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# Ethnocultural Differences in Chronic Pain Outcomes and Factors Related to Chronic Pain in Individuals Referred for Neuropsychological Assessment Following Closed Head Injury

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# Ethnocultural Differences in Chronic Pain Outcomes and Factors Related to Chronic Pain in Individuals Referred for Neuropsychological Assessment Following Closed Head Injury

by

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ABSTRACT

Ethnocultural differences in chronic pain presentation were studied in clients undergoing neuropsychological assessment following closed head injury. Data were collected at two sites: an outpatient clinic in Novi, Michigan, and a private practice in Edmonton, Alberta. Measures of interest included chronic pain outcomes (pain severity, affective distress, and activity level) and pain-related variables (life control, perceived support, and partner solicitousness).

In the Novi sample, African American males reported greater life control than Caucasian males. Otherwise African American and Caucasian clients were similar with respect to pain presentation. In the Edmonton sample, Southeast Asian and Middle Eastern clients reported greater pain severity than Caucasian clients; South Asian and Middle Eastern clients reported lower activity than Caucasian clients; and Middle Eastern clients reported greater affective distress than Caucasian clients on one of two measures. An overall ethnocultural group difference was found with respect to life control, and South Asian clients reported higher levels of partner solicitousness than Caucasian clients. Overall pain profile classifications were also found to differ across ethnocultural groups in the Edmonton sample. Compared with other groups Middle Eastern clients were more likely to be classified as having a profile associated with negative outcomes.

Foreign-born East Asian, South Asian, Southeast Asian, and Middle Eastern clients reported greater pain severity and lower activity than Canadian-born clients from the same ethnocultural groups. Ethnocultural differences in the predictive value of demographic and pain-related variables with respect to pain outcomes were studied, as were ethnocultural differences on performance validity and self-report validity measures.

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CHAPTER 1

# Literature Review

## General Introduction

Chronic pain is a serious health problem that affects many people and results in a significant burden on health care systems (Moulin, Clark, Speechley, & Morley-Forster, 2002; Gaskin & Richard, 2012). Studies have shown that the incidence of chronic pain is particularly high in individuals who have sustained a closed head injury or traumatic brain injury (TBI; Nampiaparampil, 2008; Tyrer & Lievesley, 2008). As such it is important to take the client's pain experience into account when conducting a neuropsychological assessment, as it can influence cognitive abilities (Hart, Martelli, & Zasler, 2000) and emotional functioning (McWilliams, Cox, & Enns, 2003). Furthermore, emotional distress which can be caused by chronic pain has also been shown to influence performance on cognitive tests (Levin, Heller, Mohanty, Herrington, & Miller, 2007). If one does not consider the influence of pain on cognition and emotion when interpreting test results, erroneous conclusions may be drawn. As such, research into the effects of chronic pain on neuropsychological test performance is important to inform clinicians and guide their interpretation of test results.

Another important consideration for neuropsychologists is the fact that the North American population is becoming increasingly diverse (Sue & Sue, 2007; Statistics Canada, 2010). With this in mind, it is important for neuropsychologists to understand the influence of culture on test results in order to best serve an increasingly diverse client base. Studies have shown that Caucasian individuals with English as a first language tend to obtain higher scores on cognitive tests than individuals of other ethnic/cultural backgrounds, a finding which suggests that the tests are biased (Pedraza & Mungas, 2008). Furthermore, higher levels of acculturation to the majority culture have been associated with higher scores on neuropsychological tests in minority groups (Kennepohl, Shore, Nabors, & Hanks, 2004). However, the influence of ethnicity and culture on other aspects of neuropsychological assessment also warrants consideration. Notably, different beliefs and attitudes related to dealing with stressful situations have been identified across different cultural groups. For example, people from more individualistic cultures (i.e., Caucasian Americans) tend to attribute problems to internal factors and prefer to deal with them on their own, whereas people from more collectivist cultures (i.e., African or Latin American) attribute problems to external factors and deal with them on a more communal level (Bates & Rankin-Hill, 1994).

Variance in beliefs and attitudes related to dealing with stressful situations has been found to influence the ways in which individuals from different ethnic/cultural groups deal with chronic pain and this in turn has an effect on their pain experience (Bates & Rankin-Hill, 1994). Individuals from a number of non-Caucasian ethnic backgrounds have been found to report more severe pain than those of Caucasian background (Edwards, Fillingim, & Keefe, 2001) and to report greater disability due to pain (Tan, Jensen, Thornby, & Anderson, 2005). Simply put, individuals from different cultures may respond to and experience chronic pain in very different ways. These differences could have important implications for the understanding of pain, not to mention the interpretation of pain and neuropsychological tests administered to individuals of different cultural backgrounds. In particular, perceived control over pain, perceived support from others, solicitous behaviour of others, and level of acculturation to the majority culture have emerged as important factors in determining responses to chronic pain and chronic pain outcomes across minority groups.

Although ethnic/cultural differences in response to chronic pain have been identified, the conceptualization of chronic pain in North America has largely remained focused on physical/biological aspects of pain (Bates, Edwards, & Anderson, 1993). Pain researchers have recommended a move toward a biocultural or biopsychosocial conceptualization of pain, which would take into account aspects of pain beyond biology, such as emotions, culture, and social characteristics. It is important to consider these factors when attempting to understand a client's response to chronic pain; otherwise inaccurate interpretations may be made. This recommendation is important in the context of neuropsychological evaluation, where culture, pain, and emotions have all been shown to affect test results. With this in mind, the present study will investigate ethnocultural differences in chronic pain outcomes of individuals referred for neuropsychological assessment following closed head injury. The outcome variables of interest are pain severity, affective distress, and activity level. Ethnocultural differences in variables thought to be related to chronic pain will also be explored, specifically perceived life control, perceived support from others, and solicitous behaviour from others. In addition, ethnocultural differences in overall pain profiles will also be analyzed. These analyses will be conducted taking into account the influence of sociodemographic factors, specifically age, gender, years of education, educational quality, and socioeconomic status (SES).

To ascertain whether certain variables are more or less important in determining chronic pain outcomes for certain ethnocultural groups, comparisons of the predictive value of pain-related factors (perceived control, perceived support, and partner solicitousness) and sociodemographic variables (age, years of education, quality of education, and SES) on chronic pain outcomes (pain severity, affective distress, activity level, and processing speed) will be conducted across ethnocultural groups.

The influence of acculturation-related variables on chronic pain outcomes (pain severity, affective distress, and activity level), pain-related factors (perceived control, perceived support, and solicitousness), and overall pain profiles will also be investigated through comparisons between minority group based on nativity (i.e., Canadian-born vs. foreign-born). These analyses will be conducted taking into account the influence of sociodemographic factors, specifically age, gender, years of education, educational quality, and SES. The predictive value of acculturation-related variables (time since immigration, years of English exposure, and English reading ability) with respect to pain outcomes and pain-related variables will also be explored. Finally, because performance validity and response bias have been linked to scores on measures of chronic pain, ethnocultural group differences on measures of performance validity and self-report validity will be investigated.

**Outline of Literature Review**

The following literature review will provide a broad summary of issues related to chronic pain, neuropsychological assessment of individuals of minority ethnic/cultural status, and the interaction between ethnicity/culture and chronic pain. First, statistics regarding the prevalence and impact of chronic pain will be presented and some key theories of chronic pain will briefly be discussed. The impact of chronic pain on cognition and emotions will be explored, as will the impact of beliefs and attitudes and psychosocial variables on the pain experience. Ethnic group differences in performance on cognitive tests will be discussed, as will cultural variability in response patterns on emotional measures and differences in beliefs and attitudes across ethnic groups. Finally, differences in the chronic pain presentation of individuals across ethnic/cultural groups will be presented, and possible reasons for these differences will also be discussed.

**Definitions, Prevalence, and Impact of Chronic Pain**

Pain has been defined as “an unpleasant sensory and emotional experience associated with actual and potential tissue damage or described in terms of such damage,” with the caveat that “activity induced in the nociceptive pathways by a noxious stimulus is not pain, which is always a psychological state” (IASP Subcommittee on Pain Taxonomy, 1979, p. 250). This definition’s emphasis on emotional and psychological aspects of pain is a relatively new phenomenon which will be discussed in greater detail later in this review. Two broad categories of pain have been delineated based on the time frame in which they occur. *Acute pain* is associated with noxious stimulation (e.g., high levels of heat) or injury (e.g., a broken bone) and it is resolved with the removal of the noxious stimulus or healing of the injury (Tyrer & Lievesley, 2003). This form of pain serves a functional purpose by causing an organism to avoid the source of noxious stimulation or to protect an injured body part. In contrast, *chronic pain* is more enduring in nature and may persist for months or years after healing is thought to have occurred. Unlike acute pain, it does not serve a clear functional purpose. The duration of time required before pain is classified as chronic varies somewhat from definition to definition, but generally ranges from three to six months (Merideth, Ownsworth, & Strong, 2008). Obviously, not every instance of acute pain will progress to chronic pain. In a review of 15 studies, Pengel, Herbert, Maher, and Refshauge (2003) found that individuals with acute low back pain reported 58% lower intensity of pain after one month. Eighty-two percent of those with acute low back pain had returned to work by one month, whereas 93% returned to work by 3-6 months. For reasons which will be discussed later, a minority of individuals who experience acute pain never fully recover, and may in fact experience higher intensities of pain over time.

Chronic pain is a major health problem which affects many people and results in a significant burden on health care systems. Pain has been cited as the number one reason that people visit a physician, accounting for up to 80% of hospital visits, and chronic pain is the number one reason for disability (Berry et al., 2006). Estimates of the prevalence of chronic pain vary based on the survey protocols and samples used, but overall a substantial portion of the population appears to be affected. In 2001, Moulin and colleagues (2002) conducted a census-based stratified phone survey of 2,012 Canadians over the age of 25 regarding chronic pain. Twenty-nine percent of respondents reported that they had been experiencing continuous or intermittent pain for at least six months. In comparison, previous estimates of chronic pain prevalence in Canada varied from 11% in a 1984 phone survey of 827 conducted by Crook et al. (as cited in Moulin et al., 2002) to 17% in the 1995 National Population Heath Survey (NPHS; as cited in Moulin et al., 2002), and 15% in the 1996/1997 NPHS (Van Den Kerkhof, Hopman, Towheed, Anastassiades, & Goldstein, 2003). An analysis of NPHS data from 1994 to 2007 by Reitsma, Tranmer, Buchanan, and Van Den Kerkhof (2012) produced yearly chronic pain prevalence rates ranging from 15.3% to 19.5%. International estimates of chronic pain vary from 2-46%, again based on survey methodology (e.g., definition of chronic pain used) and sampling methods. For example, the median percentage of respondents reporting chronic pain across a number of American studies was 15% (Moulin et al, 2002), whereas 19% of 46,364 respondents in 15 European countries reported chronic pain (Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006). Based on data from the 2008 Medical Expenditure Panel Survey, Gaskin and Richard (2012) estimated that about 100 million Americans, or approximately 30% of the population, experience chronic pain, and a review of 29 prevalence studies by Leadley, Armstrong, Lee, Allen, and Kleijnen (2012) suggested that 27% of adults in Europe experience chronic pain. Overall, it appears that at least 15% or one in seven adults living in North America is experiencing chronic pain at any given time – approximately 46 million Americans based on United States Census data (2011) and 5 million Canadians based on the census conducted by Statistics Canada (2012).

