# Big Five Personality Factors, Pain Response Expectancy and Headache Pain History on Cold Pressor Pain Tolerance

by

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A thesis submitted to the Faculty of Graduate Studies

in partial fulfillment of the requirements for the degree of

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FACULTY OF GRADUATE STUDIES

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Abstract

According to Eysenck's theory of cortical arousal, personality variables affect pain tolerance. However, most research examining personality variables in relation to pain has measured personality inconsistently and incompletely. Little or no research has explored the relationships between acute pain tolerance and chronic pain, pain response expectancy and chronic pain, and personality and pain response expectancy. Personality variables, pain response expectancy, headache pain history, and tolerance to experimentally induced cold-pressor pain were examined among 132 female students enrolled in an Introductory Psychology course. Group 1 consisted of 75 participants with frequent, high-intensity headache pain, whereas Group 2 consisted of 75 participants with infrequent, low-intensity headache pain. Both groups completed the Revised NEO Personality Inventory (NEO PI-R) as well as pain response expectancy ratings prior to a cold-pressor test of pain tolerance. Results revealed significant differences between groups on pain tolerance and personality. In addition, pain tolerance and pain response expectancy were each found to be correlated to personality profile features. The findings open a window on exciting new research with regards to personality, now that the relevance of using the NEO PI-R as a personality assessment instrument has been demonstrated.

# Big Five Personality Factors, Pain Response Expectancy and Headache Pain History on Cold Pressor Pain Tolerance

The nature of pain is an issue that has long intrigued professionals in various disciplines such as Medicine, Medical Rehabilitation, Nursing, Psychology and Physical Education. As a result, many studies have been conducted to expand our knowledge about pain, its components, causes, consequences and the coping strategies people use to deal with pain. The pain literature seems to support the conceptual position that there are three major characteristics of pain.

The first characteristic is the physiological reaction (Martin, 1997) or "internal physical changes" (Jaremko, Silbert & Mann, 1981, p. 266). This component seems to influence pain threshold (Ryan & Kovacic, 1966). The second is the way in which one learns to overtly express emotions resulting from pain (Martin). Finally, the last characteristic of pain is the way in which individuals report the personal experience of pain (Martin), "consisting of a verbal or cognitive description of an actual or presumed state" (Jaremko et al., p. 266). This characteristic is often referred to as "pain appraisal." According to Jaremko et al., the latter is the most behaviorally defining component of pain. From a behavioral perspective, both the overt expression of pain and the awareness, report and description of pain are components that are influenced through past learning and are therefore the product of culture, experience, gender, age, ethnicity, health and many other factors (Egan, 1988). Both Gelfund and Wolffe mention that these components also influence pain tolerance (cited in Ryan and Kovacic).

The pain literature reveals "two important processes in the experiencing of pain" (Laasch, 1994, p. 238). The first is the actual perception of pain, which is referred to as pain threshold and the second is the ability to tolerate pain subsequent to its perception, which is referred to as pain tolerance (Anshel & Russell, 1994). Many studies seem to support Gelfand and Wolffe's

idea that "pain tolerance is more highly loaded with psychological than physiological components, while the reverse is true of pain threshold" (Ryan & Kovacic, 1966, p. 383). Thus, the study of pain tolerance and its relationship to psychological factors such as personality characteristics, is important in psychological research.

### *Big Five Factors*

Personality characteristics can be brought together to create five general personality traits called the Big Five personality factors. These factors can be measured using the Revised NEO Personality Inventory (NEO PI-R) and are known as agreeableness, conscientiousness, extraversion, neuroticism and openness to experience. The NEO PI-R was developed using a rational and factor analytic method on large adult samples (Wade & Price, 2000). Selection and evaluation of test items were conducted to produce maximally discriminant facet scales (Wade & Price) and principal component analysis was a primary tool for test construction (Wade & Price). Test construction maximized discriminant and convergent validity, but the test still has internal consistency reliabilities of up to .93 (Wade & Price). The NEO PI-R scales were balanced to control for the effects of acquiescence, and are not overly sensitive to social desirability effects (Wade & Price). A literature review by Wade and Price seems to confirm that the NEO PI-R is the most widely used and accepted measure of personality. However, pain research does not seem to use the NEO PI-R to measure personality factors. In fact, most pain research is inconsistent in the selection and measurement of personality variables.

### *Voluntarism*

A number of personality variables have been hypothesized to influence pain perception and pain tolerance. A study conducted by Spangler and Reynolds (1991) however, underlines some important considerations to take into account when doing research on individual

differences in relation to pain. The study examined the relationship between volunteer status in college women who were asked to participate in a pain research study on extraversion, neuroticism, lying, psychoticism, external locus of control and trait anxiety. Results revealed that women who volunteered to undergo a cold pressor test had significantly higher scores on external locus of control than women who did not volunteer (Spangler & Reynolds, 1991). It is possible that "women who perceive themselves to control their environment are more likely to refuse participation in a test in which they perceive to have little or no control" (Spangler & Reynolds, p.499), or perhaps they refuse to participate because they do, in fact, have low pain tolerance. Either way, findings suggest that studies attempting to relate individual differences to pain experience may be strongly influenced by psychological factors. Thus research in this area requires rigorous controls. The women in this study were all volunteers.

*Response Expectancy*

According to Egan (1988), the reporting of pain is influenced by "cultural values (Kozambi, 1967), early experience in the perception of pain (Melzack & Scott, 1957), the meaning attributed to pain (Beecher, 1959) and attention, anxiety and distraction (Hall & Stride, 1954; Gly, 1971; Melzack et al., 1963)" (Egan, p. 11). Supporting this viewpoint is Zborowski who suggests that pain expectancy and pain anticipation (two attitudes determined by culture) are essential in understanding one's response to pain (as cited in Ryan & Kovacic, 1966). For example, individuals whose culture has taught them not to expect or accept a certain type of pain might develop attitudes that cause them more difficulty in tolerating and coping with pain. Others such as Nietzche have suggested that response to pain (including pain tolerance) depends on one's expectancy of "utility and harmfulness" (as cited in Egan, p. 11) of pain. Therefore the "painful situation is [sic] judged in its implications to the individual" (Egan, p. 11).

Rotter's social learning theory (Rotter, as cited in Baker & Kirsch, 1991), states that behavior is predicted by "outcome expectancy." "Outcome expectancy" is the belief that a particular behavior will produce a certain outcome (Baker & Kirsch). Two types of outcome expectancies are "stimulus expectancy" (beliefs that external events such as money, grades, praise or an aversive stimulus will occur) and "response expectancy" (one's beliefs about their nonvolitional reactions to events such as joy, pain or fear) (Baker & Kirsch).

A study conducted by Baker and Kirsch (1991) found that cognitive pain reduction strategies increased pain tolerance and that response expectancy affected pain perception and was linked to pain tolerance. It could then, be plausible that learning cognitive pain reduction strategies lowers pain response expectancy and consequently increases pain tolerance. Thus, response expectancy may be one of the mediators of treatment-provoked pain reduction (Baker & Kirsch). However, response expectancy and pain tolerance were measured using a visual analog scale from 1 to 100. It may be argued that the range of this scale was too wide and confusing for participants attempting to give pain ratings. Furthermore, although the study defined pain response expectancy (response expectancy for pain) as "participants' ratings of the amount of pain they thought they would feel if they kept their hands immersed in ice water for varying lengths of time starting with 1 minute and progressing in 30 second intervals to a maximum of 8 minutes" (Baker & Kirsch), it did not explain how the ratings were amalgamated. Using such a definition creates other problems as well. For example, it is difficult to accurately rate pain response expectancy at varying 30 second intervals with only five seconds of previous exposure to the painful stimulus. Moreover, the discontinuity and quantity of ratings obtained with such a procedure provides room for error and confusion. Perhaps an overall rating of pain response expectancy on a smaller scale would be more appropriate.

Another study by Stevens, Ohlwein and Catanzaro (1996) attempted to examine the influence of response expectancy for pain intensity and its influence on pain tolerance and intensity. Findings revealed that pain response expectancy was strongly related to pain tolerance and intensity. Thus, the results support Baker and Kirsch's (1991) conclusions that pain response expectancy is a major determinant of pain tolerance (Baker & Kirsch). However, Stevens et al. differed from Baker and Kirsch in their measure of pain response expectancy. They used a 5-point rating scale ranging from 1 *(mild)* to 5 *(excruciating)*. Although Steven et al.'s method is less confusing than that used by Baker and Kirsch, one could argue that the range of the rating scale used to measure pain response expectancy was not wide enough. Either way, the previous research illustrates the importance of considering pain response expectancy when evaluating treatments for pain (Baker & Kirsch). The present study examined pain response expectancy and measured it using a 10 point rating scale.

