$, $\beta = 0.39$, $P < 0.01$) were significant predictors of pain tolerance. The psychological factors in the model were not significant predictors of the variance in pain tolerance. Further, after controlling for these variables, sex remained a significant predictor of pain tolerance.

5. Discussion

The primary goal of this study was to examine the part that an individual's gender role expectations related to pain behaviors may play in their experimental pain report. Taken together, analyses indicated that one's GREP, as measured by the GREP, do appear to play a part in pain report. First, independent sample *t*-tests revealed significant sex differences on GREP scores, including personal attributions of pain endurance compared to the typical woman and typical man, and personal attributions related to willingness to report pain compared to the typical man and typical woman. Male subjects indicated significantly greater pain endurance than the typical woman and the typical man when compared to female subjects. Further, female subjects reported a significantly greater willingness to report pain than the typical man when compared to the male subjects. Females reported that their willingness to report pain was slightly less than the typical woman's while males indicated their willingness to report pain was far less than the typical woman. These beliefs were generally consistent with experimental pain report, with women reporting lower threshold and tolerance compared to men, hence enduring pain for relatively less time and conversely, more willing to report pain.

After controlling for age, regression analyses indicated that the GREP predicted an additional 7% of the variance in pain threshold, an additional 11% in pain tolerance, and notably, an additional 21% of the variance in VAS ratings of pain unpleasantness. Further, when entering GREP scores into regression models, sex was no longer a significant predictor of pain threshold or pain unpleasantness. However, it remained a significant predictor of pain tolerance, accounting for an additional 6% of the variance. Gender-role expectations of pain (GREP) were significant albeit modest predictor of pain threshold. Expectations related to gender role and the pain appear to be stronger predictors of pain tolerance and pain unpleasantness.

It may be that when using psychophysical procedures, such as threshold and tolerance, both an individual's sex and gender role expectations play some part in their pain report. The pattern of results suggests that sex may play a stronger role when using these types of assessment procedures. However, when subjects are asked to give a more global rating of pain unpleasantness after the pain testing, socially learned, gender specific expectations tend to play a larger role. Specifically, when subjects indicated themselves to be less willing to report pain than the typical man or have greater pain endurance than the typical man, they provided lower pain unpleasantness ratings. VAS ratings of pain unpleasantness are generally accepted as a measure of the emotional-affective component of experimental pain (Price and Harkins, 1992).

One interpretation of this relationship is that the less willing that an individual is to openly verbalize pain, the less likely they are to indicate that the experimental pain they underwent was comprised of a high affective component, or was unpleasant to them. Importantly, this relationship appears specific for pain unpleasantness as opposed to pain sensation intensity. This is consistent with the constructs of gender roles and learned beliefs regarding acceptable behaviors and emotional expressions for men and women. For example, previous research has

demonstrated significant sex differences in disclosure of and emotional response to imagined bodily pain (Klonoff et al., 1993). When compared to females, male participants were less apt to disclose pain to others and associated feelings of embarrassment with having to admit pain. Further, women rated their response to pain as entailing more irritability and worrying when compared to men, and a high likelihood of disclosing it. Thus, learned gender roles, manifesting as gender specific pain behaviors and emotional expressions, may be influencing pain unpleasantness ratings, as measured by the GREP.

Assessing the construct of gender role and its relationship to pain behavior is still in the preliminary stages. It may be that in the future, improvements in the measurement of gender-role expectations related to pain will assist in demonstrating the important role that this construct is thought to play in the sex differences demonstrated in laboratory pain.

In sum, this study revealed two primary findings. First, significant sex differences emerged for measures of pain threshold, pain tolerance, and pain unpleasantness. However, after statistically controlling for age, the sex difference in pain unpleasantness ratings was no longer statistically significant. Second, after statistically controlling for age, GREP scores were significant predictors of threshold, tolerance, and pain unpleasantness, accounting for an additional 7, 11, and 21% of the variance, respectively. Sex remained a significant predictor of pain tolerance in hierarchical regression analyses after controlling for GREP scores. Results provide support for two competing but not mutually exclusive hypotheses related to the sex differences in experimental pain. Both psychosocial factors and biological sex differences remain as viable explanations for differences in experimental pain report between the sexes. It appears that gender-role expectations of pain do play a part in determining an individual's pain report and may be contributing to the sex differences in the laboratory setting.

We would further suggest that the appropriate analytic strategy for examining the relative contribution of gender role and sex to pain perception is to force gender role into statistical models prior to the inclusion of the dichotomous variable of sex. The dichotomous variable sex is often inappropriately considered a proxy for biology when in fact it is a multidimensional variable which includes both first-order biological components and social learning components. By putting sex in statistical models before gender, measures will give an underestimate of the true nature of gender influences in pain report. It is also quite possible that additional, gender role related psychosocial factors could further explain the reported sex differences in pain perception. Ultimately, statistical models should include direct measures of the biological parameters often implied by the dichotomous variable sex, in conjunction with gender role variables.

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Table 1Means (SD) for demographic variables and questionnaire scores^a

	Age	Years of formal education	PILL score	BDI score
Males	23.6 (4.3)	15.8 (2.6)	92.7 (35.9)	2.5 (14.0)
Females	19.1 (1.4)	13.0 (1.7)	105.11 (20.3)	6.6 (5.5)

^aPILL, Pennebaker Inventory of Limbic Languidness; BDI, Beck Depression Inventory.

Table 2
Means (SD) for thermal pain measures by sex (***P* < 0.001; **P* < 0.05)

	Average threshold (s)**	Average tolerance (s)**	Computer VAS of pain intensity (average peak)	VAS-pain intensity (global)	VAS-pain unpleasantness(global)*
Male	22.6 (3.6)	29.0 (1.9)	48.3 (28.6)	44.0 (20.5)	41.6 (23.6)
Female	20.0 (3.8)	26.2 (3.1)	38.4 (39.1)	49.9 (22.2)	51.0 (25.8)

Table 3

Effect sizes for pain ratings

Average threshold	Average tolerance	Computer VAS-pain intensity (average peak)	VAS-pain intensity (global)	VAS-pain unpleasantness (global)
0.70	1.05	0.27	0.28	0.37

Table 4
Summary of regression analysis for variables predicting pain threshold (***P* < 0.01)

Predictors	<i>R</i> ²	ΔR^2	<i>F</i> (ΔR^2)	<i>B</i>	<i>SE B</i>	β
Age	0.12	0.12	17.6**	0.37	0.09	0.34**
GREP score	0.18	0.07	5.6**	-4.5	0.02	0.28**
Sex	0.19	0.01	0.87	-0.78	0.84	-0.10

Table 5
Summary of regression analysis for variables predicting pain tolerance (***P* < 0.01)

Predictors	<i>R</i> ²	ΔR^2	<i>F</i> (ΔR^2)	<i>B</i>	SE <i>B</i>	β
Age	0.10	0.10	15.7**	0.26	0.07	0.32**
GREP score	0.21	0.11	9.6**	-3.7	0.01	-0.30**
Sex	0.27	0.06	10.7**	-2.0	0.60	-0.32**

Table 6
Summary of regression analysis for variables predicting pain unpleasantness (**P* < 0.05; ***P* < 0.01)

Predictors	<i>R</i> ²	Δ <i>R</i> ²	<i>F</i> (Δ <i>R</i> ²)	<i>B</i>	SE <i>B</i>	<i>β</i>
Age	0.04	0.04	5.4*	-1.3	0.55	-0.19*
GREP score	0.25	0.21	19.9**	0.37	0.07	0.41**
Sex	0.25	0.00	0.18	2.1	5.0	0.04