Given the high prevalence and disabling effects of chronic pain it is no surprise that chronic pain conditions result in a heavy burden on society in terms of health care cost and lost productivity. Statistics cited by Latham and Davis (1994) suggest that the costs of chronic pain in the United States alone range from $30-50 billion per year. A more recent estimate by Gaskin and Richard (2012) suggested that chronic pain results in a much higher economic burden in the United States, ranging from $560 to $635 billion dollars. This estimate places the cost of chronic pain above costs associated with other prevalent medical conditions, including heart disease, cancer, and diabetes. Beyond the burden to society as a whole, chronic pain also results in substantial burdens at the individual level, financial and otherwise. Not surprisingly, Richards and Gaskin (2012) noted that health care costs were higher for individuals experiencing chronic pain than for those without pain. Moulin et al. (2002) conducted in-depth interviews regarding the impact of chronic pain with a subset of 340 survey respondents who reported chronic pain; the mean income of this group was lower than that of survey respondents who did not report chronic pain. Furthermore, of the chronic pain respondents 49% endorsed social difficulties due to pain, 61% endorsed difficulties with recreation, and 58% indicated that they had difficulty performing activities of daily living. Ramage-Morin (2008) found that chronic pain was associated with lower self-ratings of happiness and health in Canadian seniors. A meta-analysis by Doth, Hansson, Jensen, and Taylor (2010) showed that individuals experiencing chronic neuropathic pain reported lower quality of life than individuals without pain and individuals with other chronic health conditions. Chronic pain respondents in Breivik and colleagues' (2006) survey of chronic pain in Europe reported depression (21%), sleep problems (56%), social changes (27%), reduced sexual functioning (43%), and difficulties with work functioning (61%). Nineteen percent reported that they lost their job as a result of pain-related disability. Clearly, chronic pain has an impact on aspects of life beyond physical suffering and disability.

The burden of chronic pain is not distributed equally. In their analysis of Canadian NPHS data from 1994 to 2007, Reitsma and colleagues (2012) found that rates of chronic pain were somewhat higher for women (ranging from 16.8% to 22.7%) than for men (ranging from 12.1% to 13.6%). Older age, lower education, and widowed, separated, or divorced marital status were associated with higher rates of pain for women, but no sociodemographic factors predicted rates of pain for men. Moulin and colleagues' (2002) survey found that women were slightly more likely to report pain than men (31% vs. 27%), and that chronic pain tended to be more common in older individuals, with those above the age of 55 reporting the highest prevalence (39%). Similar patterns were reported by Van Den Kerkhof and colleagues (2003), Breivik and colleagues (2006), and Ramage-Morin (2008); the latter study also showed that individuals with lower levels of education were more likely to report chronic pain. Chronic pain respondents in Moulin and colleagues' (2002) survey reported an average pain duration of 10.7 years and an average pain intensity of 6.3/10 – 80% of the chronic pain group classified their pain as moderate to severe. Although older adults were more likely to experience chronic pain, younger individuals tended to report more severe pain. The authors suggested that this phenomenon occurred because older adults tended to experience pain due to slow onset conditions such as arthritis, which are common as one ages, whereas younger individuals are more likely to have pain due to sudden-onset accident or injury. In Breivik and colleagues' (2006) European survey of chronic pain, respondents rated their pain at 5/10 on average. Sixty-six percent reported moderate pain, whereas 34% characterized their pain as severe. Forty-six percent stated that they were in constant pain and the remainder noted intermittent pain. Unfortunately, 40% of the European respondents indicated that their pain was not adequately managed, and 12% suggested that there was nothing more that could be done to alleviate their pain.

Looking beyond general population surveys, Mailis-Gagnon (2007) conducted a study of patient characteristics in an urban Canadian pain treatment program. She found that patients had experienced pain for an average of 7.8 years before consultation, that the mean age of presentation was 48.5 years, that only 20% were employed, that more women than men were receiving treatment, and that 75% of those attending the program had psychological comorbidity. A review of patient files revealed that 77% of patients showed evidence of objectively-measured physical pathology (e.g., x-ray results suggesting a reason for pain); women were less likely than men to show physical pathology, whereas older individuals were more likely than younger individuals to show physical pathology. Overall, Mailis-Gagnon indicated that 51% of the patients were experiencing pain due to medical and psychological factors, 21% had a presentation which was thought to be primarily due to psychological factors, and 26% had a presentation which was primarily due to physical factors. The idea of "psychological factors" is prominent in chronic pain research and practice and refers to reasons for the maintenance of pain which are not objectively measurable (Melzack, 1993), such as reinforcement for pain behaviour or somatization. Given that chronic pain is defined as pain which persists beyond the point of functional usefulness, psychological factors are clearly important in defining the course and prognosis of chronic pain. These factors will be explored in greater depth later in this review.

**Pain and Traumatic Brain Injury**

Chronic pain is very common following TBI. In a review of 21 studies regarding pain and TBI, Nampiaparampil (2008) found that 51.5% of 3,289 American civilians studied reported chronic pain, as did 43.1% of 917 military veterans. Most individuals studied experienced pain in the form of headaches, but neck and back pain were also common complaints. Tyrer and Lievesley (2003) cited evidence that up to 80% of people who sustain a TBI experience headaches at some point in their recovery and noted that painful conditions such as whiplash, spasticity, and complex regional pain syndromes also occur comorbidly with TBI. These researchers also noted that individuals who sustain mild TBI seem more likely to report chronic pain six months post-injury (58%) than those who sustain moderate to severe TBI (52%). Tyrer and Lievesley suggested that individuals who sustain moderate to severe TBI may report less pain due to a reduced ability to express pain as a result of language disturbance, a lower level of insight, or less emphasis on pain due to greater emphasis on other consequences of a more severe TBI (e.g., cognitive or movement disorders). Dobscha and colleagues (2009) noted that younger age, higher education, and white collar work history were associated with better outcomes for pain following TBI, whereas experiencing multiple injuries in addition to TBI, cognitive disability, and lower limb injury were associated with worse outcomes.

Given that one of the primary roles of a neuropsychologist is to asses a client's cognitive and emotional functioning (Kolb & Whishaw, 2009), it is important to be mindful when performing an assessment on someone experiencing chronic pain, as it can affect the results of cognitive and emotional tests (e.g., Hart et al., 2000; McWilliams et al., 2003). As such, it is important for neuropsychologists to have a proper understanding of pain and its effects. With that in mind, consideration of theoretical models of chronic pain and the cognitive/emotional effects of chronic pain is crucial.

**Theoretical Models of Chronic Pain**

The high prevalence and negative impact of chronic pain has made it the subject of extensive research. Chronic pain research is generally undertaken to achieve better understanding of the factors which interact to maintain and exacerbate pain in order to improve treatments and outcomes. Accurate and thorough models of pain are important in conceptualizing these factors. Early models of pain were predominately focused on the physical aspects of the pain experience and were based on Descartes' concept of mind-body dualism (Melzack, 1993). In essence, these models held that pain was produced through a direct signal from the location of injury to the brain and that the intensity of pain was isomorphic – higher pain intensity was due to a greater severity of injury or greater stimulation. Based on these models, some treatments for pervasive chronic pain were designed to stop transmission of pain impulses through lesions of sensory nerves, and patients without an objectively verifiable physical reason for persisting pain (e.g., no x-ray findings) were viewed as having psychological problems or as "fakers." In spite of the fact that lesion-based pain treatment was not particularly effective, the practice continued as it was consistent with prevailing theory.

It was not until the 1960s that pain researchers such as Melzack and Wall (1965) began to consider alternative theories of pain. Along with the ineffectiveness of lesion-based treatments, these researchers noted other circumstances that were incompatible with an isomorphic pain model. For instance, phantom limb pain occurs without external stimulation, gentle touch and vibration can elicit pain responses in some individuals, and soldiers have been known to feel no pain in response to injury until well after it has occurred. Based on these observations, Melzack and Wall proposed the *Gate Control Theory* of pain, in which a "gate" system exists in the dorsal horns of the spinal cord and modulates (inhibits or facilitates) the intensity of pain signals to the brain. This gate system was thought to be modulated through top-down influence from the brain based on factors such as past pain experiences and level of attention. In this model, pain was not thought of as caused by injury, but as associated with injury. Whereas "psychological factors" were previously seen as separate from physical aspects of pain and therefore less legitimate, as reactions to pain, or as non-organic causes of somatized or factitious pain (i.e., physical expressions of psychological problems), the gate control theory connected psychological factors directly to the pain experience and legitimized their role (Melzack, 1993). In fact, it has been suggested by some that psychological aspects of pain are actually more important than biological, injury-related aspects (e.g., Hadjistavropoulos et al., 2011). Based on new models of pain, lesion treatments have largely been replaced by treatments geared toward modulating pain input, including psychotherapy, and pain has begun to be conceived across three dimensions: sensory-discriminative (pain stimulation and perception), motivational-affective (factors influencing pain interpretation), and evaluative (reaction to pain experience; Melzack, 1993).

Since the advent of the Gate Control Theory of pain, conceptualizations of pain and chronic pain have become increasingly biopsychosocial in nature – integrating biological, psychological, and social aspects of the pain experience to account for all of the factors that modulate pain perception and responses to pain. One such model, conceived by Gatchel, Peng, Peters, Fuchs, and Turk (2007) proposes that multiple levels of biological factors (e.g., autonomic reactions, genetic predispositions, etc.) interact with multiple psychological factors (e.g., cognitive interpretations, affective reactions, etc.) and social factors (e.g., environmental stressors, interpersonal relationships, social expectations, etc.) to determine an individual's pain experience.

For instance, a man experiencing pain due to a work-related (work history) back injury (biological) may experience fear-inducing anxiety (affective) and have thoughts of re-injuring his back if he over-exerts himself (cognitive). This could persuade him to avoid movement, which would in turn result in physical deconditioning (biological), which would put him at greater risk for injury and increase functional deficits. The avoidance of activity due to concerns about increased pain or re-injury is known as fear-avoidance (Letham, Slade, Troup, & Bentley, 1983). Meanwhile, the reaction of the man's family (social support) and his response to their reaction (interpersonal relationships) would also play a role in determining the course and prognosis of his pain. The interested reader is directed to Gatchel and colleagues (2007) for additional information regarding the biopsychosocial model, including a detailed diagram. Acute pain is generally thought to become chronic due to a combination of biological, behavioural, emotional, and cognitive changes and influences which result in a vicious cycle that reinforces disability and prevents the resolution of pain and restoration of function (Hart, Martelli, & Zasler, 2000).

Some models of chronic pain focus primarily on the social/communicative aspects of chronic pain (e.g., Hadjistavropoulos et al., 2011; Newton-John, 2002; Romano, Jensen, Turner, Good, & Hops, 2000). In essence, these models suggest that chronic pain is caused and maintained by social reinforcement for displaying pain behaviours. The role of social learning has also been emphasized by some theorists, who note, for example that a child's level of fear regarding visiting the dentist is related to the level of fear displayed by their parents (Bates, 1987). Other models focus more broadly on the factors that cause an acute pain condition to develop into chronic pain. For example, Turk (2002) noted that a wide variety of pain responses can occur as a result of the same pathology and that the correlation between level of physical pathology and disability due to pain is quite low. With these findings in mind, he proposed a diathesis-stress model of chronic pain in which an individual's pre-existing beliefs and attitudes (e.g., anxiety sensitivity, tendency to catastrophize) influence their interpretation of the injury or event causing pain to determine whether or not pain will become chronic. Still other models of pain focus more on biological aspects of the pain experience – this is the case with Jensen's (2010) neuropsychological model of pain.

In order to conceive his theory of pain, Jensen (2010) surveyed the results of imaging studies regarding pain and determined that four main cerebral areas are concerned with pain. First, he cited evidence that the prefrontal cortex (PFC) is involved with encoding cognitive aspects of acute and chronic pain. The PFC has also been associated with evaluating the meaning of pain and making decisions regarding how to best cope. Interestingly, greater activity in the PFC is associated with a lower severity of pain, which suggests that this area may have an inhibitory effect in the perception of pain. Correspondingly, the PFC has been shown to exert top-down influence on brainstem regions during the pain experience, which is associated with reduced pain severity. Secondly, the anterior cingulate cortex (ACC) has been linked with affective-motivational components of pain, or the experience of suffering. This area is also associated with motivational-motor aspects of pain (e.g., preparing to move away from a painful stimulus), as well as the initiation of more complex behavioural coping strategies.