### *Situational factors*

A study conducted by Stevens (1994) attempted to examine the moderating effects of situational variables, and also the moderating effects of global/dispositional and demographic variables on responses to acute pain. Global/dipositional variables included social desirability, trait anxiety, cognitive rigidity-flexibility, locus of control, repression-sensitization and major stressors whereas specific/situational variables included history of pain, state anxiety, strength of self-efficacy for tolerating pain and regulating intensity, different types of state coping and minor stressors such as hassles. Demographic variables included gender and race. Results indicated that race and gender significantly predicted tolerance times, that self-efficacy for tolerating pain significantly predicted tolerance times and that hassles significantly predicted tolerance times. In addition, pain intensity ratings were significantly predicted by age, social desirability,

cognitive state coping and self-efficacy for regulating intensity. Thus, the evidence suggests that situational variables, especially self-efficacy for tolerating pain, influence the amount of pain tolerance and perceived intensity to a greater extent than global/dispositional ones (Stevens).

Stevens (1994) argues that the larger effect of situational variables on pain tolerance and perceived intensity occurs because situational variables are more "contextually sensitive and relevant to how individuals respond to painful stimulation" (Stevens, p.319). The study however, may be criticized in its use of global/dispositional variables such as Social Desirability, Trait Anxiety, Cognitive Rigidity-Flexibility, Locus of Control, Repression-Sensitization and Major Stressors to measure global aspects of one's life as well as disposition or personality. These variables are insufficient to adequately represent personality. Perhaps, the NEO PI-R would have been more appropriate to use, since it is based on five orthogonal factors that encompass a wider range of personality dimensions, and since it is most often recognized as the most reliable and valid overall measure of personality. It is possible that, had personality been more appropriately measured using the NEO PI-R, global/dipositional variables would have been found to have a greater influence on pain tolerance and intensity ratings. Furthermore, the study did not seem to take into account the possible overlap or interaction between global/dispositional and situational variables. In fact, state coping could be influenced by most if not all of the global/dispositional variables used. If the global/dispositional variables in the study influenced the situational variables, it is quite possible that the overlap of the global/dipositional variables caused the larger effect of the situational variables on pain tolerance and perceived intensity. Thus, it could be possible for global/dispositional variables to have more influence (though possibly less direct) on pain tolerance and perceived intensity than situational variables. In light of such possibilities, further studies should identify new and

perhaps more appropriate situational variables in the study of pain tolerance. This study focused on measuring dispositional variables, which have been less researched in the pain literature, using the NEO PI-R.

## *Dispositional factors*

### *Anxiety*

Although trait anxiety is not one of the Big Five factors of the NEO PI-R, it is highly correlated to, and an important dimension of neuroticism (broad-based negative affectivity). In fact, trait anxiety has been studied extensively as a personality construct of anxiety-proneness (Cooper, Weaver & Hay, 2000). A study by James and Hardardottir (2002) examined the effects of trait anxiety on the tolerance of acute cold pressor pain and the effectiveness of employing cognitive attention focus strategies to improve pain tolerance. It was speculated that high anxiety was likely to cause attention to focus on the painful stimulus, decreasing tolerance to it. The study's results revealed that high trait anxiety significantly decreased pain tolerance, whereas low anxiety significantly increased pain tolerance. The findings also revealed that cognitive distraction strategies could help increase pain tolerance in anxious individuals and that low anxiety participants reported more happiness, alertness, friendliness, less anger and less tension than participants high in anxiety (James & Hardardottir). Thus, overall findings reveal the important influence of trait anxiety (a dispositional variable) on the tolerance of acute pain and the role of cognitive strategies to increase pain tolerance in highly anxious individuals.

Another study conducted by Cooper, Weaver and Hay (2000) used the State-Trait Anxiety Inventory (STAI) and the Revised Eysenk Personality Questionnaire (EPQ-R) to examine state and trait anxiety, neuroticism, extraversion, psychoticism and lying in relation to pain intensity ratings of a painful and anxiety provoking procedure. Results were consistent with

those of Mumford, Newton and Ley (1973) in that they indicated no relationship between personality factors and pain ratings (Mumford,et al., Cooper et al.). Furthermore, Cooper et al..'s study also found that state anxiety was highly correlated to actual pain reports whereas trait anxiety was not. However, the pain reports in Cooper et al.'s study were subjective ratings and were given by participants who had received analgesics. Many of the most distressed and most medicated participants who were likely to be experiencing the most pain, were confused, sleepy and had difficulty reporting their pain. Thus, the pain reports were most likely underestimated (Cooper et al.), putting into question the objectivity and validity of the study and its results. Furthermore, Lie scale scores on EPQ-R were found to be negatively correlated with the overall pain ratings taken after the procedure, but not correlated to pain ratings during the procedure. These results might indicate that the participants attempted to give socially desirable responses (lower pain ratings), but could only do so once the procedure was over. Again, these results call into question the reliability of the findings. Another shortcoming of the previous studies involves their personality measure of choice. The EPQ and the STAI may be considered inferior to the NEO PI-R as measures of personality. Thus, perhaps these findings should be replicated with newer and more sophisticated personality measures such as the NEO PI-R and with more objective, physiological measures of pain.

*Extraversion and Neuroticism*

According to Petrie's model (1960), some individuals labeled "reducers" decrease "the intensity of all incoming stimuli, implying a greater tolerance and need for stimuli" (Gundersheim, p. 88, 1987). In contrast, other individuals labeled "augmenters" increase "the strength of all incoming stimuli, thereby preferring low levels of stimulation"

(Gundersheim, p. 88, 1987). These are said to be "constitutional differences ... between individuals relative to the ability to tolerate all modalities of stimuli" (Gundersheim, p. 88). A 1969 study by Vando (as cited in Gundersheim) found a significant relationship between reducers and pain tolerance and between pain tolerance and extraversion, which links reducers to extraversion. If reducers have a better ability to tolerate pain and a greater need for sensory stimulation (like extraverts), perhaps they would be inclined to seek involvement in stimulating activities that are more likely to expose them to pain.

Interestingly, some studies have established that athletes tend to tolerate more pain than non-athletes and that contact sport athletes tend to tolerate more pain than non-contact sport athletes (Ryan & Kovacic, 1966; Walker, 1971). In fact, a study by Ryan and Foster found high school male contact sport athletes to be reducers, non-athletes to be augmenters and non-contact sport athletes to be in between. Thus, the research leads one to wonder whether increased pain tolerance that results from high stimulation perception thresholds leads one to develop characteristics of extraversion such as sensation seeking behavior; or if sensation seeking behavior increases the likelihood of frequent exposure to pain, which leads one to develop high stimulation perception thresholds, which increases pain tolerance. That is, does pain tolerance influence sensation seeking behavior and extraversion or do sensation seeking behavior and extraversion increase exposure to pain and influence pain tolerance? This study attempted to further explore the role of extraversion and frequent exposure to pain on pain tolerance.

Similar to Petrie's (1960) concept of reducers and augmenters, is Eysenck's theory of cortical arousal (1957, 1960a). According to Eysenck's theory, a tendency towards attenuation of sensory input is found in people who have low arousal in the cortex. This tendency increases pain tolerance and also produces a need for stimulation that is characteristic of extraverts

(Schalling, 1971). Thus, Eysenck's theory of personality includes the idea that extraverts who are exposed to prolonged pain sensations feel less pain because it is inhibited more strongly and quickly (Lynn & Eysenck, 1961). Eysenck's theory also supports the idea that neuroticism is negatively correlated to pain tolerance because anxiety over anticipated pain -which is often present with physiological pain- exacerbates the total pain experience (Lynn & Eysenck). This anxiety can be thought of as a conditioned response. Since extraverts are thought to condition less well than introverts, it is also possible that, in addition, extroverts do not experience the exacerbating fear component in the total pain experience to the same extent as others (Lynn & Eysenck). Lynn and Eysenck attempted to examine the role of extraversion and neuroticism on pain sensation and tolerance among thirty volunteer university students. Pain was induced using heat stimulation by a thermo-stimulator while personality was measured using the Maudsley Personality Inventory and the Spiral After-effect test (an objective measure of extraversion according to Eysenck). Results found significant correlations between extraversion and pain tolerance ($r$ =.69, $p$<.01) and between neuroticism and pain tolerance ($r$ =-.36, $p$<.05), which supports Eysenck's theory of personality factors influencing pain reporting (Lynn & Eysenck). Thus, there are theoretical reasons why these dispositional variables may be significantly related to pain tolerance. However, because Lynn and Eysenck's study was conducted in 1961, the personality measures used may be out of date and perhaps somewhat questionable. The same study should be subjected to newer personality measures such as the NEO PI-R.

Further evidence suggesting a link between extraversion and pain tolerance was found in a literature review by Philips and Gatchel (2000). After examining 15 studies, they concluded that the majority indicated that extraversion was positively associated to pain tolerance and threshold, whereas introversion was negatively associated to pain tolerance and threshold.

However, like Lynn and Eysenck's (1961) study, most of the studies reviewed were conducted several decades ago and did not use the NEO PI-R to measure extraversion, neuroticism or other personality factors. In fact, nine of the studies used the Maudsley Personality Inventory, the same personality measure used by Lynn and Eysenck in 1961. Furthermore, the N of the reviewed studies was quite small, giving them little power. Again, research in this area should focus on increasing N size and employing updated or revised personality measures.

Also consistent with Eysenck's theory are the results of Maushammer, Ehmer and Eckel (1981), that revealed a positive correlation between anxiety scores on the Fear Survey Schedule and long "latencies" at two different stimulus intensities. "Latencies" were described as the difference between pain threshold and pain tolerance, and were negatively correlated with pain tolerance (Maushammer et al.). Thus, longer latencies were associated with decreased pain tolerance. Longer latencies were also positively correlated with psychological state and neuroticism scores on the Eysenck Personality Inventory (Maushammer, et al.). Since longer latencies of sensory evoked potentials are found in people who are less pain tolerant, the results would indicate that less pain tolerant people with longer latencies of sensory evoked potentials are higher in neuroticism. Thus, the results suggest that high neuroticism and anxiety are related to decreased pain tolerance.

The study however, has a few drawbacks. First of all, the sample of participants used (N=15) is too small to have much power and to make any reliable conclusions. Secondly, the study used a variety of different personality measures, none of which are as sophisticated as the NEO PI-R. The third shortcoming of the study is its measure of pain tolerance. Pain tolerance was defined as the intensity at which an electrical square–wave impulse was first reported as "hardly bearable." This measure of pain tolerance is quite subjective since it requires a value

judgment to be made. Furthermore, it is unclear whether "intensity" refers to the voltage of the shock delivered, whether it refers to the quantity of shock delivered within a restricted period of time, or whether it refers to something else. Perhaps, a clearer, more objective measure of pain tolerance would have measured the length of time it took for participants to remove themselves from a painful stimulus.

Similar results were found in a study by Shiomi (1978). The results revealed a significant positive correlation between Maudsley Extraversion scores and 3 and 4 degrees Celsius cold pressor pain tolerance, as well as a significant negative correlation between pain threshold and scores on Maudsley Neuroticism and the Manifest Anxiety Scale. Accordingly, an extensive literature review by Philips and Gatchel (2000) on the relationship between extraversion and acute and chronic pain concluded that "even though extraverted individuals are more prone to complain about pain, they also paradoxically have a higher tolerance for pain and experience less pain in given conditions than do introverts" (Philips & Gatchel, p.181). In addition, neuroticism and ethnic background were found to affect pain.

An interesting study by Libman and Stern (1985) compared personality and pain tolerance among frequent and infrequent cannabis users. Findings revealed that infrequent cannabis users were more pain tolerant ($p<.01$) and scored higher on extraversion ($p<.05$), neuroticism ($p<.05$) and lie scales ($p<.05$) from the Eysenck Personality Inventory than frequent cannabis users. Furthermore, although sensation perception was affected by THC, pain threshold and tolerance were not. Libman and Stern stated that "the findings...indicate that a difference in response to pain exists between experienced and naïve cannabis users, and suggest that this difference, in turn, is related to personality differences." (Libman & Stern, p.173). Thus, the findings suggest that extraversion, neuroticism and lying influence pain tolerance independently

of THC, supporting Eysenck's theory of cortical arousal. Unfortunately, like several others, this study ignores the benefits of using the NEO PI-R to measure personality and relies on subjective value judgments of "very strong pain" and "very faint pain" to measure pain tolerance and threshold.

Another study reported to support Eysenck's theory of cortical arousal conducted by Hentschel (1977), found differences in cold pressor, electric shock and pressure pain tolerance among extroverts using the Spiral After-effect, a test considered by Eysenck to be an objective measure of extraversion (Eysenck, 1960b). Furthermore, Davidson and McDougall (1969) found a negative relationship between manifest anxiety and both pressure and shock tolerance and a significant relationship between shock tolerance and extraversion. Perhaps future research should move towards ensuring the consistent measure of personality as well as of pain tolerance.

### *Dispositional Variables and Chronic Pain*

From the research literature, the extent to which personality influences acute pain tolerance remains undermined. To help clarify this issue, perhaps dispositional personality variables should be examined in relation to more persistent, naturalistic pain such as chronic pain.

#### *Extraversion*

After examining the findings of 16 studies, Philips and Gatchel (2000) concluded that most studies supported the idea that introversion was positively associated to chronic pain conditions, whereas extraversion was negatively associated with chronic pain conditions, but positively associated with pain complaints and health seeking behavior. Extraversion was thought to influence reactive inhibition to pain, to increase social support, expression of feelings and social activity. In turn, these factors were thought to decrease levels of stress, increase the

demand for pain relief and amount of pain distracting activities, and decrease conditioned fear response (Philips & Gatchel, 2000). Thus, chronic pain studies seem to support the notion that some individuals, especially those with high levels of introversion, are more predisposed than others to experience symptoms of pain (Philips & Gatchel; Wade & Price, 2000).

Although some of the studies reviewed were more recent than those pertaining to acute pain, most had small N's and used the same personality measures. The studies were also subjective and inconsistent in their measures of pain. Furthermore, one might consider that perhaps research should pay more attention to the relationship between chronic pain and pain tolerance, especially since both seem to be related to similar personality factors.

*Neuroticism*

According to Wade and Price (2000), the research literature indicates that neuroticism is often conceived of as a "chronic condition of proneness to distress" (Wade & Price, p.96) that can contribute to physical changes associated to disease progression.

A study by Tanum and Malt (2001) examined the relationship between somatic distress, pain reports and personality among non-psychopathological patients with functional gastrointestinal disorder (FGD). Tanum and Malt proposed that there was a link between the altered autonomic activity and motility seen in people with FGD and clinical manifestations of personality factors. Personality was measured with the Buss-Durkee Hostility Inventory, the NEO PI, the Eysenck Personality Questionnaire and the Giessener Physical Complaints Checklist, while pain reports were measured by the McGill Pain Questionnaire and the Visual Analogue Scale for abdominal pain and distress (Tanum & Malt). Findings revealed that neuroticism and concealed aggression scores were higher in patients with FGD compared to controls ($p<.001$; $p<.01$), and that extraversion scores were higher in female patients with FGD

compared to controls ($p<.05$). In addition, mean neuroticism scores in non-psychopathological FGD patients were higher than mean neuroticism scores from a normative sample, whereas mean neuroticism scores for a non-psychopathological control group were lower than normative samples. Furthermore, from examination of items determining neuroticism scores, Tanum and Malt concluded that "there was no indication that the presence or absence of illness could explain the higher scores in patients compared with controls" (Tanum & Malt, p.145). Thus, the study concluded that concealed aggression and neuroticism influenced reports of pain and were most likely predisposing factors in the development of FGD (Tanum & Malt). The findings of this study however, contain substantial gender differences. This rendered the data vulnerable to statistical biases and increased the likelihood of statistical significance between groups (Tanum & Malt). In addition, although the study used the NEO PI as one of its personality measures, it did not use the revised version that the present research used.

A longitudinal study by Kikkonen, Pulkkinen and Kinnunen (2001) examined the mediating role of "emotion regulation" (a mode, type or synonym for coping) between personality characteristics and physical symptoms. The presence of personality characteristics reflecting low self-control of emotions at age eight and 27 was expected to decrease the likelihood of attempting to repair negative emotions (emotion-regulation strategy), which was expected to increase the report of physical symptoms at age 36 (Kikkonen et al.). Findings demonstrated that inattentiveness and anxiety in childhood was linked to high neuroticism at age 27, which was directly related to chronic physical symptoms such as gastrointestinal problems, cardiovascular and nervous system problems at age 36. Thus, the study supports the idea that certain personality characteristics such as anxiety and neuroticism have a direct influence on the

onset of chronic disease. Due to the longitudinal design of the study, causal inferences about the nature of the relationship between personality variables and chronic disease can be made.

*Big Five Factors*

Accordingly, a study by Jerram and Coleman (1999) used the NEO Five Factor Inventory and found that neuroticism was associated to the report of several health problems, negative health perceptions and frequent visits to the doctor. Openness to experience and agreeableness were significantly related to positive health perceptions, while extraversion was significantly associated to positive health behaviors. In addition, conscientious men had more positive health perceptions and visits to the doctor, while agreeable women had less health problems and visits to the doctor (Jerram & Coleman). This seems to indicate that Big Five personality factors affect health reporting in women and men differently. If, as findings suggest, personality characteristics influence perception of health, health related behaviors and the reporting of health problems, they may also influence expectancy for pain tolerance. Thus, it is possible that personality characteristics directly influence the reporting of health problems or indirectly influence the onset of health problems by affecting perception of health and health related behavior. It is important to note, that the NEO Five Factor inventory is a shorter version of the NEO PI-R that evaluates the same Big Five personality traits. Nevertheless, this study underlines the importance of the Big Five personality traits, instead of neuroticism and extraversion alone (Jerram & Coleman, 1999), impacting on pain experiences. One implication of the study is that it might be valuable to include formal information on personality in busy clinics in order to increase treatment effectiveness (Jerram & Coleman).

*Summary*

Although some research seems to indicate that situational variables have more influence on the tolerance of acute, experimentally induced pain than dispositional personality variables; the operational distinction between situational and dispositional variables is not clear, and needs more rigorous investigation.