Furthermore, the ACC is thought to have a role in the acquisition of fearful memories, which can have an influence in the response to potentially painful stimuli (Jensen, 2010). The sensory cortex (primary and secondary) is the third area that Jensen cited as involved in pain processing. This area is involved in encoding the severity of pain intensity and the quality of a given pain sensation, as well as the location of the painful sensation. Finally, the insula has been implicated in processing motivational aspects of one's physical condition across a number of biologically important areas. That is to say, it governs sensations of hunger, thirst, pain, and so on, and is more active when there is a threat to physiological well-being (e.g., low blood sugar). Together, the PFC, ACC, sensory cortex, and insula form a cortical network for the processing of pain – the PFC, ACC, and insula are more associated with affective-motivational aspects of pain, whereas the sensory cortex is associated with sensory-discriminative aspects. Jensen emphasized the plasticity of the pain network, and cited evidence that chronic pain can alter the brain's response to painful stimuli. For example, sensitization may occur due to excessive excitement of neurons caused by high levels of synaptic activity, and this can in turn result in greater brain activity in response to subsequent sensations. Specifically, Jensen presented a number of studies that have found reduced PFC grey matter in individuals with chronic pain conditions – this suggests reduced ability to inhibit the processing of painful stimuli.

Clearly, chronic pain is a complex phenomenon involving a myriad of interacting components. In spite of the development of expansive, biopsychosocial-type models of the pain experience, though, biomedical models still have a great deal of prominence in North American health care systems (Monsivais & McNeill, 2007). Conceptualizing chronic pain in biomedical terms results in the search for a cure, which may not be available. This can be frustrating for both treatment providers and individuals with chronic pain. Instead of finding a cure, learning to better manage chronic pain through an understanding of the factors involved in the pain experience may be a better approach. These factors, including the cognitive effects of pain, the emotional effects of pain, and the effects of beliefs and attitudes on pain, will be considered in the following sections. Later, the important role of culture in shaping chronic pain experience will be discussed.

**Pain and Cognitive Function**

In the previous section, it was noted that chronic pain can result in changes to the brain and potentially even result in a loss of neurons (Jensen, 2010). With that in mind, it is not surprising that chronic pain has been associated with cognitive changes as well. Tyrer and Lievesley (2003) stated that these changes make it difficult to disentangle the cognitive effects of a TBI from the cognitive effects caused by comorbid chronic pain. Failure to account for chronic pain in the interpretation of cognitive test results may cause a neuropsychologist to draw erroneous conclusions and overestimate deficits caused by a TBI. Tyrer and Lievesley broadly stated that attention and concentration are often affected by chronic pain and suggest that this may be due to the fact that pain is a highly salient stimulus which demands a high level of attention. In a more thorough systematic review of 23 studies concerning the cognitive effects of chronic pain (usually whiplash or diffuse pain), Hart and colleagues (2000) found that impairments were often observed in attention, processing speed, and psychomotor speed. Some studies suggested that higher pain severity was associated with worse cognitive performance, and others suggested that headache or neck pain were associated with worse cognitive performance than other types of pain. Most of the studies they reviewed did not include individuals with TBI, but results from the studies that did include such individuals were indicative of greater impairment for those who had TBI and chronic pain than those with only chronic pain. Hart and colleagues noted that the cognitive effects and other symptoms of chronic pain overlap with those associated with mild TBI more than with moderate or severe TBI, and they stated that this makes pain a particularly relevant confounding factor in cases of mild TBI. A more recent systematic review of the cognitive effects of chronic pain by Kreitler and Niv (2007) showed that memory was affected in 30 of 34 studies (88%) surveyed, processing speed was affected in 14/17 studies (82%), and attention was affected in 9/13 (69%) of studies.

As noted in the review by Hart and his colleagues (2000), there is mixed evidence that pain severity is associated with the extent of cognitive deficits observed in chronic pain patients. Iezzi, Duckworth, Vuong, Archibald, and Klinck (2004) administered a number of cognitive tests to 70 chronic pain patients attending a general hospital pain clinic and found that pain severity did not contribute to scores on tests of attention and concentration when accounting for level of education. However, pain severity did predict difficulties in immediate and delayed memory for stories and visual figures even with education taken into account. In a study of 163 community-dwelling older adults with chronic lower back pain, Weiner, Rudy, Morrow, Slaboda, and Lieber (2006) found that individuals with back pain performed worse than healthy controls on measures of immediate and delayed memory, language, mental flexibility, and fine motor coordination. They also found that higher pain severity was associated with worse performance on neuropsychological tests.

There is also some evidence which suggests that chronic pain is associated with changes in executive functions. In their 2007 review, Kreitler and Niv noted that individuals experiencing chronic pain showed deficits in mental flexibility relative to healthy controls in 8 of 11 studies examined (73%). Glass and colleagues (2011) administered a go/no-go task to 18 patients with chronic pain due to fibromyalgia and 14 age-matched healthy controls and found that although their performance did not differ in terms of reaction time or accuracy, there were differences on functional magnetic resonance imaging (fMRI). The fibromyalgia patients showed less activation in areas associated with inhibition, including the right insular cortex and the right inferior frontal gyrus. Consistent with Jensen's (2010) neuropsychological model of pain, Glass and colleagues (2011) interpreted their fMRI findings to mean that inhibition and pain perception networks are related, and that when resources are being used for pain processing, they may not be available for inhibitory processing.

Solberg Nes made similar observations in a 2009 review, citing evidence that chronic pain patients display abnormalities in cerebral blood flow in the thalamus, caudate, and ACC, areas implicated in regulation and executive functioning. In turn, the regulatory and inhibitory requirements of pain may tax these systems to the point that they are less effective in regulating and inhibiting other responses. Interestingly, Oosterman, de Vries, Djikerman, de Haan, and Scherder (2009) found that higher scores on executive functioning measures were associated with higher levels of self-reported pain severity in a group of 41 nursing home residents with arthritis and no known neurological problems. They interpreted their results to mean that relatively intact executive functioning abilities are needed to fully experience and report pain, and suggested that because areas associated with the affective-motivational dimension of pain (PFC and ACC) are also related with executive functioning, the affective-motivational aspects of pain are more closely linked to cognitive functioning.

In summary, chronic pain has been shown to influence performance on neuropsychological measures of attention, processing speed, psychomotor speed, and memory, and there is also evidence that chronic pain can affect some aspects of executive functions. Although the assessment of cognitive functioning is often seen as the primary role of a neuropsychologist, it is also important to take an individual’s emotional status into account in the course of assessment. As such, it is important to consider the relationship between chronic pain and emotions.

**Pain and Emotional Distress**

The experience of pain can be highly unpleasant, and therefore it stands to reason that prolonged pain can result in significant levels of emotional distress, which further increases the burden of those experiencing chronic pain. In addition, there is overlap in brain areas involved in pain processing and those concerned with emotional processing. For instance, Mee, Bunney, Reist, Potkin, and Bunney (2006) noted that induced sadness and grief due to a recent loss have been shown to produce activity in the PFC and insula, areas which were implicated in pain processing by Jensen (2010). Furthermore, Lumley and colleagues (2011) cited evidence that the amygdala, which is involved in the processing of fearful and emotionally salient stimuli, is more active in individuals with chronic pain. Clearly, pain and emotions are closely linked.

Supporting the link between pain and emotional distress, a number of studies have demonstrated that individuals experiencing chronic pain are at elevated risk for experiencing psychological disorders such as depression and anxiety. McWilliams, Cox, and Enns (2003) analyzed data from the 1992-1994 United States National Comorbidity Survey and found a significant association between severe arthritis and mood or anxiety disorders, with odds ratios (ORs) ranging from 1.97 to 4.27. The association was strongest for panic disorders (OR = 4.27) and post-traumatic stress disorder (PTSD; OR = 3.69). In total, 22% of the 382 individuals who reported arthritis pain met diagnostic criteria for a mood disorder and 35% met criteria for an anxiety disorder. In comparison, only 10% of the 5,495 survey respondents who did not report arthritic pain met criteria for a mood disorder and 18% met criteria for an anxiety disorder. Although anxiety disorders as a whole were more prevalent in those with arthritis than mood disorders, depression was the most commonly associated psychological condition, experienced by 20% of the individuals with arthritis. Chronic pain has also been associated with higher risks of suicidal behaviour. Tang and Crane (2006) performed a review of 12 studies regarding chronic pain and suicide, and determined that the risk of suicide was at least doubled for chronic pain patients relative to controls. The percentage of individuals with chronic pain who reported attempting suicide at any point in their life ranged from 5-15%, in comparison to 4-6% in the general US population. These statistics highlight the emotional impact of chronic pain, and the importance of considering emotional distress in the assessment and treatment of individuals who have pain disorders.

Self-report questionnaires regarding emotional functioning are commonly used in the course of neuropsychological assessment (Kolb & Whishaw, 2009), and given the above-noted association between chronic pain and emotional distress it is important to understand how chronic pain affects responses to these measures. The Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1943) and its revision, the MMPI-2 (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989) are the most commonly used questionnaires regarding emotional functioning (Greene, 2000) and as such it is particularly important to be familiar with the response patterns of people experiencing chronic pain on these questionnaires. MMPI and MMPI-2 profiles include ten clinical scales associated with different types of psychological concerns (Greene, 2000). Research regarding the MMPI and MMPI-2 responses of individuals experiencing chronic pain has typically revealed elevations on three scales in particular: scale 1, Hypochondriasis, scale 2, Depression, and scale 3, Hysteria (Deardorff, Chino, & Scott, 1992). Slesinger, Archer, and Duane (2002) examined the MMPI-2 profiles of 209 inpatients being treated for chronic pain and found that scales 1, 2, and 3 were best able to discriminate patients from matched controls selected from the MMPI-2 normative sample. Although all three scales tended to be elevated for chronic pain patients relative to controls, scale 1, Hypochondriasis, was the most discriminative and captured 62% of the variance between groups. In another study involving MMPI-2 profiles of outpatients at an Australian back pain clinic, Strassberg, Tilley, Bristone, and Oei (1992) also found that the MMPI-2 profiles of chronic pain patients were characterized by elevations on scales 1, 2, and 3 relative to the American normative sample. In summary, research has demonstrated that chronic pain is associated with emotional distress and that this distress is apparent in elevations on scales 1, 2, and 3 of the MMPI/MMPI-2.

**The Effect of Emotions on Pain**

Numerous studies have shown that chronic pain is associated with emotional distress and psychological disorders. However, as one would expect based on biopsychosocial models of pain, the relationship is not unidirectional – emotional states can also influence an individual's pain experience. The association between anxiety and chronic pain in particular has received a great deal of research attention. In his review of relevant literature, Asmundson (2002) noted that both pain and anxiety have a biological value in minimizing threats to one's well-being; pain causes a withdrawal or guarding response, whereas anxiety results in caution or avoidance of potentially dangerous situations. In addition, the reticular activating system of the brain is involved in processing both pain and anxiety. Based on his review, Asmundson suggested that anxiety serves to maintain chronic pain through an operant conditioning-type model: if an individual with chronic pain avoids activities that could potentially worsen pain by avoiding this activity does not experience a worsening of pain, then this reinforces the avoidance of the activity. Eventually, however, avoidance can lead to deconditioning and in turn a higher level of pain severity. Asmundson concluded by suggesting that anxiety and fear regarding pain may be more disabling than pain itself. Furthermore, Lumley and colleagues (2011) noted that high levels of anxiety regarding movement at the onset of a painful condition predict future disability, presumably because individuals who are anxious about movement avoid activities which could improve their condition.

Additional evidence linking chronic pain and anxiety was presented in a meta-analysis by Ocanez, McHugh, and Otto (2010). Their review of 14 clinical studies involving 2,093 clients and 27 non-clinical studies involving 3,815 participants determined that anxiety sensitivity (i.e., concern regarding anxiety symptoms such as an increased heart rate) was strongly associated with fearful appraisal of pain and moderately associated with negative affect related to pain. A small to moderate association was found between anxiety sensitivity and pain severity ratings/pain-related disability. Ocanez and colleagues suggested that people who have higher anxiety sensitivity are more likely to interpret painful sensations as harmful or dangerous, which causes an increased fear of pain. This in turn results in a greater degree of activity avoidance, which causes more pain due to deconditioning.