Furthermore, evidence concerning the nature of the relationship between major psychometrically valid personality variables and pain has not been empirically established. What personality characteristics influence or are influenced by pain tolerance, chronic pain, or both, and how? Do personality characteristics influence pain tolerance and chronic pain? If so, is their influence moderated by the effect of pain response expectancy? On the other hand, does exposure to chronic pain influence changes in personality and/or pain response expectancy that affect pain tolerance? In order to make such conclusions, future research will need to make consistent, clearer and sounder conclusions about the relationships between personality, pain response expectancy, pain tolerance and chronic pain. To date, conclusions about such relationships remain mixed. Surprisingly, little or no research has explored the potential relationship between acute pain tolerance and chronic pain, between pain response expectancy and chronic pain or between personality and pain response expectancy, let alone the possible relationships between all of these variables. Moreover, personality seems to have been measured inconsistently and incompletely across most research. In fact, the only established orthogonal factors accounting for personality differences that have been studied are neuroticism and extraversion.

However, there are three other orthogonal factors that can account for personality differences that are seldom examined. They are labeled agreeableness, conscientiousness and openness to experience. Together, all five factors are known as the Big Five personality factors.

The NEO PI-R is a measure of the Big Five personality factors and offers a clearer, more distinct, global, valid and constant way of measuring personality variables. In light of the existence of a clear and distinct measure of dispositional variables, perhaps more emphasis should be placed on examining the extent of their influence on acute, experimentally induced pain tolerance using the NEO PI-R; rather than on the situational variable construct, which still cannot be measured in a clear and distinct way.

The present study examined the influence of the Big Five personality factors, pain response expectancy and headache pain history on acute, experimentally induced cold pressor pain. Findings were expected to help illuminate the potential relationship between personality and pain tolerance, pain expectancy and pain tolerance, between personality and chronic pain, pain expectancy and chronic pain, between personality and pain response expectancy, and between pain tolerance and chronic pain. Although causal relationships could not be examined, the study attempted to help clarify the debate on what variables or considerations to take into account in order to treat chronic pain most effectively.

### *Hypotheses*

The current study put forth nine hypotheses. They were as follows:

1. It is hypothesized that there will be significantly higher neuroticism scores in participants reporting frequent, high intensity headache pain than in participants reporting infrequent, low intensity headache pain.

2. It is hypothesized that there will be significantly lower extraversion scores in participants reporting frequent, high intensity headache pain than in participants reporting infrequent, low intensity headache pain.

3. It is hypothesized that there will be significantly higher pain response expectancy ratings in participants reporting frequent, high intensity headache pain than in participants reporting infrequent, low intensity headache pain.

4. It is hypothesized that there will be significantly lower pain tolerance in participants reporting frequent, high intensity headache pain than in participants reporting infrequent, low intensity headache pain.

5. It is hypothesized that there will be a positive correlation between pain response expectancy and neuroticism

6. It is hypothesized that there will be a negative relationship between pain response expectancy and extraversion.

7. It is hypothesized that there will be a negative relationship between neuroticism scores and pain tolerance

8. It is hypothesized that there will be a positive relationship between extraversion scores and pain tolerance

9. It is hypothesized that there will be a negative relationship between pain response expectancy and pain tolerance.

Hypotheses about agreeableness, openness to experience and conscientiousness and their relationship to headache pain history, pain tolerance and pain response expectancy were not made due to the lack of information in the pain research literature concerning their influence. Thus, certain aspects of this research were exploratory in nature.

## Methods

### *Participants*

Participants were 132 volunteer female students enrolled in Introductory Psychology courses at the University of Manitoba. Of the 132 participants, 69 reported frequent, high intensity headache pain (Group 1) while another 63 reported infrequent, low intensity headache pain (Group 2). Participants who believed they had a condition that would be exacerbated by cold water arm immersion or who had any unstable medical condition (apart from headaches) requiring medication or regular visits to the doctor were instructed not to participate in the study (Appendix A). Participants who were under the age of 18, who had any injury to the arm or hand with which they did not write were also excluded from the study. Participation in the study was completely voluntary and contingent upon the participant signing a consent form prior to receiving the survey (Appendix B) and prior to receiving the cold pressor test (Appendix C). After completion of the cold pressor test, participants were provided with the opportunity to take a debriefing form explaining the general purposes, hypotheses and implications of the study (Appendix D).

### *Procedure and Materials*

*Questionnaire session.* All participants were given a questionnaire to complete. The questionnaire included the NEO PI-R self-report form and a set of general questions about demographics and headache pain (Appendix A). The NEO PI-R is a published, well known, copyrighted, questionnaire. The NEO PI-R is a measure of the Big Five personality factors consisting of 240 questions on a five-point scale from *strongly disagree* to *strongly agree*. It was devised to emphasize discriminant and convergent validity rather than internal structure checks (Wade & Price, 2000). Furthermore, the measure was balanced to control for acquiescence and

has internal consistency reliabilities for the five scales that ranges between .76 and .93 (McCrae & Costa, 1985).

Three group sessions of approximately 60 minutes were conducted to test all participants. The questionnaire was administered to each participant in one of three group settings following their signing of the questionnaire consent form. Each questionnaire was numbered in order to identify participants numerically and to maintain their individual confidentiality. Participants were instructed to take note of this number and to bring it to the cold pressor session. Participants were also instructed to wear a t-shirt for the cold pressor session. At the time of questionnaire completion, participants were reminded to sign up for the cold pressor part of the study and that debriefing would occur after the cold pressor session.

*Cold pressor session.* The cold pressor test was administered to all participants during individual appointments of approximately 10 minutes each. Participants were asked to give their identification number and were given a second consent form pertaining to the cold pressor part of the experiment. Participation in the cold pressor part of the study was contingent upon the signing of this consent form. Each participant's identification number was recorded on individual pain expectancy rating forms. Participants were reminded that the procedure was safe, that no short term or long term physical harm could occur and assured that they could withdraw from the study at any time (Appendix E). Next, participants were instructed to touch the bottom of a tank of cold water between 2 and 4 degrees Celsius and to retract their arm as quickly as possible. This was done to provide the participant with an experience of the temperature of the water (Appendix E). Next, participants were asked to fill out the pain expectancy rating form bearing their identification number. The form instructed them to indicate on a scale of 1 *(a small amount of pain)* to 10 *(a large amount of pain)* how much pain they

expected to experience from immersing their arm in the tank of cold water for as long as they could (Appendix E). Following the initial experience with the cold water tank, participants underwent the experimental procedure.

The cold pressor test is a safe and widely used measure of pain tolerance (James & Hardardottir, 2002; Lautenbacher, Spernal, Schreiber & Krieg, 1999; James & Hardardottir, 1998; Baker & Kirsch, 1991; Jaremko, Silbert & Mann, 1981; Knox, Hanford-Jones & Shum, 1979; Shiomi, 1978; Hentschel, 1977; Davidson & McDougall, 1969; Rubin, Barbero & Sibingal, 1967). The cold pressor apparatus consisted of an insulated tank of cold water with a handle to grasp on the inner side wall, a wooden bar across the top of the tank (in order to maintain consistent arm immersion depth), a digital water thermometer monitoring the water temperature, and a water pump circulating the water. The water in the tank was circulated regularly and kept between 2 and 4 degrees Celsius. Prior to arm immersion, participants were instructed to immerse their arm in the cold-water tank for as long as they could stand. They were also instructed to hold on to the handle on the inside wall of the tank for the total duration of arm immersion (Appendix E) and to keep their forearm fully immersed. Next, participants were reminded that they could withdraw from the study at any time and assured that they would be instructed to remove their arm from the tank if they reached a predetermined time limit. The duration of arm immersion in the cold-water tank was measured using a Water Resistant Stopwatch with hours, minutes, seconds and one hundredth of seconds. The stopwatch was started as soon as participants grabbed the handle on the inside wall of the tank and stopped when participants let go of the handle on the inside wall of the tank. If participants reached an upper time limit of 10 minutes, they were instructed to remove their arm from the tank. Water temperature was recorded at its highest and lowest points during arm immersion and an average

was calculated for each participant. These water temperatures were recorded on each participant's numbered pain expectancy rating form. Participants's arm immersion time in seconds was also recorded on their numbered pain expectancy rating form. Following arm immersion, participants were given the opportunity to ask questions and to take a debriefing sheet explaining the general purposes of the study. Prior to data analysis, each participant's pain expectancy rating form was placed with its corresponding questionnaire.

## Results

For the purposes of data analysis, participants were divided into two groups. The first criteria for placement in Group 1, was that participants reported frequent, high intensity headache pain. High frequency was operationally defined as reporting headaches once a week or more, on average. The second criteria for participants to be placed in Group 1, was that participants reported high intensity headache pain. High intensity headache pain was operationally defined as rating headache painfulness to be, on average, a 7 or higher on a scale of 1 *(barely painful)* to 10 *(extremely painful)*. The first criteria for placement in Group 2, was that participants reported infrequent headache pain. Infrequent headache pain was operationally defined as reporting headaches five times a year or less, on average. The second criteria for participants to be placed in Group 2, was that participants reported low intensity headache pain. Low intensity headache pain was operationally defined as rating headache painfulness to be, on average, a 4 or less on a scale of 1 *(barely painful)* to 10 *(extremely painful)*.

The results of 23 participants were discarded either because they did not meet the headache intensity rating criteria required to be placed into Group 1 or Group 2, or because they did not meet the headache frequency criteria required to be placed in Group 1 or Group 2.