Emotions clearly play a role in the chronic pain experience, but they have also been shown to influence basic pain perception in laboratory studies. For example, Carter, and colleagues (2002) induced 80 student participants with depressed, anxious, happy, or neutral moods and tested their tolerance (time until they asked to discontinue) for pressure pain. They also had participants rate their level of pain throughout the task. In keeping with the results of chronic pain studies, the students displayed reduced pain tolerance when they were induced with an anxious or depressed mood. Those who had been induced with a depressed mood also rated their pain as more severe. Induced happiness did not influence pain tolerance or severity ratings in this study. However, positive emotional states have been shown to influence the pain experience in other studies. In their 2011 review of literature regarding pain and emotions, Lumley and colleagues cited evidence that positive emotional states are associated with reduced pain. They suggested that pain is reduced because increased brain activity in the dopaminergic mesostriatal circuit caused by positive emotional states contributes to pain suppression. Lumley and colleagues also emphasized the importance of emotional expression and suppression in the pain experience. For instance, emotional suppression is associated with greater pain and maladjustment in individuals with chronic pain, and individuals with chronic pain who inhibited anger during the day reported higher levels of pain at the end of the day relative to individuals who expressed their anger (Lumley et al., 2011). These findings have also generalized to laboratory settings: anger suppression is associated with lower pain tolerance and higher pain ratings in experimental studies involving exposure to uncomfortably cold stimuli (Lumley et al., 2011).

Given the seemingly inextricable link between negative emotions and pain, it is difficult to determine which comes first. In a linear structural equation modeling study of 511 veterans with chronic pain, Tan and colleagues (2008) found strong relationships between negative emotions, pain severity, and level of disability, with a particularly strong association between pain and depression. Greater levels of pain severity, depression, and anxiety resulted in a higher degree of disability. Overall, the researchers suggested that although negative emotions may precede pain in some individuals, pain preceding negative emotions seems to be the more common pattern.

Pain has been shown to have a significant impact on emotional functioning; individuals experiencing chronic pain are at an elevated risk for mood and anxiety disorders (McWilliams et al., 2003), and this must be taken into account when conducting neuropsychological assessment. The evidence suggests that depression and anxiety are especially closely linked to chronic pain. Given that TBI is also associated with negative emotional outcomes (Tyrer & Lievesley, 2003), it is particularly important to consider the emotional status of individuals who have sustained a TBI and experience comorbid chronic pain, since these individuals may have an even greater risk of negative emotional outcomes. Further complicating matters for neuropsychologists, though, is the finding that negative emotional states affect cognition. Once again, a proper understanding of this phenomenon is important to avoid errors in the interpretation of neuropsychological findings.

**Emotions and Performance on Cognitive Testing**

As with the association between pain and negative emotional states, a link between negative emotional states and cognition makes intuitive sense. When one is experiencing high levels of emotional distress, it becomes difficult to focus on anything else. Correspondingly, brain areas involved in emotional processing are also involved in cognitive processes. In a review of the link between depression and cognitive deficits, Levin and colleagues (2007) noted that depression is associated with reduced activity in the PFC and ACC, which are implicated in aspects of executive functioning and attention. As noted previously, these areas are also involved in the processing of pain (Jensen, 2010). It appears that the PFC and ACC may be linked to stressful experiences in general, and that stressful experiences, be they emotional (depression) or physical (pain), prevent these areas of the brain from effectively engaging in cognitive processes.

In their review, Levin and colleagues (2007) indicated that depression tends to be associated with lower performance on tests of memory, attention, and problem solving. This phenomenon has been observed both in experimental studies where depression is induced and in studies of individuals diagnosed with clinical depression. More severe depression has been associated with greater negative impact on cognitive testing. Levin and colleagues reasoned that since memory, attention, and problem-solving are all associated with executive functioning, the reduced PFC activity observed in individuals with depression may account for these findings. For example, reduced PFC activity may prevent individuals with depression from generating efficient strategies for memory recall or problem-solving, or reduce their ability to avoid distraction on tests of attention. The ACC has also been implicated in monitoring for conflicts in attention, and therefore reduced activity in this area could also account for deficits on tests of attention (Levin et al., 2007). Although less consistent than findings regarding decreased memory, attention, and problem solving, individuals with depression have also shown lower scores on tests of verbal fluency, planning, inhibition, and set-shifting than controls (Levin et al., 2007).

A similar review by Lönnqvist (2010) produced congruent findings. Lönnqvist cited evidence that chronic stress such as that experienced by those with psychological disorders is associated with impaired attention, working memory, judgment, and decision making. He noted that persistent stress is associated with atrophy in the hippocampus, which is involved in memory, as well as the PFC and ACC. Lönnqvist also emphasized the role of stress and depression in excessive activity of the hypothalamic-pituitary-adrenal axis (HPA axis), which results in the release of glucocorticoids which negatively impact cognition. Finally, a meta-analysis by Burt, Zembar, and Niederehe (1995) showed a significant and stable association between depression and memory deficits. The association was stronger when effortful recall measures were used as opposed to less effortful recognition measures, and individuals with more severe depression performed more poorly than those with milder symptoms.

Some multivariate studies have investigated the impact of both pain and emotional distress on cognition. Hart, Wade, and Martelli (2007) cited the findings of a 1991 study by Kewman and colleagues, who found that although pain intensity correlated significantly with scores on a cognitive screening measure, this correlation was no longer significant when the effects of emotional distress were controlled statistically. Conversely, the effects of emotional distress on cognition remained significant even when pain intensity was controlled for. In another study of 275 clients at a pain treatment clinic, McCurry and colleagues (2001) found that use of antidepressants, pain severity, pain-related anxiety, and depression were all significant predictors of self-reported cognitive deficits. However, when these variables were entered into a multiple regression equation, depression accounted for the most variance. Studies regarding the effect of emotional distress on cognition (e.g., McCurry et al., 2001; Levin et al., 2007; Lönnqvist, 2010) seem to emphasize the importance of taking emotional factors into account when interpreting the results of a neuropsychological assessment. With that said, the relationship between depression and cognitive functioning may not be so clear-cut.

Rohling, Green, Allen, and Iverson (2002) conducted a study in which clients undergoing outpatient neuropsychological assessment as a part of litigation were divided into high depression ($n$ = 112) and low depression ($n$ = 115) groups based on their scores on the Beck Depression Inventory (Beck & Steer, 1993), a popular self-report measure of depression. Rohling and colleagues (2002) omitted clients who scored below cutoff on either of the two symptom validity measures (i.e., effort tests) administered during the assessment from the sample. The performance of clients reporting high depression and low depression was compared on cognitive tests of varying complexity which tapped a number of cognitive domains, and no differences were found. However, clients in the high depression group reported more cognitive problems in spite of the aforementioned equivalent test performance. The authors suggested that because clients reporting high levels of depression and low levels of depression obtained equivalent results on cognitive tests when those who scored below cutoff on symptom validity measures were omitted from the sample, the effects of depression on cognition found in other studies may have been due to lower effort on the part of the groups experiencing depression and not due to depression per se. The authors also suggested that individuals who are highly depressed may have more negative appraisals of their cognitive abilities than those who are experiencing less severe depression symptoms. In effect, an individual's beliefs regarding cognition may be more affected by depression than their actual cognitive performance.

Correspondingly, even though chronic pain appears to be associated with negative emotion and cognitive difficulties, and emotional distress also appears to be associated with cognitive difficulties, the role of attitudes and beliefs also appears to play a significant role in these relationships. This relationship was explored by Sullivan, Hall, Bartolacci, Sullivan, and Adams (2002), who administered a questionnaire regarding perceived cognitive deficits and measures of anxiety, depression, and pain experience to 29 individuals with whiplash pain, 24 individuals with work-related soft tissue injury, and 28 healthy controls. They found that both the whiplash and soft tissue injury groups rated themselves as having more cognitive deficits than the healthy controls, which suggested that the specific mechanism of injury did not account for the perceived deficits. Although pain severity correlated with level of perceived deficits and perceived deficits correlated with pain-related disability, when a hierarchical multiple regression analysis (MRA) was performed only anxiety and depression measures were found to be significant predictors of perceived deficits. Sullivan and colleagues suggested that emotional distress may be more related to the cognitive deficits observed in chronic pain conditions than chronic pain itself. Unfortunately they did not perform objective tests of cognitive ability to compare with self-reported perceived cognitive deficits. Nevertheless, their study showed the importance of beliefs and attitudes in shaping the chronic pain experience, as individuals with chronic pain believed that they had cognitive deficits related to their pain. Perceived control over pain is one specific belief which has been linked to chronic pain outcomes. This topic will be explored in greater depth in the following section.

**Chronic Pain, Locus of Control, and Self-Efficacy**

As illustrated in the previous section, beliefs and attitudes play an important role in an individual's chronic pain experience. An individual's beliefs and attitudes shape how they view the world, and this is important in determining how they react to life events such as the experience of pain. In a 1991 review, Jensen, Turner, Romano, and Karoly noted that not all individuals with chronic pain experience psychological dysfunction or significant functional disability – they suggested that beliefs and attitudes are important in determining the level of dysfunction or disability experienced by an individual with chronic pain. Jensen and colleagues specifically identified an individual's locus of control as having an important role in shaping pain outcomes.

An individual's locus of control refers to how much control that they believe they have over their environment (Jensen et al., 1991). Someone with an internal locus of control believes that they have a high degree of control over events in their life, whereas someone with an external locus of control believes that they have relatively little influence and that events are dictated by external forces. With regard to pain, an internal locus of control would be associated with beliefs of control over pain and personal influence in the pain experience, whereas an external locus would be consistent with beliefs that there is nothing that can be done about pain and that it is simply something with which one must live. In keeping with this concept, individuals experiencing chronic pain who endorse an internal locus of control tend to engage in more active methods of dealing with pain, whereas those with an external locus of control tend to employ more passive methods (Jensen et al., 1991). Overall, it appears that an internal locus of control is associated with better pain-related outcomes, such as lower levels of depression and less life interference due to pain, whereas an external locus of control is associated with higher degrees of emotional distress and depression (Jensen et al., 1991). For example, Jensen and Karoly (1991) interviewed 118 chronic pain patients regarding pain severity, health activities, life satisfaction, and level of pain control, and found that higher levels of perceived control over pain were associated with better psychosocial functioning and higher levels of activity. Similar findings regarding the positive benefits of perceived control over pain have been produced in a number of other studies (e.g., Tan et al., 2002; Keefe et al, 1987).

Locus of control is related to the concept of self-efficacy, which refers to an individual's level of belief that they are able to perform a specific behaviour (Jensen et al., 1991). For instance, someone with chronic pain who has a high sense of self-efficacy with respect to dealing with pain may believe that they are able to continue working despite their pain, whereas someone with low self-efficacy with respect to dealing with pain may believe that their pain makes working impossible. Consistent with findings regarding locus of control, the review by Jensen and colleagues suggested that individuals experiencing chronic pain who have high self-efficacy tend to have better pain-related outcomes than those who endorsed low self-efficacy. Individuals with high self-efficacy with respect to dealing with pain were more likely to continue employment following the onset of pain and engage in more physical exercise than those with low self-efficacy. They also reported lower levels of pain and disability, used less analgesic medication, and endorsed the use of more strategies for dealing with pain. Emotionally, high self-efficacy was associated with lower levels of depression, higher self-esteem, and higher life satisfaction. The benefits of self-efficacy are apparent even when accounting for pain severity. In a study of 126 chronic pain patients without prior depression, Arnstein, Caudill, Mandle, Norris, and Beasley (1999) found that perceived self-efficacy mediated the relationship between pain and disability – higher levels of self-efficacy were associated with lower levels of disability, even for individuals with high pain intensity.