*Differences Between Groups on Demographic Variables and Headache Pain Intensity*

First of all, comparisons were conducted between Group 1 and Group 2 on age and pain intensity ratings using a One-Way ANOVA (see Table 1). While age was not found to be significantly different between groups, Group 1 was found to report significantly higher ratings of pain intensity than Group 2.

Comparisons between Group 1 and 2 on all other demographic variables were conducted using crosstabulation and chi square (see Table 2). Only one significant result was found amongst the chi-square comparisons. Employment was found to be significantly different between Group 1 and Group 2 ($X^2 = 11.898$, $p=.003$). In Group 1, 34.8% of participants as compared to only 18.2% of participants in Group 2 were employed on a part time basis. Furthermore, 15.9% of participants in Group 1 as compared to 28.8% of participants in Group 2 were students who were not employed.

*Relationship Between Water Temperature and Pain Tolerance Time*

Bivariate correlations were conducted between pain tolerance time and highest, lowest and mean water temperatures during arm immersion. Results revealed significant positive relationships between pain tolerance time in seconds with both mean water temperature during arm immersion ($r=.413$, $p<.001$) and highest water temperature during arm immersion ($r=.616$, $p<.001$), but not with lowest water temperature during arm immersion ($r=.136$, $p=.122$). Results were summarized in Table 3.

*Differences Between Groups on NEO PI-R Factor and Facet scores*

In another series of comparisons, Headache pain groups were compared against NEO PI-R factor and facet scores. Raw scores for the NEO PI-R were scaled and converted to *t*-scores.

Each participant received a scaled *t*-score for each of the five NEO PI-R factors as well as for the six facet scores that comprised each factor. Thus each participant received a total of five NEO PI-R factor scores and 30 NEO PI-R facet scores (see Table 4).

A One-Way ANOVA revealed significant differences between groups on three of the five NEO PI-R factor scores and 9 of the 30 facet scores (see Table 5).

The One-Way ANOVA tested hypothesis 1, and revealed that neuroticism factor scores were significantly higher in Group 1 than in Group 2 ($F=14.904$, $p<.001$). Furthermore, facet scores of neuroticism such as anxiety ($F=10.571$, $p=.001$), angry hostility ($F=18.248$, $p<.001$), depression ($F=7.163$, $p<.01$), self-consciousness ($F=11.721$, $p=.001$) and vulnerability ($F=5.474$, $p<.05$) were also found to be significantly higher in Group 1 than in Group 2. Thus, hypothesis 1 was supported.

The One-Way ANOVA also tested hypothesis 2 and revealed that extraversion factor scores were significantly lower in Group 1 than in Group 2 ($F=4.261$, $p<.05$). Furthermore, positive emotions facet scores of extraversion were found to be significantly lower in Group 1 than in Group 2 ($F=4.930$, $p<.05$), while gregariousness facet scores of extraversion were lower in Group 1 than in Group 2, but not significant ($F=2.786$, $p=.097$). Therefore hypothesis 2 was also supported.

Openness to experience factor scores were also found to be significantly lower in Group 1 than in Group 2 ($F=4.721$, $p<.05$). Furthermore, facet scores of openness to experience such as actions were found to be significantly lower in Group 1 than in Group 2 ($F=9.829$, $p<.01$), while facet scores of openness to experience such as ideas ($F=3.160$, $p=.078$) and values ($F=2.997$, $p=.086$), were lower in Group 1 than in Group 2, but not significant.

Although agreeableness factor scores were not found to be significantly different between groups, facet scores of agreeableness such as trust ($F=8.707$, $p<.01$) and compliance ($F=7.238$, $p<.01$) were found to be significantly lower in Group 1 than in Group 2.

None of the conscientiousness factor or facet scores were found to be significantly different between groups.

*Differences Between Groups on Pain Response Expectancy and Pain Tolerance Time*

Further analyses testing hypothesis 3 compared groups on pain response expectancy ratings (see Table 6). Pain response expectancy was defined as the number rating selected by each participant on a scale of 1 *(a small amount of pain)* to 10 *(a large amount of pain)*. In contrast to predictions, no significant difference was found between groups on pain response expectancy ($F=.778$, $p=.379$).

On the other hand, analyses testing hypothesis 4 revealed significant differences between groups with regards to pain tolerance time in seconds (see Table 6). Pain tolerance was defined as duration of arm immersion in seconds. A One-Way ANOVA revealed that pain tolerance in seconds was significantly lower in Group 1 than in Group 2 ($F=4.189$, $p<.05$), as predicted.

*Relationship Between Pain Response Expectancy and NEO PI-R Factor and Facet Scores*

Partial correlations were conducted between pain response expectancy rating and NEO PI-R factor and facet scores while controlling for group and pain tolerance time in seconds (see Table 7). Partial correlations testing hypothesis 5 revealed significant positive relationships between pain response expectancy rating and neuroticism factor scores ($r=.177$, $p<.05$), angry hostility facet scores of neuroticism ($r=.1825$, $p<.05$) and vulnerability facet scores of neuroticism ($r=.1751$, $p<.05$), as expected. A near significant positive relationship was also

found between pain response expectancy rating and anxiety facet scores of neuroticism ($r$=.1601, $p$=.070). Thus, hypothesis 5 was supported.

Partial correlations testing hypothesis 6 revealed a near significant negative relationship between pain response expectancy rating and excitement seeking facet scores of extraversion ($r$=-.1635, $p$=.064), partially supporting predictions (see Table 7).

Other partial correlations revealed another near significant negative relationship between pain response expectancy rating and fantasy facet scores of openness to experience ($r$=-.1697, $p$=.055). Data is also summarized in Table 7.

*Relationship Between Pain Tolerance Time and NEO PI-R Factor and Facet Scores*

To test hypothesis 7 and 8, partial correlations were conducted between pain tolerance time in seconds and NEO PI-R factor and facet scores while controlling for group and pain response expectancy rating (see Table 8). They revealed significant negative relationships between pain tolerance time in seconds and anxiety facet scores of neuroticism ($r$=-.2047, $p$<.05), partially supporting hypothesis 7.

Partial correlations controlling for group and pain response expectancy rating also revealed significant negative relationships between pain tolerance time in seconds and extraversion factor scores ($r$=-.2023, $p$<.05), gregariousness facet scores of extraversion ($r$=-.2126, $p$<.05) and positive emotions facet scores of extraversion ($r$=-.2633, $p$<.01). Thus, results also support hypothesis 8 (see Table 8).

Further partial correlations controlling for group and pain response expectancy rating revealed a significant relationship between pain tolerance time in seconds and dutifulness facet scores of conscientiousness ($r$=.1734, $p$<.05). Results are also summarized in Table 8.

*Relationship Between Pain Tolerance Time and Pain Response Expectancy*

In order to test hypothesis 9, a final partial correlation was conducted between pain response expectancy rating and pain tolerance time in seconds, while controlling for group and NEO PI-R factor and facet scores (see Table 9). However, in contrast to predictions, no significant relationship was found between pain tolerance time in seconds and pain response expectancy rating ($r$=.0842, $p$=.417).

## Discussion

It is clear that data analysis has yielded significant results, many of which were predicted in the hypotheses, but some of which were unanticipated.

A significant difference between groups on headache intensity ratings was expected, and was found ($p$<.001), due to the fact that intensity ratings determined group placement. The group criteria were found to have maximum contrast, as intended in regards to reported headache intensity.

Hypotheses about demographic variables were not made since it was assumed there would be no significant differences. Although most demographic variables were not found to be different between groups, results did reveal a significant difference in employment between groups. A significantly higher proportion of participants reporting frequent, high intensity headache pain were students employed part-time, whereas a significantly higher concentration of participants reporting infrequent, low intensity headache pain were students-not-employed. This may lead one to speculate whether the stress of being a student and working is an exacerbating component of headache frequency and intensity.

It is important to note that none of the other demographic variables were found to be significantly different between groups. Thus, the risk that results were influenced by

confounding demographic variables such as age, religion, marital status, years of education or major area of study is minimal.

Water temperatures during arm immersion were not anticipated to be related to pain tolerance time due to the narrow water temperature range used during the experiment. However, results revealed that increases in mean water temperature during arm immersion, as well as highest temperature during arm immersion, led to higher pain tolerance times in seconds. At first glance, these results may seem alarming since they could indicate that slight temperature fluctuations in the water affected pain tolerance times. However, lowest water temperature during arm immersion was not found to be related to lower pain tolerance times. Furthermore, observations during testing indicated that water temperature rose as participants approached the 10 minute maximum pain tolerance time. This was likely due to body heat from the arm raising the water temperature. It is reasonable therefore, to conclude that the results are most likely reflective of the warming effects of room temperature and body heat over time on water temperature, than that of rising water temperature increasing pain tolerance time.

In concordance with hypothesis 1, this study found significantly higher neuroticism factor scores in participants reporting frequent, high intensity headache pain. This is consistent with the findings of Tanum and Malt (2001), Kikkonen, Pulkinnen and Kinnunen (2001) and with those of Wade and Price (2000), that participants reporting frequent, high intensity headache pain were found to have significantly higher neuroticism scores. In the current study, participants reporting frequent, high intensity headache pain were also found to have significantly higher scores on all but one facet score (impulsiveness) of neuroticism. If frequent, high intensity headache pain prevents one from doing work or living normally, this would certainly cause distress and anxiety. Furthermore, people with high intensity and frequent pain

are more likely to be irritable, angry, hostile and depressed. These feelings along with a pain condition may lead people with frequent, high intensity headache pain to feel self-conscious and vulnerable. Thus, persistent and severe physiological pain may have contributed to increasing negative personality characteristics such as neuroticism and its facets. On the other hand, it is possible that neurotic worry about pain conditions actually predisposes one to developing them. Because the current research data was correlational, future research should examine causal relationships.