Perhaps not surprisingly, individuals who believe that they have control over their pain and believe that they have the ability to be active in spite of pain are more likely to do so than those who do not share such beliefs. This may have to do with the fact that having a sense of control over pain intrinsically makes people feel better (i.e., the opposite of learned helplessness), or because individuals who believe that have control are motivated to work harder and therefore benefit more from treatment (Jensen & Karoly, 1991). Consistent with the second hypothesis, some research has suggested that chronic pain patients with higher ratings of self-efficacy are more likely to complete multidisciplinary treatment programs (Kerns & Habib, 2004). Regardless of the precise mechanism of action, it is clear that perceived control and self-efficacy are important factors in determining an individual's chronic pain experience. Two other factors that have been shown to be important in determining chronic pain outcomes are support from others and solicitous behaviour on the part of others.

**Support, Solicitousness and Pain**

As demonstrated in the preceding sections, an individual's beliefs regarding their level of control over pain, their ability to complete tasks in spite of their pain, and the potential negative effects of their pain are important in shaping their chronic pain experience. Although pain research tends to focus on beliefs and attitudes intrinsic to the self, some studies have demonstrated that the roles and behaviours of others are also associated with pain-related outcomes. Specific emphasis has been placed on support from others and solicitous behaviour of others.

A greater degree of social support has been associated with positive outcomes in a number of health conditions (Campbell, Wynne-Jones, & Dunn, 2011), as well as stressful situations in general (Chao, 2011) and it would stand to reason that this would also be true of chronic pain disorders. Lee and colleagues (2007) found that higher levels of social and family support were associated with lower levels of depression in 171 chronic pain outpatients, whereas Payne and Norfleet (1986) cited studies suggesting that poor marital relationship ratings (i.e., lower perceived support) were associated with higher ratings of pain severity. In a review of 17 studies regarding the role of informal social support in the prognosis for chronic back pain, Campbell and colleagues (2011) found that a higher degree of support was moderately associated with better psychological outcomes and suggested that this was because social support acted as a buffer against pain-related stress. Three of the studies reviewed suggested that social support was a risk factor for negative outcomes; however, associations were weak and inconsistent. Although it seems counterintuitive that support from others might result in negative chronic pain outcomes, certain forms of support, notably solicitousness, have specifically been linked with negative outcomes.

Solicitousness, or the provision of high levels of attention and support to loved ones in times of stress (Newton-John, 2002) is thought to have an important role in chronic pain outcomes. In the chronic pain context, solicitousness could be seen in the beliefs that one should take on the duties of someone experiencing pain, provide medication when needed, or dote on the individual with pain constantly. Some studies have suggested that solicitous behaviours are associated with negative outcomes in chronic pain patients. For instance, Romano, Jensen, Turner, Good, and Hops (2000) videotaped 232 chronic pain patients and their partners engaging in activities together and coded the videos for verbal and non-verbal pain behaviours on the part of the individual with chronic pain, as well as solicitous and negative behaviours on the part of the partner. Their results showed that solicitous partner behaviours were associated with more verbal and non-verbal pain behaviours on the part of the individuals with chronic pain. Romano and colleagues suggested that solicitous partner behaviours encourage the patient to adopt a sick role because the partner's concern and sympathy discourages patients from engaging in activity. Solicitous behaviours observed on the videotapes were also correlated with higher patient ratings of pain intensity and lower ratings of activity.

In another study of 241 chronic pain patients by Jensen, Turner, Romano, and Lawler (1994), beliefs that others should be solicitous were associated with a higher level of sickness impact. A review of 27 studies by Newton-John (2002) generally supported the role of solicitous behaviour in reinforcing chronic pain behaviour, and suggested that the behaviour of people close to individuals experiencing chronic pain influences their ability to deal with pain. Although the review showed that solicitous behaviour was associated with negative outcomes such as higher pain intensity, greater disability, reduced activity, more pain behaviour, fewer self-directed methods of dealing with pain, and more help-seeking behaviour, Newton-John pointed out that solicitousness may not have resulted in these outcomes, but that instead more negative pain factors (e.g., higher intensity) on the part of individuals with chronic pain may have elicited more solicitous behaviour from their loved ones.

**Chronic Pain and Validity Measures**

The validity of test results is an important consideration in neuropsychological assessment, as invalid test performance or misrepresentation of symptoms makes it difficult to determine the true extent of an individual's cognitive impairment, emotional distress, or pain concerns (Strauss, Sherman, & Spreen, 2006). This has led to the creation and refinement of test measures and procedures designed to identify whether cognitive and emotional complaints are legitimate or valid. Performance-based symptom validity tests are generally designed to look like they would be difficult to someone with cognitive impairment, when in fact this is not actually the case (Strauss et al., 2006). For example, remembering relatively short lists of numbers may appear to be difficult for an individual who has troubles with memory or attention, when in fact this ability is generally preserved in clients with neuropsychological dysfunction except in extreme cases. Scores on performance validity measures are typically classified using cutoff scores that are set below the typical performance of individuals with significant cognitive dysfunction (e.g., severe traumatic brain injury, dementia). If an individual undergoing neuropsychological assessment for reasons not usually associated with significant cognitive dysfunction (e.g., mild traumatic brain injury, chronic pain) scores below what would be expected of someone with a severe traumatic brain injury or dementia on a performance validity measure, it is thought to mean that the test results are not valid (Strauss et al., 2006). Invalid scores on neuropsychological tests are often attributed to low effort on the part of the examinee, but more recent research has suggested that this is not always the case (Van Dyke, Millis, Axelrod, & Hanks, 2013).

Validity measures on self-report instruments gauging emotional distress or psychological status generally relate to inconsistent responding on similar items, excessive endorsement of symptoms, or endorsement of symptoms which are not commonly reported (Strauss et al., 2006). As researchers and clinicians have learned more about the extent of symptom exaggeration, symptom validity tests have become an important component of most neuropsychological assessments.

Unfortunately, potentially invalid responding (e.g., symptom exaggeration) appears to be a common phenomenon in patients referred for neuropsychological assessment. In a survey of members of the American Board of Clinical Neuropsychology, data provided by respondents suggested that approximately 30% of clients seen for assessment, including those presenting with chronic pain, were exaggerating their symptoms in some way (Mittenberg, Canyock, & Condit, 2002). In a review of archival data from clients who were referred for assessment for reasons other than head injury (i.e., chronic pain, psychological concerns), Gervais, Rohling, Green, and Ford (2004) found that up to 43% of clients scored below cutoff on at least one performance-based symptom validity measure. These researchers also found that clients who scored below cutoff on one or more of these measures reported higher levels of pain severity than clients who did not, which they interpreted to mean that performance-based measures may be an indicator of exaggeration of chronic pain complaints. Johnson-Greene, Brooks, and Ference (2013) found similar results in a study involving patients with fibromyalgia who were undergoing neuropsychological assessment. Thirty-seven percent of their sample scored below cutoff on one or both of the performance validity tests administered, and clients who scored below cutoff on more of these measures reported higher chronic pain severity and greater fatigue. However, other recent research has suggested that scores on performance validity tests may not be associated with exaggeration of self-reported symptoms (Van Dyke et al., 2013).

On the other hand, Etherton, Bianchini, Greve, and Heinly (2005) found that clients who scored below cutoff on a performance-based symptom validity test did not differ from those who did not score below cutoff on any such tests with regard to pain severity ratings. In another study with important implications for neuropsychologists, Meyers and Diep (2000) found that chronic pain patients in the process of litigation regarding their injuries were far more likely to score below cutoff on performance-based validity tests than patients with chronic pain who were not in the process of litigation. One third of clients in litigation scored below cutoff on two or more of the six performance-based validity tests administered in their test battery, whereas none of the non-litigants scored below cutoff on two or more validity measures.

In summary, scoring below cutoffs on performance-based validity measures appears to be a fairly common occurrence in clients referred for neuropsychological assessment who are experiencing chronic pain. However, the evidence is mixed with regard to whether individuals who score below cutoffs on performance-based measures of symptom validity report higher levels of pain than those who do not score below cutoffs on such measures. In any case, symptom exaggeration is important to take into account in neuropsychological assessment, as well as in research regarding neuropsychological assessment and chronic pain.

There is clear evidence that pain-related attitudes and beliefs are important in shaping an individual's chronic pain experience. Locus of control, perceived support, solicitous behaviour on the part of loved ones, and symptom exaggeration have all been implicated in pain-related outcomes, and an understanding of these factors is important for conceptualization and treatment. However, factors external to individuals experiencing chronic pain are also important in determining how these individuals will react to and cope with pain.

**Psychosocial Factors and Chronic Pain**

In considering factors that influence chronic pain behaviours and outcomes, researchers seem to focus predominately on factors that are internal such as a person's emotions, cognitions, and beliefs. However, it is also important to consider extrinsic factors such as socioeconomic status (SES; usually quantified using income, vocation, or some combination of demographic factors), educational level, work status/work-related factors, compensation or litigation, and family or social support. Although it does not appear that low SES and educational level have received a great deal of attention in the chronic pain literature specifically, these factors have been associated with higher prevalence, recurrence, and duration of back pain (Dionne, Von Korff, Koepsell, Deyo, Barlow, & Checkoway, 2001). Individuals with lower educational attainment also tend to report higher levels of disability and are less likely to return to work after the onset of back pain than those with higher levels of education. In general, low SES and education have been associated with worse health outcomes, as well as reduced access to and use of health care services, greater environmental and behavioural risk factors, and reduced use of strategies for dealing with health problems. Differences in health care access in individuals with lower SES will be explored in greater detail later in this review.

A return to work is an important goal for many persons with chronic pain and treatment programs. In a review of 18 studies, Truchon and Fillion (2000) found that a number of work-related factors were important in determining whether individuals with chronic pain returned to work following the onset of pain. A negative appraisal of one's own ability to work (self-efficacy) and job dissatisfaction were associated with reduced probability of returning to work. Interestingly, and somewhat counter-intuitively, higher physical demands such as lifting did not impact the probability of a return to work. Overall, Truchon and Fillion suggested that appraisals of ability to resume work were more important than work demands in determining whether or not an individual experiencing chronic pain would resume employment. They noted that job satisfaction and job-related stress also played a role in determining the likelihood of a return to work. Jackson, Iezzi, and Lafreniere (1997) noted that unemployment is associated with fewer opportunities for control and use of skills, as well as less task variety, goals to strive for, income, social status, and interpersonal contact, and suggested that as such it could contribute to negative outcomes for individuals experiencing chronic pain.

Some researchers have suggested that providing financial compensation to individuals who are injured or experiencing chronic health conditions such as chronic pain serves to reinforce their illness behaviour and disability (Rohling, Binder, & Langhinrchsen-Rohling, 1995). This possibility has received some study, with mixed results. In an early review of related literature by Mendelson (1986), there was no evidence that chronic pain litigants were exaggerating the severity of their pain, but some support for the hypothesis that financial compensation was associated with worse prognosis. A somewhat more recent meta-analysis of 32 studies including 3,802 chronic pain patients and 3,849 controls by Rohling and colleagues (1995) produced significant effect sizes for the association between compensation and negative pain-related outcomes. Overall, it seemed that financial compensation was related to higher pain severity and lower treatment efficacy. However, it is difficult to state definitively that compensation results in worse outcome given that individuals with more severe pain conditions may be more likely to seek and receive compensation.

Overall, it appears that psychosocial risk factors may be important in shaping the chronic pain experience. However, it has been suggested by some that they are less important than the emotional and belief-related variables presented earlier (Truchon & Fillion, 2000; Raymond et al., 2011). It may be that the effect of psychosocial factors is moderated by beliefs regarding pain and support from others. This was supported by the review conducted by Raymond and colleagues, who reported that depression, psychological distress, low perceived control, and fear-avoidance were usually linked with poor outcomes, whereas social and occupational factors did not seem to be associated with outcomes. In any event, given that emotions, cognitions, behaviours, and psychosocial factors are all heavily dependent on culture and ethnicity, the role of culture in shaping emotions, cognitions, and beliefs and attitudes will be explored in the following section.

**Notes Regarding Terminology**

The terminology in research regarding ethnicity, race, and culture can be somewhat confusing due to the tendency of researchers to use certain terms interchangeably or inconsistently (Edwards et al., 2001). Generally speaking, *culture* refers to a belief system and value orientation shared by a group of people, *race* refers to an externally assigned category used to define people of various skin colours as a group, and *ethnicity* refers to the acceptance of the group values and attitudes of one's own culture (APA, 2003). For the purposes of this review, these terms will be used in a manner that is consistent with how they were used by the authors of the original literature. Another source of potential confusion in a literature review regarding ethnicity, race, and culture is the tendency for seemingly similar groups to be defined using different terms. For instance, studies concerning Caucasians, Whites, and European Americans are generally referring to individuals with the same identifying characteristics.

In the interest of consistency, the term *Caucasian* will be used in this review to identify light-skinned individuals of European background who may be referred to as Whites or European Americans in other studies. *African American* will be used to identify dark-skinned individuals of African origin residing in America, who may be referred to as Blacks in other studies, and *Hispanic American* will be used to identify Americans of Mexican or Latin American heritage. *Asian American* will be used to denote Americans of Asian heritage. *Native American* will refer to individuals who may otherwise be referred to as American Indian and *Aboriginal Canadian* will refer to individuals who may otherwise be referred to as Native Canadian. However, in cases when subsets of these groups are being studied (e.g., Irish Americans, Puerto Ricans, Plains Indians), the original terminology will be used. Similarly, when individuals from a specific geographical region or an ethnic/cultural group not mentioned above are referred to, a more thorough description will be provided. Although it has rightly been argued that the use of blanket terms such as Hispanic and Asian ignores within-group differences with respect to nation of origin, nation of birth, culture, and language (e.g., Sue & Sue, 2007), these are conventions used in most multicultural research and the study of differences between broadly defined groups can still be informative.

The concepts of acculturation, assimilation, individualism, and collectivism will be important in later discussions regarding differences in cognitive test performance, responses to emotional measures, and beliefs and attitudes across cultural groups. *Acculturation* refers to changes in patterns of behaviour brought about by the meeting of new cultures while *assimilation* specifically refers to the adoption of new patterns of behaviour when one immigrates to an area primarily inhabited by individuals of a different cultural group (Sam & Berry, 2006). The degree to which a particular culture is individualistic versus collectivistic is one of the principal defining features of a given culture's worldview and an important conceptual distinction to keep in mind. Broadly speaking, *individualism* refers to a system of beliefs wherein the individual is the most important social unit, whereas *collectivism* refers to a belief system where the needs and roles of social groups such as family take precedence over those of the individual (Sue & Sue, 2007). In individualistic cultures, each individual is seen as responsible for their own destiny and problems are generally faced through the individual taking action to shape the environment to better suit their needs. Conversely, in collectivist cultures each individual is defined by their social roles, and conflicts tend to be resolved by individuals changing themselves to better suit the greater need. Older theories regarding individualism and collectivism suggested that Western cultures (e.g., America, Canada, Europe, Australia) tend to be more individualistic, while the rest of the world (e.g., Asia, the Middle East, Africa, Latin America) is more collectivistic (e.g., Triandis et al., 1993; Oyserman, Coon, & Kemmelmeir, 2002). However, contemporary researchers caution against making broad and simplistic distinctions between individualistic and collectivistic cultures (e.g., Triandis et al., 1993; Oyserman, Coon, & Kemmelmeir, 2002).

In a survey of 1,876 students and workers across a number of countries, Triandis and colleagues (1993) found that endorsement of individualistic and collectivistic tendencies varied across a number of areas. For instance, Chinese respondents simultaneously endorsed high in-group interdependence and high levels of solitary action, suggesting that individualistic and collectivistic tendencies depend to some extent on the context. Overall, though, Western respondents (e.g., Illinois, France) endorsed higher levels of independence and lower levels of dependence on others, whereas non-Western respondents (e.g., India, Indonesia, China, Japan) endorsed lower levels of independence and higher levels of dependence on others. Similar general tendencies were revealed in a meta-analysis of studies regarding individualism and collectivism conducted by Oyserman, Coon, and Kemmelmeir (2002). Their analysis showed that Caucasian Americans were more individualistic and less collectivistic than individuals in all other countries studied, including Europeans, Asians, Middle Easterners, Africans, and South Americans. With regard to studies conducted using ethnic groups within the United States, Caucasians were found to be less collectivistic than Asian Americans, African Americans, and Hispanic Americans, but more individualistic only in comparison to

Asian Americans. Although individualism and collectivism are multi-faceted constructs, the distinction between cultures which are generally individualistic and generally collectivistic can nevertheless be informative regarding behaviour and worldview (Boone, Meng, & van der Velden, 2007).

**Diversity in North America**

As noted in the introduction, North America is becoming increasingly multicultural. By 2050, it is expected that individuals from "minority" groups will outnumber people of European descent in America (Sue & Sue, 2007), and at least one third of Canadians is expected to belong to a visible minority group by 2031 (Statistics Canada, 2010). With this in mind, it is important for health care professionals, including neuropsychologists, to understand the potential challenges of working with individuals from various ethnic and cultural backgrounds. This is important not only for pragmatic reasons (i.e., if we do not know how to work with diverse clientele, we will get less work), but for ethical reasons as well – providing inadequate services to clients from diverse ethnic and cultural backgrounds is an ethical violation (APA, 2003).

**Multiculturalism and Ethical Practice**

Although most psychologists would likely consider themselves to be considerate and sensitive to the needs of their clients, many of the techniques and theories underlying clinical practice are based on research conducted using largely Caucasian participants (Sue & Sue, 2007). If these techniques are applied without consideration to cultural differences they may be ineffective or even harmful, no matter how well meaning the intentions of the clinician. Researchers in multicultural aspects of psychology have suggested that psychologists are insensitive to the needs of minorities, do not adequately understand them, and are unaware of their shortcomings in understanding cultural differences (Sue & Sue, 2007). As a result, clients from minority groups often report that they feel abused, intimidated, and harassed by treatment professionals. These problems can be avoided through the development of *cultural competence*, which is defined by Sue and Sue as increased awareness of other cultures, as well as one's own, along with efforts to develop treatment strategies that will be appropriate for various cultural groups. Given the increasingly diverse client population seen by psychologists in North America, it has been suggested that cultural competence is no longer optional, but has become a foundation for practice (Arthur & Collins, 2005).

In developing cultural competence, it is important to consider differences in viewpoints as they may relate to presenting problems and treatment goals, including addressing the needs of clients with chronic pain (Sue & Sue, 2007). For example, in America the phrase "the squeaky wheel gets the grease" implies that one should seek treatment when they experience persistent pain. However, in Japan the saying "the nail that stands up should be pounded down," cautions against overtly displaying the need for assistance, even when experiencing chronic pain. As a result, individuals from Japan often seek treatment for physical and psychological concerns only as a last resort, and by that time they display severe symptoms which could be seen as exaggerated. Psychologists and other treatment professionals must avoid *ethnocentricity*, which refers to the tendency to consider the problems of all clients in the context of the majority culture (APA, 2003). The more that we know about the influence of culture in shaping the development of beliefs, attitudes, and worldviews, the better we will be able to provide effective services to individuals of diverse backgrounds (APA, 2003). In the context of neuropsychological assessment, it is especially important to understand the role of culture in determining how clients cope with life challenges, and how they may differ from the majority culture on measures of emotional and cognitive functioning.

**Mental Health of Minorities in North America**

Individuals from minority groups experience a great deal of stress due to discriminatory treatment, tend to have a lower SES than those in majority groups, and often live in areas which put them at risk of exposure to violence, drug abuse, and crime (Anderson & Mayes, 2010). It has been suggested that these factors lead to an elevated potential for negative mental health outcomes (Sue & Sue, 2007), and this has generally been demonstrated in studies of ethnic/cultural groups in the United States. Anderson and Mayes conducted a review of relevant literature in 2010 and found consistent support for a higher prevalence of depression and anxiety in minority groups in the United States. African Americans, Hispanic Americans, people of Asian descent, and Native Americans were all shown to have higher rates of depression than Caucasian Americans, and all of these groups save Native Americans had a higher prevalence of anxiety as well. Anderson and Mayes were unable to find any studies which examined the rate of anxiety in Native Americans. The authors noted that although gender differences in the rate of mental health concerns were similar across ethnic groups, with women having higher rates of both depression and anxiety, there were differences in symptom presentation across the groups studied. For instance, Hispanic Americans and Asians tended to report more somatic symptoms of depression and anxiety than other groups. Anderson and Mayes suggested that although consideration of SES is essential when conducting research regarding mental health in minority groups, cultural differences in beliefs and attitudes may also play a role in the expression of mental health symptoms.

A recent review of Canadian literature concerning mental health across ethnocultural groups, on the other hand, produced no clear patterns (Hansson, Tuck, Lurie, & McKenzie, 2012). Different groups were found to have higher or lower rates of mental health problems than Caucasian Canadians depending on the study, and the literature was not comprehensive. Only 17 relevant studies were identified, and most of them focused on specific ethnocultural groups in specific locations. Furthermore, rates of mental health concerns within a given ethnocultural group were found to vary by age, ethnocultural background, and status in Canada (e.g., landed immigrant vs. refugee).

In one of the few studies addressing mental health across ethnocultural groups in Canada, Clarke, Colantonio, and Rhodes (2008) analyzed data from the Canadian Community Health Survey (CCHS), a national telephone-based survey conducted between September of 2000 and February of 2001. In this survey, questions were asked in the native language of the respondents, though the methods of translation were not made explicit by the authors. Clarke and colleagues found that English-speaking Caucasian Canadians were more likely to be classified as depressed based on a diagnostic interview than any of the other groups surveyed. English-speaking Caucasian Canadians were classified as depressed in 10.7% of cases, in comparison to 8.5% of cases for French-speaking Caucasian Canadians, 9.5% of cases for foreign-born Caucasian immigrants, and 7.2% of cases for participants of visible minority status. Similarly, another study using CCHS data conducted by Ali (2002) showed that immigrants to Canada reported lower prevalence of major depressive episodes in the past year (6%) as compared to Canadian-born respondents (8%). However, immigrants who had resided in Canada for more than 10 years were found to have a rate of major depressive episodes more comparable to that of Canadian-born individuals. This was thought to represent a “healthy immigrant effect” similar to that found with regard to physical health. With that said, a review of studies concerning the healthy immigrant effect for mental health (Islam, 2013) found mixed evidence for this phenomenon.

More thorough research appears to have been dedicated to mental health concerns in the Canadian Aboriginal population. A 2006 review by the Government of Canada cited evidence that individuals of Aboriginal heritage living on reserves were twice as likely to have experienced a major depressive episode in the past year (16%) as the general Canadian population (8%). Similar findings were produced in a survey regarding the mental health of Aboriginal Canadians living off-reserve. Thirteen percent of Aboriginal Canadians reported a major depressive episode in the previous year, in comparison to seven percent for other Canadians. Aboriginal Canadians living on reserves were also twice as likely to see a health professional for anxiety as the general Canadian population, and suicide rates for Aboriginal Canadians are up to twice as high as those of the rest of the Canadian population. Clearly, Aboriginal Canadians are at a higher risk of mental health concerns in comparison to other Canadian residents.

**Culture/Ethnicity and Locus of Control**

As noted previously, locus of control is an important factor in defining an individual’s chronic pain experience (Jensen et al., 1991). Research has shown that locus of control tends to vary based on ethnicity/culture, which has implications for response to pain; if locus of control and therefore pain responses differ across ethnocultural groups, then these differences must be considered in the assessment and treatment of minority group individuals experiencing chronic pain. Broadly speaking, individualistic cultures tend to have a more internal locus of control, whereas collectivist cultures have a more external locus of control. For instance, Hamid (1994) surveyed students in China and

New Zealand, and found that the Chinese students endorsed a high external locus of control, whereas the New Zealanders were more internally oriented. Similar results have been obtained when comparing Taiwanese and British samples (Lu, Kao, Cooper, & Spector, 2000), as well as Chinese and Caucasian samples (Liang & Bogat, 1994).