Supporting hypothesis 2, the current study found significantly lower extraversion factor scores in participants reporting frequent, high intensity headache pain than in participants reporting infrequent, low intensity headache pain. These results are consistent with the conclusions of Wade and Price (2000) and with those of Philips and Gatchel (2000). The current study also found that participants reporting frequent, high intensity headache pain also had significantly lower positive emotions scores (a facet score of extraversion) and near significantly lower gregariousness scores (another facet score of extraversion). Thus, frequent high intensity headache pain may prevent one from participating in social activities or to go to social events, which may influence their level of gregariousness. Furthermore, one may speculate that people who cannot participate in social encounters and who experience pain on a regular basis are far less likely to experience positive emotions. However, individuals who tend to have less positive emotions and who are more introverted may focus more attention on their negative physical sensations, causing them to experience more pain. Perhaps low levels of extraversion predispose one to think about and to feel more pain, causing less engagement in social activities and even lower levels of extraversion. These ideas are consistent with Jerram and Coleman's (1999) findings that extraversion was related to positive health behavior.

Although hypotheses were not made with regards to openness to experience, agreeableness and conscientiousness due to the lack of data in the pain research literature concerning their influence on headache pain, pain tolerance and pain response expectancy; results did reveal some interesting and significant findings.

Openness to experience factor scores and actions (a facet score of openness to experience) were found to be significantly lower in participants reporting frequent, high intensity headache pain. Ideas and values (both openness to experience facet scores) were also found to be lower, though not significantly, in participants reporting frequent, high intensity headache pain. Perhaps frequent, high intensity headache pain causes one to be less willing to engage in new potentially pain exacerbating activities. This may cause one to have less exposure to opportunities in which they might be able to acquire experience, knowledge or interest in areas that would expand their level of openness. However, it is also possible that openness to experience, as Jerram and Coleman's (1999) findings suggest, is related to positive health perceptions and that individuals with high intensity and frequency headache pain do not have positive health perceptions.

Although agreeableness was not found to be significantly different between groups, trust and compliance (two facet scores of agreeableness) were significantly lower in participants reporting frequent, high intensity headache pain. Thus, persistent and intense headache pain may lead one to become more irritable and less compliant with others. Furthermore, since people with recurrent and intense headache pain have been found to be more neurotic, less extraverted and less open to experience, it is not surprising that they would be less likely to trust others easily. The alternative explanation that less compliant and trusting individuals may be more likely to expose themselves to situations that cause headaches more frequently and intensely,

appears less plausible. It is also possible that low agreeableness decreases positive health perceptions (Jerram & Coleman, 1999), which increases one's vulnerability to persistent, intense headache pain.

The only NEO PI-R factor that did not reveal any significant differences between groups on its factor score or within any of its facets was conscientiousness.

Contrary to the 3rd hypothesis, that participants reporting frequent, high intensity headache pain would have significantly higher pain response expectancy ratings, significant differences between groups on pain response expectancy ratings were not found. These results are surprising because they suggest that although individuals with high frequency and intensity headache pain are similar to chronic pain patients in their lower tolerance for pain, they are less pessimistic in their expectations than chronic pain patients. Thus, perhaps individuals with high frequency and intensity headache pain have less pathological personality features because they represent a less severe or less advanced form of chronic pain.

As predicted by hypothesis 4, participants reporting frequent, high intensity headache pain did have significantly lower pain tolerance time in seconds than participants reporting infrequent, low intensity headache pain. Thus, experiencing frequent, high intensity headache pain may wear down one's ability to tolerate other kinds of pain. Nevertheless, low ability to tolerate pain may be a predisposing factor in the frequency and severity of headache pain.

Results also supported hypothesis 5, that pain response expectancy was positively related to neuroticism. In fact, higher pain response expectancy was found to be significantly related not only to higher neuroticism, but to both higher angry hostility and higher vulnerability (two facet scores of neuroticism). Furthermore, higher pain response expectancy was related to higher

anxiety (another facet scores of neuroticism), though not significantly. Thus, findings may suggest that personality features are comorbid with frequent and intense pain.

On the other hand, extraversion was not found to be negatively related to pain response expectancy, as hypothesis 6 had predicted. A near significant relationship however, was found between lower pain response expectancy and higher excitement seeking (a facet score of extraversion). Furthermore, an unanticipated near significant relationship between lower pain response expectancy and higher fantasy (a facet score of openness to experience) was found.

These results have established a close link between pain response expectancy and neuroticism along with its facet scores. As well, results reveal a possible link between pain response expectancy and both facet scores of extraversion and openness to experience. These findings are significant in that little or no research has attempted to research, let alone discover such a relationship. Perhaps pain response expectancy mediates the influence of personality on pain tolerance.

Although lower pain tolerance time in seconds was not found to be significantly associated to higher neuroticism as hypothesis 7 predicted, partial correlations did reveal that higher anxiety (a facet score of neuroticism) was significantly related to lower pain tolerance time in seconds. Thus, as proposed by the findings of Hardardottir (2002), the results of this study suggest that anxiety may play an important part in decreasing pain tolerance. Furthermore, because anxiety is a facet score of neuroticism, the results may also suggest that neuroticism plays a part in decreasing pain tolerance. If that is the case, hypothesis 7, about the presence of a negative relationship between neuroticism scores and pain tolerance, would be fully supported.

Furthermore, as hypothesis 8, about the presence of a positive relationship between extraversion and pain tolerance, predicted, results revealed that higher extraversion was

significantly related to higher pain tolerance time in seconds. In addition, higher pain tolerance time in seconds was found to be significantly related to both higher gregariousness and higher positive emotions (two facet scores of extraversion). These findings are consistent with those of Hentschell (1977), Davidson and McDougall (1969) and with Philips and Gatchel's (2000) review.

From these studies, it seems clear that extraversion and pain tolerance are inextricably linked and that future studies should concentrate on illuminating the causal relationship between them.

The above results seem to be consistent with Eysenck's theory of cortical arousal (Eysenck, 1957, 1960a), and with the findings of Lynn and Eysenck (1961), Shiomi (1978), and Libman and Stern (1985). Findings also highlight the necessity of considering the relationship between personality variables and pain tolerance in research.

The importance of the relationship between personality variables and pain tolerance is further underlined by the finding that higher dutifulness (a facet score of conscientiousness) was found to be significantly related to higher pain tolerance time in seconds. Thus, individuals who strictly adhere to their ethical principles and who are more reliable seem to tolerate more pain. Perhaps, such individuals are more likely to behave in ways that involve self-control and self-sacrifice and are therefore, are better equipped to deal with pain. In light of this new discovery, further research should examine the relationship between conscientiousness and pain tolerance in greater detail, or at least include it in studies examining personality and pain.

Baker and Kirsch (1991) had suggested that pain response expectancy was one of the mediators of pain reduction. However in contrast to their suggestion, to the results of Stevens, Ohlwein and Catanzaro (1996), and to hypothesis 9, about the presence of a negative relationship

between pain response expectancy and pain tolerance, no significant relationship was found between lower pain response expectancy and higher pain tolerance. Thus, the current results do not support the idea that pain response expectancy has an influence on pain reduction whether it is direct or indirect.

### *Summary and Conclusions*

It is evident from the results of the current study that dispositional psychological factors are undeniably linked to acute and chronic physiological pain. Furthermore, pain response expectancy is not significantly associated with the experience of persistent intense pain, but is nevertheless related to dispositional personality variables.

However, personality can be a thorny issue to operationally define. It is difficult to find a uniform understanding in the pain literature of how personality mediates the mechanisms involved in pain coping or pain tolerance. Pain is also a difficult construct to define and measure. There are various different methods of measuring pain tolerance, many of which are uncorrelated and yield contrasting results (Davidson & McDougall, 1969), indicating the lack of a consistent generalization of pain tolerance. Causation is another problem. It is often difficult to know which variable is the cause and which is the effect, unless a longitudinal study is conducted. However, even in the case of longitudinal studies there are always possibilities of confounding variables causing misleading results. Thus, personality and pain research has many limitations, all of which must be considered when attempting to draw conclusions about theoretical constructs, their semblance to human characteristics and their practical applications.

It is difficult, then, to reach many definite conclusions based on the limited evidence currently available. That is why studies such as this one, along with many more about the psychological and physiological components of pain, are essential to build up the body of

knowledge and thereby turn possibilities into probabilities, and probabilities themselves into definite conclusions.

The current study clearly warrants the use of the NEO PI-R in future research. It is hard to know the extent of the generalizability of the findings of the current research due to the population and location of the pain. In consequence, the findings of the current study allow for a great deal of possibilities for replication. Furthermore, the current findings open a window on exciting new research with regards to personality, now that the relevance of using the NEO PI-R as a personality assessment instrument has been demonstrated.

Finally, future research must focus on finding ways to establish causal relationships between personality variables and acute pain tolerance, between personality variables and chronic pain, and between acute pain tolerance and chronic pain. Such research is necessary in order to develop better treatments to help individuals with chronic pain and is a key factor in furthering our understanding of an experience that is all too human, the experience of pain.

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Appendix A

Demographic and Pain Questionnaire

1. Date of Birth _____Day _____Month _____Year

2. Age _____ years

3. Sex Male_____ Female_____

4. Religion Protestant_____ Buddhist_____

Catholic_____ Hindu_____

Jewish_____ Muslim_____

Atheist_____ Traditional Aboriginal Spirituality_____

Other_____

5. Marital Status Single_____

Married_____

Separated_____

Divorced_____

Common Law_____

Other_____

6. Years of Education Completed (for example, 1st year of university = 13)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 16+

7. Employment Full-Time_____ Part-Time_____

Student_____ Unemployed_____

8. Area of Major Study Arts_____ Sciences_____

Physical Education_____ Engineering_____

Architecture_____ Education_____

Other_____

9. Do you have any arm or hand injury on the limb with which you DO NOT write?

_____

If yes, what injury do you have? _____

10. Are you less than 18 years of age?_____

11. Do you have any unstable medical condition that requires medication or regular visits to the doctor (Eg. Diabetes, hypertension, cancer, asthma)?_____

If yes, what condition do you have?_____

12. Do you have any condition that you think may be exacerbated or worsened by immersing your arm in very cold water?_____

If yes, what condition is it?_____

13. Do you on average have headaches once a week or more?_____

14. Do you on average have headaches 5 times a year or less?_____

15. On average, how painful would you rate your headaches on a scale from 1-10:

1 2 3 4 5 6 7 8 9 10

barely painful moderately painful extremely painful

Appendix B

Questionnaire Participant Consent Form

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

This study has two parts. This is the first part in which you will be required to fill out a questionnaire that will take you approximately 60 minutes to complete. The purpose of the study is to examine pain and personality. You will receive 2 credits for completing this part of the study. The results will be available in June, 2004. If you wish to see the results, fill out your name, phone number and mailing address on the sheet that shall be passed around shortly. To maintain confidentiality, the data collected shall be locked in a research room in the Duff Roblin building and will be shredded after a period of 2 years. If you have any further questions or concerns, please contact Dr. Michael Thomas at 474-9633, the Human Ethics Secretariat at 474-7122, or Anushka Lenoski at 256-8699. We would ask that you do not discuss this study with persons in your class or from other sections of the introductory psychology course, as they may be potential participants in the future, if additional data are required.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and/or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.

1. I, _____, agree to participate in this study investigating pain and personality conducted by Ms. Anushka Lenoski and supervised by Dr. Michael Thomas, Associate Professor of Psychology at the University of Manitoba.

2. I consent to the publication of the study results so long as my name is not included and my identity is kept confidential.

3. I understand that my participation in the study includes answering truthfully and to the best of my ability questions on a questionnaire for credit towards my course.

4. I understand that I may withdraw from this study at any time.

5. I understand that when the study is completed, the results will be accessible to

me if I so choose.

_____ _____

Participant's Signature Date

Phone Number_____

This research has been approved by the Human Ethics Secretariat. If you have any concerns or complaints about this project you may contact the Human Ethics Secretariat .

. A copy of this consent form has been given to you to keep for your records and reference. Also, please note that help and counseling is available for you at the Peer Advisor`s office in 150 University Centre (474-6696), at the Counseling Service (474-8592) or at the Psychological Service Centre (474-9222).

Thank you for your time and cooperation.

Anushka S. Lenoski
Dr. Michael Thomas

Appendix C

Cold Pressor Participant Consent Form

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

You are now about to complete the second part of this study. It will require you to make an ability rating and to immerse your arm for as long as you can in an insulated tub of cold water kept at a constant temperature of approximately 3 degrees Celsius and will take you no more than 15 minutes to complete. We will stop you if you reach a predetermined time limit. This procedure is safe and is not a risk for acute or long term injury to your arm. If you think you have a condition that would be exacerbated by exposure to cold water, please tell the researcher before the experiment. Once again, the purpose of this study is to examine pain and personality. You will also receive 1 credit after completing this part of the study. The results will be available in June, 2004. If you wish to see the results, fill out your name, phone number and mailing address on the sheet that shall be passed around shortly. To maintain confidentiality, the data collected shall be locked in a research room in the Duff Roblin building and will be shredded after a period of 2 years. If you have any further questions or concerns, please contact Dr. Michael Thomas or Anushka Lenoski. We would ask that you do not discuss this study with persons in your class or from other sections of the introductory psychology course, as they may be potential participants in the future, if additional data are required.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and/or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.

1. I, _____, agree to participate in this study investigating pain and personality conducted by Ms. Anushka Lenoski and supervised by Dr. Michael Thomas, Associate Professor of Psychology at the University of Manitoba.

2. I consent to the publication of the study results so long as my name is not included and my identity is kept confidential.

3. I understand that my participation in the study includes immersing my arm for as long as I can in an insulated tub of very cold water kept at a constant temperature of approximately 3 degrees Celsius for credit towards my course.

4. I understand that I may withdraw from this study at any time.

5. I understand that when the study is completed, the results will be accessible to me if I so choose.

_____ _____

Participant's Signature Date

Phone Number_____

This research has been approved by the Human Ethics Secretariat. If you have any concerns or complaints about this project you may contact the Human Ethics Secretariat

A copy of this consent form has been given to you to keep for your records and reference. Also, please note that help and counseling is available for you at the Peer Advisor's office in 150 University Centre (474-6696), at the Counseling Service (474-8592) or at the Psychological Service Centre (474-9222).

Thank you for your time and cooperation.

Anushka S. Lenoski
Dr. Michael Thomas

## Appendix D

## Debriefing Form

The purpose of this study was to investigate differences (if any) in personality variables, pain response expectancy and pain tolerance amongst a group of people with recurrent headaches and a group of people without recurrent headaches in a university young adult sample. In other words, we are attempting to determine whether headache pain history influences pain tolerance, if personality and one's expectation of pain is related to pain tolerance and if personality and one's expectation of pain is related to headache pain history.

We measured personality using the NEO PI-R. This personality questionnaire a offers a clearer, more distinct, global, valid and constant way of measuring personality variables than those used in similar research. Furthermore, because gender differences have been found with regards to pain tolerance, we decided to use only women.

We hypothesized that there would be a negative relationship between neuroticism scores and pain tolerance, a positive relationship between extraversion scores and pain tolerance and a negative relationship between pain response expectancy and pain tolerance. Furthermore, participants with frequent, high intensity headaches were expected to have significantly higher Neuroticism scores, significantly lower Extraversion scores and significantly higher pain response expectancy ratings than participants with infrequent, low intensity headaches. The study also hypothesized that pain response expectancy would be positively related to Neuroticism and negatively related to Extraversion. Finally, pain tolerance was expected to be significantly lower in participants with frequent, high intensity headache pain history than in participants with infrequent, low intensity headache pain history.

Hypotheses about agreeableness, openness to experience and conscientiousness and their relationship to headache pain history, pain tolerance and pain response expectancy were not made due to the lack of information in the pain research literature concerning their influence. Thus, certain aspects of the present research were exploratory in nature.

We would like to thank you for participating in our study. The results will be available in June, 2004 and the strictest of measures shall be taken to maintain confidentialitv. If you have any further questions or concerns, please contact Dr. Michael Thomas . We would ask that you do not discuss this study with persons in your class or from other sections of the introductory psychology course, as they may be potential participants in the future, if additional data are required.

Thank you for your time and cooperation.

Appendix E

**Instructions for testing the water temperature:**

In a few minutes, I will be asking you to immerse your arm in this tank of cold water for as long as you can. There is a handle on the inside wall of the tank that I will ask you to hold on to while your arm is in the tank.

"Right now I am going to ask you to test the temperature of the water with the arm that you do NOT write with. In order to do this, quickly touch the bottom of this tank of cold water and retract your arm"

**Instructions for pain response expectancy:**

"Now that you know how cold the water is, please complete the following:"

Overall, during this procedure I expect to experience

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| a small amount of pain | | | | a moderate amount of pain | | | | | a large amount of pain |

**Instructions for cold pressor test:**

"I am going to ask you to immerse the arm that you do NOT write with in this tank of cold water. There is a handle on the inside wall of the tank. You must hold on to this handle while your arm is in the tank. Keep your arm in the tank while holding on to the handle as long as you can. Make sure that your forearm is fully immersed up to your elbow (demonstrate). This procedure is safe and no short term or long term physical harm can occur. We will ask you to remove your arm if you reach our time limit. Remember, if you do not wish to proceed, you are free to go. If you wish to leave at any time, you may do so."

Table 1

*Differences Between Groups 1 and 2 on the Demographic Variable Age and on Pain Intensity Rating*

| Variable | F | Significance |
|---|---|---|
| Age | 1.252 | .265 |
| Headache pain intensity rating | 1519.150 | .000*** |

*Note.* *** $p < .001$.