Locus of control has also been associated with levels of stress and adjustment experienced across cultures. In their study of 347 Taiwanese office managers and 224 British managers, Lu and colleagues (2000) found that higher self-ratings of internal locus of control were associated with more job satisfaction for both groups. However, internal locus of control was associated with lower ratings of work pressure only for the British group. Similarly, Liang and Bogat (1994) found that although internal locus of control was associated with better psychological adjustment for both Chinese and Caucasian students, the relationship between internal locus of control and the benefits of social support differed by ethnicity. Caucasians with internal locus of control reported higher levels of stress reduction due to social support in comparison to those who endorsed more external locus of control, whereas locus of control did not influence the stress buffering effects reported by Chinese individuals. These results suggest that although internal locus of control is associated with positive psychological and stress-related outcomes across cultures in some situations, there are also important differences to take into consideration. This was emphasized in a study of Japanese and British students by O'Connor and Shimizu (2002) in which participants' sense of life control was only associated with lower psychological distress for British students. Furthermore, acculturation has been shown to influence locus of control. For example, Korean Canadians who were more integrated in Canadian culture were more successful in using methods of coping with stressful situations associated with an internal locus of control (problem-focused strategies) than those who reported less integration (Noh & Kaspar, 2003). It is clear that differences in locus of control exist across ethnic/cultural groups, and these have important implications for chronic pain responses.

**Culture/Ethnicity and Social Support**

As illustrated above, individualistic and collectivistic outlooks are associated with differences in locus of control. Given that these constructs are based on differences in the way society is structured, it is not surprising that individuals from individualistic and collectivistic cultures differ in their expectations of social support. However, it may initially seem surprising that individuals from collectivistic cultures such as Asians and Asian Americans are actually *less* likely to ask for social support than those from individualistic cultures (Kim, Sherman, & Taylor 2008). When one considers the role of the individual in both types of cultures, though, this phenomenon begins to make more sense. People from individualistic cultures tend to be more focused on the well-being of the self and seek to achieve well-being by acting on their environments – this could include strategies such as asking others for help or going to others to share problems. Conversely, people in collectivistic cultures are more concerned with the well-being of their group and the maintenance of their role in the group, and as such they may be concerned about the potential negative consequences of asking others for help, such as being viewed as a burden. This tendency has been demonstrated in laboratory studies: when shown a video of a woman experiencing problems and seeking help from someone else, Caucasians evaluated her behaviour positively, whereas Asian participants were less positive (Kim, Sherman, & Taylor, 2008).

Willingness to seek social support has been shown to be dependent on level of exposure to individualistic culture: for instance, Asian immigrants are less likely to seek social support than Asian Americans (Taylor et al., 2004). Interestingly, although people from more collectivist cultures may not actively seek social support, it still appears to play a role in their well-being. Lincoln, Chatters, and Taylor (2003) conducted a structural equation modeling study using data from the United States National Comorbidity Study and found that low reports of social support were more predictive of mental health problems for African Americans than for Caucasian Americans. Research regarding willingness to seek social support has also been extended to willingness to seek professional help for mental health concerns. In a study of 2,678 first-year college students from various ethnic groups, Sheu and Sedlacek (2004) found that although African Americans were more likely to seek help from friends and family than other groups, they were not more likely to see a counselor in the event of mental health concerns. Asian Americans were the least likely to endorse help-seeking behaviour and tended to use more avoidant strategies. Overall, students from minority groups were less likely than Caucasians to use mental health services, in spite of the higher prevalence of emotional difficulties noted in other studies. This may to some extent reflect mistrust for mental health services, which are predominately delivered by Caucasians and can be seen as oppressive by minorities (Sue & Sue, 2007; APA, 2003).

Ethnic/cultural differences clearly affect beliefs and attitudes related to dealing with stressors and mental health concerns. In addition, minority ethnic groups tend to differ from the dominant culture with respect to SES, level of education, and language (Sue & Sue, 2007). As such, their performance on measures of emotional distress and cognitive functioning administered by neuropsychologists could be expected to be discrepant from those of the dominant culture. This is important to consider when conducting neuropsychological assessment, as it is essential in drawing accurate conclusions when assessing minorities.

**Ethnic/Cultural Differences on the MMPI and the MMPI-2**

Ethnic and cultural differences have been demonstrated in rates of mental health problems (Anderson & Mayes, 2010) and in beliefs and attitudes related to stress responses (e.g., Hamid, 1994). Thus, it would be expected that individuals of different ethnic/cultural groups would differ with regard to response patterns on tests of personality and emotional distress. Based on results of studies concerning the MMPI and the MMPI-2, this appears to be the case. Hall, Bansal, and Lopez (1999) conducted an extensive meta-analysis of 31 years worth of studies involving MMPI and MMPI-2 scores across various cultural groups and found a number of differences. Their meta-analysis included data from comparisons of 1,428 African American males with 2,837 Caucasian males, 1,053 African American females with 1,470 Caucasian females, and 500 male Hispanic American males with 1,345 Caucasian males. African American males scored higher than Caucasian males on a number of scales, including those designed to determine whether the test-taker is responding in an honest and non-defensive manner (the L, F, K scales), as well as on some clinical scales. On the other hand, Caucasian males scored higher on African Americans on a number of other clinical scales. Similar results were observed with African American and Caucasian females. Hispanic males scored higher than Caucasian males on the L, F, and K scales, but lower on all clinical scales. In spite of the differences observed on many MMPI and MMPI-2 scales, Hall and colleagues noted that all differences represented small effect sizes and likely did not have clinical significance; even in studies that controlled for differences in

SES differences, effect sizes remained significant but small. Similar observations were made by Greene (2000), whose review of ethnic variation in MMPI and MMPI-2 response patterns found no consistent differences on any one scale in studies comparing Caucasians to African Americans or Caucasians to Hispanic Americans.

It appears that relatively few studies have been conducted regarding MMPI responses in ethnic groups beyond African Americans and Hispanics. In a non-clinical study, Stevens, Kwan, and Graybill (1993) compared the MMPI-2 scores of 25 foreign Chinese students and 21 Caucasian students at an American university. The questionnaire was administered in English for both groups and although clarification of unfamiliar words was offered, none of the Chinese or Caucasian students requested assistance. Stevens and colleagues found that Chinese males scored higher on the social introversion scale than Caucasian males, whereas Chinese females endorsed more items reflecting depression, defensiveness, lack of awareness of problems, and atypical gender interests than Caucasian females. However, the magnitude of differences was not presented and therefore the clinical utility of these findings are limited. Butcher, Cheung, and Lim (2003) cited results from other MMPI and MMPI-2 studies with Chinese and Korean respondents. These studies were conducted with published translations of the questionnaires constructed using a back-translation method. In a large-scale Chinese normative study of 1,553 males and 1,516 females, profiles tended to be elevated on the depression and schizophrenia scales relative to American normative data, whereas in the Korean studies cited respondents generally had elevated mean scores on clinical scales relative to American normative data. Once again, data regarding the magnitude of these differences were not presented. In a study of Asian American college students, Tsai and

Pike (2000) found that the MMPI-2 profiles of Asian American students who endorsed low levels of acculturation to the majority differed from those of Caucasian students on nine scales, while the profiles of Asian American students who endorsed high levels of acculturation did not differ from those of Caucasian students on any scales. Students who reported moderate levels of acculturation (i.e., bicultural) produced profiles which differed from those of Caucasian students on six scales. Based on these results, the authors suggested that level of acculturation should be considered when interpreting MMPI-2 profiles of Asian Americans and other clients of minority ethnocultural status.

In a study of the MMPI-2 profiles of 258 Native Americans, Pace, Robbins, Choney, Hill, Lacey, and Blair (2006) found elevations of more than 5 T-scale points relative to normative data on eight of the thirteen MMPI-2 basic validity and clinical scales. Greene (2000) reported similar findings, though he noted that there was little consistency in which scales were elevated across studies. Pace and colleagues suggested that differences of the magnitude observed in their study were not due solely to higher levels of emotional distress in the Native American sample, but may have been accounted for in part by cultural factors, such as differences in the interpretation of certain items and religious beliefs which would be considered unusual by majority group standards. It is also possible that the differences observed in these and some other studies cited were due to stress due to racial discrimination, cohort effects, SES, or some combination of these factors, and not due to ethnocultural differences per se. In any event, Pace and colleagues (2000) emphasized caution when using the MMPI-2 and other measures of emotional distress or personality with Native Americans and noted that a contextual understanding of the individual’s emotional functioning is important in the interpretation of personality measures. Similar recommendations were made in a review by Mesquita and Walker (2003), who cautioned that differences in what is normative across cultures with respect to emotions and interpersonal functioning should also be considered in personality assessment. For instance, they hypothesized that people from cultures with more emphasis on social order and social rules may display higher levels of anxiety, but that this is functional within their culture as it helps them maintain harmony in social relationships. Given the results of studies demonstrating ethnocultural differences in patterns of MMPI responding, it is important to consider cultural differences in the emotional assessment of diverse clients.

**Ethnic/Cultural Differences on Cognitive Tests**

Although clinical neuropsychologists are concerned with the assessment of emotional functioning, their primary role tends to be in the assessment of cognitive functions (Kolb & Whishaw, 2009). Taking into consideration the differences in education and language that often occur across ethnic/cultural groups, in addition to the differences in attitudes and worldview previously discussed, it is not surprising to find that the influence of culture on cognitive test results is even more pronounced than on tests of emotion and personality (Pedraza & Mungas, 2008). Indeed, in North America many neuropsychological tests produce biased results when used to assess individuals from many or most minority groups. This means that the scores produced when a test is administered to a member of a minority group do not mean the same thing that they would when the test is administered to individuals from the majority group and the scores are therefore less valid. For example, an English-language test designed to measure verbal memory would likely produce biased results when administered to someone who is not fluent in English, as it would be measuring English language familiarity more so than verbal memory. Although one could argue that it is unethical to use tests developed predominately with Caucasian native English-speakers to assess clients from different cultural and ethnic groups, it would also be unethical to avoid assessing minorities at all (Manly, 2008). Ideally, it would be best to use assessment measures which are relevant and appropriate to individuals of minority group status, but presently few such measures are available. As such, it is important to consider the influences of education, language, and ethnicity/culture when performing cognitive assessment with clients from minority groups. Fortunately, a great deal of literature is available regarding this issue to help guide neuropsychological practice.

Generally speaking, the literature regarding ethnicity/culture and cognitive assessment suggests that most tests developed and used by Western psychologists are biased against individuals from many minority groups. For example, in a 2001 meta-analysis of IQ scores across ethnic groups, Roth, Bevier, Bobko, Switzer, and Tyler found that African Americans scored one standard deviation below Caucasians in terms of Full Scale IQ (FSIQ), whereas Hispanic Americans scored two thirds of a standard deviation below Caucasians. Similar results were observed in a 2009 review of 19 studies of performance on Wechsler scales across cultures by Walker, Batchelor, and Shores. These authors noted that African Americans tended to score lower than Hispanics and Caucasians on Wechsler measures of verbal comprehension, perceptual skills, processing speed, and auditory memory. Hispanics, Asians, and Arab Americans scored lower than Caucasians on tests of vocabulary knowledge and verbal reasoning, but not on visuospatial measures. Dickens and Flynn (2006) found that African Americans scored 10 FSIQ points lower than Caucasians, while Neisser and colleagues (1996) found that

Native Americans and Hispanic Americans scored 7-8 verbal IQ (VIQ) points lower than Caucasians, but obtained equivalent performance IQ (PIQ) scores. On the other hand, Asian Americans scored 3-4 FSIQ points higher than Caucasians. In another review, Pedraza and Mungas (2008) pointed out that African American older adults were classified as cognitively impaired far more often when using Caucasian normative data than when African American norms were used. It is important to note that many of the studies cited in the above-mentioned reviews did not take into account sociodemographic factors; for instance, groups were not equivalent in terms of education or SES. The influence of these factors will be explored later in this section.