Table 2

*Differences Between Groups 1 and 2 on Remaining Demographic Variables*

| Demographic Variable | Pearson's Chi Square | Significance |
|---|---|---|
| Religion | 8.338 | .304 |
| Marital Status | 7.347 | .119 |
| Years of Education Completed | 8.630 | .125 |
| Employment | 11.898 | .003** |
| Major area of study | 3.559 | .736 |

*Note*. ** $p < .01$.

Table 3

*Relationship Between Water Temperature and Pain Tolerance Time in Seconds*

| Variables Correlated | r | Significance |
|---|---|---|
| PTTS and Mean water temperature during arm immersion | .431 | .000*** |
| PTTS and Highest water temperature during arm immersion | .616 | .000*** |
| PTTS and Lowest water temperature during arm immersion | .136 | .122 |

*Note*. PTTS= Pain Tolerance Time in Seconds.
*** $p < .001$.

Table 4

*Factors and Facets of the NEO PI-R*

| FACTORS | FACETS |
|---|---|
| Neuroticism | Anxiety |
| | Angry Hostility |
| | Depression |
| | Self-Consciousness |
| | Impulsiveness |
| | Vulnerability |
| Extraversion | Warmth |
| | Gregariousness |
| | Assertiveness |
| | Activity |
| | Excitement-Seeking |
| | Positive Emotions |
| Openness to Experience | Fantasy |
| | Aesthetics |
| | Feelings |
| | Actions |
| | Ideas |
| | Values |
| Agreeableness | Trust |
| | Straightforwardness |
| | Altruism |
| | Compliance |
| | Modesty |
| | Tender-Mindedness |
| Conscientiousness | Competence |
| | Order |
| | Dutifulness |
| | Achievement Striving |
| | Self-Discipline |
| | Deliberation |

Table 5

*Differences Between Groups 1 and 2 on NEO PI-R Factor and Facet Scores*

| Factor | Facet | F | Significance |
|---|---|---|---|
| Neuroticism | | 14.904 | .000*** |
| | Anxiety | 10.571 | .001*** |
| | Angry Hostility | 18.248 | .000*** |
| | Depression | 7.163 | .008** |
| | Self-Consciousness | 11.721 | .001*** |
| | Impulsiveness | .668 | .415 |
| | Vulnerability | 5.474 | .021* |
| Extraversion | | 4.261 | .041* |
| | Warmth | .344 | .559 |
| | Gregariousness | 2.786 | .097+ |
| | Assertiveness | 1.045 | .309 |
| | Activity | .287 | .593 |
| | Excitement-Seeking | .541 | .464 |
| | Positive Emotions | 4.930 | .028* |
| Openness to Experience | | 4.721 | .032* |
| | Fantasy | .044 | .834 |
| | Aesthetics | 1.329 | .251 |
| | Feelings | .022 | .883 |
| | Actions | 9.829 | .002** |
| | Ideas | 3.160 | .078+ |
| | Values | 2.997 | .086+ |
| Agreeableness | | .586 | .445 |
| | Trust | 8.707 | .004** |
| | Straightforwardness | .400 | .528 |
| | Altruism | .110 | .741 |
| | Compliance | 7.238 | .008** |
| | Modesty | 2.388 | .125 |
| | Tender-Mindedness | .014 | .906 |
| Conscientiousness | | .719 | .398 |
| | Competence | 2.259 | .135 |
| | Order | .277 | .559 |
| | Dutifulness | .120 | .730 |
| | Achievement Striving | .110 | .741 |
| | Self-Discipline | .964 | .328 |
| | Deliberation | .001 | .971 |

*Note*. + indicates near significance. * $p < .05$. ** $p < .01$. *** $p \leq .001$.

Table 6

*Differences Between Groups 1 and 2 on Pain Response Expectancy Rating and Pain Tolerance Time in Seconds*

| Variable | F | Significance |
|---|---|---|
| Pain response expectancy rating | .778 | .379 |
| Pain tolerance time in seconds | 4.189 | .043* |

*Note.* * $p < .05$.

Table 7

*Relationship Between Pain Response Expectancy Rating and NEO PI-R Factor and Facet Scores Controlling for Group and Pain Tolerance Time in Seconds*

| Variables Correlated: | | | |
|---|---|---|---|
| Factors Scores | Facet Scores | r | Significance |
| Neuroticism and PRER | | .177 | .045* |
| | Anxiety and PRER | .1601 | .070+ |
| | Angry Hostility and PRER | .1825 | .038* |
| | Depression and PRER | .1201 | .175 |
| | Self-Consciousness and PRER | .0722 | .416 |
| | Impulsiveness and PRER | .0489 | .582 |
| | Vulnerability and PRER | .1751 | .047* |
| Extraversion and PRER | | -.0945 | .287 |
| | Warmth and PRER | -.1242 | .161 |
| | Gregariousness and PRER | -.1150 | .194 |
| | Assertiveness and PRER | .0542 | .542 |
| | Activity and PRER | -.0252 | .777 |
| | Excitement Seeking and PRER | -.1635 | .064+ |
| | Positive Emotions and PRER | .0320 | .719 |
| Openness to Experience and PRER | | -.0908 | .306 |
| | Fantasy and PRER | -.1697 | .055+ |
| | Aesthetics and PRER | .0165 | .853 |
| | Feelings and PRER | .0148 | .868 |
| | Actions and PRER | -.1064 | .230 |
| | Ideas and PRER | -.0287 | .747 |
| | Values and PRER | .0689 | .438 |
| Agreeableness and PRER | | -.0678 | .445 |
| | Trust and PRER | -.0543 | .541 |
| | Straightforwardness and PRER | -.0142 | .873 |
| | Altruism and PRER | -.1123 | .205 |
| | Compliance and PRER | -.1422 | .108 |
| | Modesty and PRER | .0250 | .779 |
| | Tender-Mindedness and PRER | -.0547 | .538 |
| Conscientiousness and PRER | | -.0385 | .665 |
| | Competence and PRER | -.0030 | .973 |
| | Order and PRER | .0067 | .940 |
| | Dutifulness and PRER | -.0399 | .654 |
| | Achievement Striving and PRER | -.0407 | .647 |
| | Self-Discipline and PRER | -.0949 | .285 |
| | Deliberation and PRER | .0012 | .990 |

*Note*. PRER = Pain Response Expectancy Rating.
+ indicates near significance. * $p < .05$.

Table 8

*Relationship Between Pain Tolerance Time in Seconds and NEO PI-R Factor and Facet Scores Controlling for Group and Pain Response Expectancy Rating*

| Variables Correlated | | | |
|---|---|---|---|
| Factor Scores | Facet Scores | r | Significance |
| Neuroticism and PTTS | | -.0785 | .377 |
| | Anxiety and PTTS | -.2047 | .020* |
| | Angry Hostility and PTTS | -.1080 | .223 |
| | Depression and PTTS | .0721 | .417 |
| | Self-Consciousness and PTTS | -.0271 | .760 |
| | Impulsiveness and PTTS | -.0486 | .584 |
| | Vulnerability and PTTS | -.1369 | .122 |
| Extraversion and PTTS | | -.2023 | .021* |
| | Warmth and PTTS | -.0727 | .413 |
| | Gregariousness and PTTS | -.2126 | .016* |
| | Assertiveness and PTTS | -.0389 | .662 |
| | Activity and PTTS | .1096 | .216 |
| | Excitement-Seeking and PTTS | -.0498 | .575 |
| | Positive Emotions and PTTS | -.2633 | .003** |
| Openness to Experience and PTTS | | .1001 | .259 |
| | Fantasy and PTTS | .0286 | .748 |
| | Aesthetics and PTTS | .0654 | .462 |
| | Feelings and PTTS | -.0521 | .558 |
| | Actions and PTTS | .1383 | .118 |
| | Ideas and PTTS | .0989 | .265 |
| | Values and PTTS | .0316 | .722 |
| Agreeableness and PTTS | | .0049 | .956 |
| | Trust and PTTS | -.1066 | .229 |
| | Straightforwardness and PTTS | .0935 | .292 |
| | Altruism and PTTS | .0754 | .396 |
| | Compliance and PTTS | -.1289 | .146 |
| | Modesty and PTTS | .0592 | .505 |
| | Tender-Mindedness and PTTS | -.0219 | .805 |
| Conscientiousness and PTTS | | .1187 | .180 |
| | Competence and PTTS | .0563 | .526 |
| | Order and PTTS | .1171 | .186 |
| | Dutifulness and PTTS | .1734 | .049* |
| | Achievement Striving and PTTS | .0718 | .419 |
| | Self-Discipline and PTTS | .0692 | .436 |
| | Deliberation and PTTS | .0255 | .774 |

*Note*. PTTS= Pain Tolerance Time in Seconds. PRER=Pain Response Expectancy Rating.
* $p < .05$. ** $p < .01$.

Table 9

*Relationship Between Pain Tolerance Time in Seconds and Pain Response Expectancy Rating Controlling for NEO PI-R Factor and Facet Scores and Group*

| Variables Correlated | r | Significance |
|---|---|---|
| PTTS and PRER | .0842 | .417 |

*Note*. PTTS=Pain Tolerance Time in Seconds. PRER=Pain Response Expectancy Rating.