A common approach when performing cognitive assessment of minority individuals is to rely more heavily on non-verbal tests, with the goal of minimizing the influences of language and education, and therefore reducing bias (Rosselli & Ardila, 2008). However, there is nevertheless an association between education and scores on non-verbal measures which can result in biased results and cultural differences in the perception of test materials can also play an important role. For instance, individuals from certain cultures may be less familiar with pictorial representations of objects and may therefore have difficulty understanding tests that involve pictures. In their comparison of the performance of Greek individuals to British and American samples on visuospatial tests, Kosmidis, Tsotsi, Karambela, Takou, and Vlahou (2010) found that the scores of all three groups were similar on more concrete tests, but varied on more abstract tests, with the Greeks having advantages relative to the British and American samples in some cases and disadvantages in others. Rosselli and Ardila (2008) suggested that differences across cultures on non-verbal measures likely had more to do with education and socialization to stimuli similar to those used in the testing than to culture. In their review of relevant studies, they found that higher educational levels were associated with higher scores on non-verbal cognitive tests regardless of culture, and that individuals from different cultures with similar levels of education tended to have similar scores. Clearly, education plays a role in neuropsychological test performance. Furthermore, other studies have shown that language and acculturation also have important roles.

In a review of neuropsychological test data from 83 Caucasians, 31 African Americans, 30 Hispanics, and 17 Asians assessed at a hospital neuropsychological clinic, Boone, Victor, Wen, Razani, and Pontón (2007) found that although there were group differences on certain tests, these were significantly attenuated when acculturation (years resided in the US) was considered. Many of the differences observed tended to be dependent on language as well, with individuals with English as a second language scoring lower on tests of verbal functioning than native English speakers. Similarly, having attended school in the United States was associated with higher scores on certain measures. Acculturation has also been shown to be important in the cognitive test scores of African Americans. Kennepohl, Shore, Nabors, and Hanks (2004) gave an acculturation questionnaire to 71 African American patients at a TBI rehabilitation facility undergoing neuropsychological assessment and found that lower levels of acculturation to the dominant Caucasian culture were associated with lower scores on a number of tests. In the previously mentioned review by Walker and colleagues (2009), the authors found that higher levels of acculturation and education were associated with better scores on Wechsler measures.

A study of IQ test scores in South Africans by Shuttleworth-Edwards et al. (2004) showed that although White Africans (of European descent) had higher scores than Black Africans (of African descent) overall, highly educated Black and White Africans both had similar scores to the United States standardization group, regardless of first language. Lower education was associated with lower scores, especially in individuals who spoke English as a second language. Similar results were obtained by McCurry and colleagues (2001) in a sample of Japanese American older adults; lower education and having English as a second language were associated with lower scores on most measures.

In a study of acculturation, reading level, and neuropsychological test performance in older African Americans, Manly, Byrd, Touradji, and Stern (2004) found that reading level was the most influential predictor of cognitive test scores, beyond self-reported acculturation and years of education. This is consistent with the suggestion of Pedraza and Mungas (2008) that years of education are less important than quality of education in predicting cognitive test scores, as reading level, an index of educational quality, is more correlated with cognitive performance than years of education in some U.S. studies (Manly et al., 2004; Baird, Ford, & Podell, 2007). Although SES has been shown to correlate highly with IQ scores in some studies (e.g., Noble et al., 2007), others have shown that this correlation is diminished after years of education or educational quality are taken into account (e.g., Gasquoine, 1999).

Overall, it appears that the more an individual differs from the majority group normative sample for a given neuropsychological test in terms of having fewer years of education, poorer educational quality, lower SES, less acculturation, and having a first language other than English, the more likely that person is to obtain lower scores on these tests. Since these scores are lower by virtue of environmental influences and not individual differences in ability within a given culture, it is important to take these effects into account when interpreting assessment results with diverse individuals.

**Ethnic/Cultural Differences on Validity Measures**

As noted earlier in this review, the assessment of effort or performance validity has become an important aspect of neuropsychological assessment, and performance on neuropsychological instruments has been found to differ across ethnic/cultural groups. With these findings in mind, it is important to consider that scores on validity measures may be affected by factors related to ethnicity or culture. Unfortunately, very little research exists addressing this issue. In a 2012 review of concerns regarding the assessment of malingering, Faust, Ahern, Bridges, and Yonce identified a lack of information regarding the influence of ethnicity/culture as a major gap in knowledge. Of the more than 2800 published studies that the authors found in a search regarding malingering, only 1% of them mentioned culture or ethnicity. Information regarding ethnic/cultural differences on performance-based validity measures is particularly sparse. This is a major issue, as the few studies which have been conducted suggest that scores on these measures differ across ethnic groups. For instance, Salazar, Lu, Wen, and Boone (2007) examined the scores of ethnically diverse clients on nine measures of performance validity in outpatient neuropsychological assessment records and found that even when controlling for age and education, Hispanic clients ($n$ = 32) scored lower than Caucasian clients ($n$ = 85) on two of nine measures, and African American clients ($n$ = 32) scored lower than Caucasian clients on four of nine measures. The scores of Asian American clients ($n$ = 19) on performance validity indicators did not differ from those of Caucasian clients. Similarly, in a study of performance validity indicators in clients with fibromyalgia, Johnson-Greene, Brooks, and Ference (2013) found that Hispanic clients were more likely to score below cutoff on performance validity indicators than Caucasian clients.

Ethnic/cultural differences on self-report validity scales have received a greater extent of study than scores on performance validity indicators. However, the literature is still relatively limited and results are variable, with some studies finding differences and others finding comparable scores. Cheung, Song, and Butcher (1991) found that volunteers in China produced elevated scores on one validity scale (F) when using American norms, and a meta-analysis by Hall and colleagues (1999) found that African American males obtained higher scores on validity scales than Caucasian American males, though the differences were noted to be small. Pace and colleagues (2006) found that Native American responders produced elevated scores on validity scales in comparison to the predominately Caucasian normative sample. On the other hand, Tsushima and Tsushima (2009) found no differences on five MMPI-2 validity scales in Caucasian and Asian American respondents in a sample of patients in the process of injury litigation. DuAlba and Scott (1993) found no differences on the MMPI-2 dissimulation scale in Hispanic and Caucasian worker's compensation clients, while Dean and colleagues (2008) found no ethnic group differences on the Symptom Validity Scale (FBS; formerly Fake Bad Scale) in a sample of Caucasian, Hispanic, and African American clients. Interestingly, Sue, Keefe, Enomoto, Durvasula, and Chao (1996) found that scores on one MMPI-2 validity scale (F) were elevated for less-acculturated Asian college students relative to Caucasian students, but that the scores of highly-acculturated Asian students did not differ in comparison to Caucasian students.

Overall, there is very limited data suggesting that ethnic/cultural differences exist with regard to performance-based validity measures. Evidence with regard to scores on self-report validity measures is inconsistent, with some studies suggesting ethnic/cultural differences and others suggesting no differences. Results of one study suggest that acculturation plays some role in responses to self-report validity measures, though evidence remains limited.

**Ethnicity/Culture and Chronic Pain**

Cultural and ethnic differences have been shown to influence beliefs and attitudes (Hamid, 1994; Lu et al., 2000; Liang & Bogat, 1994), emotions (Anderson & Mayes, 2010; Hall et al., 1999), and cognition, which are factors implicated in the chronic pain experience (Pedraza & Mungas, 2008; Roth et al., 2001). Given the role of biopsychosocial factors in shaping the pain experience and the influence of culture on biopsychosocial factors, the role of culture is important to take into account when conceptualizing the presentation of a client with chronic pain. Substantial research in North America has demonstrated that individuals from minority groups are at greater risk for negative chronic pain outcomes such as greater pain intensity (Edwards, Fillingim, & Keefe, 2001; Nguyen et al., 2005), greater interference from pain in life (Green et al., 2003), and lower levels of employment (Fuentes et al., 2007). Individuals from minority groups also tend to have reduced access to health care services (Cintron & Morrison, 2006; Nguyen et al., 2005; Shavers et al., 2010), which would likely influence their chronic pain experience First, a survey of general data regarding chronic pain across ethnic/cultural groups will be presented, and following this section the role of cultural factors in shaping the pain experience will be explored.

**Prevalence of Chronic Pain across Ethnic/Cultural Groups**

A number of studies have investigated chronic pain prevalence across ethnic groups in the United States. Portenoy, Ugarte, Fuller, and Haas (2004) conducted a phone survey of 454 Caucasians, 447 African Americans, and 434 Hispanics and found that approximately one third of the respondents from each cultural group reported persistent pain, and one third of those who reported pain stated that it was disabling in nature. Although there was no difference in pain prevalence across groups, the nature of the pain experience was shown to vary by ethnicity. Caucasians tended to report lower levels of pain intensity overall, Hispanics indicated that they were less likely to visit a physician regarding their pain than the other groups, and African Americans were more likely to use prescription medication. Overall, disabling pain was associated with female gender, lower income, lower education, and being divorced. Although ethnicity was not a predictor of disability, the authors noted that individuals in the African American and Hispanic groups tended to have more risk factors for disabling pain. In a review of chronic pain studies with individuals of Native American ethnicity, Jiminez, Garroutte, Kundu, Morales, and Buchwald (2011) found an elevated prevalence of chronic pain conditions, including arthritis, neck pain, and headaches.

In another survey of 1,037 university undergraduates without chronic pain, Hastie, Riley, and Fillingim (2005) found no differences in the frequency of acute pain incidents that were experienced across African American, Hispanic, and Caucasian students, but once again there were differences with respect to the experience of pain. Caucasian students tended to engage in more self-care behaviours (e.g., exercise) than the other groups, whereas African American and Hispanic students reported the use of prayer to cope with painful experiences more frequently than Caucasian students. Hastie and colleagues noted that since their sample was made up of individuals without chronic pain, ethnic differences in methods of dealing with stressful situations exist prior to the onset of chronic pain and are not triggered by the chronic pain experience itself.

Overall, with the notable exception of Native Americans (Jiminez et al., 2011) it appears that rates of chronic pain do not differ across ethnic/cultural groups in the United States. However, prevalence studies and general surveys of chronic pain have produced results suggesting that culture influences the pain experience. This will be explored in the following section.

**Ethnicity/Culture and the Chronic Pain Experience**

Research regarding pain and culture is generally thought to have started with Zborowski's seminal 1963 text, *People in Pain.* In this book, the chronic pain experiences and reactions of four American cultural groups were compared and contrasted. Zborowski found that the groups differed in important ways: Irish Americans were most likely to deny and minimize pain, and Old Americans (those with multiple generations of American ancestry) also minimized pain but were more optimistic about their chance of recovery. On the other hand Italian Americans were highly expressive and not optimistic, whereas Jewish Americans were also highly expressive but more optimistic than Italians. Zborowski suggested that these different presentations occurred because the different cultural groups had varying attitudes regarding pain, which influenced their behaviours when experiencing pain. He also commented that similar pain-related behaviour did not necessarily reflect similar attitudes or social intentions across cultures. For instance, a person experiencing pain could be stoic and unexpressive because they do not wish to be perceived as weak, or because they do not wish to burden others with worry regarding their condition. Although few research studies regarding ethnicity/culture and pain were undertaken in the years immediately following the release of *People in Pain*, the literature regarding ethnic/cultural differences in the pain experience has become quite extensive in recent years (Keefe et al., 2002).

Although ethnic groups may not differ in terms of the prevalence of chronic pain, numerous studies attest to differences in the chronic pain experience. In a review of ethnicity and pain, Edwards, Fillingim, and Keefe (2001) cited research demonstrating that African Americans report higher levels of pain severity than Caucasians across a number of clinical conditions, including AIDS, glaucoma, and temporomandibular joint disorder. Riley and colleagues (2002) performed a large-scale survey of 1084 Caucasians and 473 African Americans with chronic pain at a university medical center and found that although reports of pain intensity did not differ across groups, African Americans reported higher levels of pain unpleasantness, negative emotional response, and greater frequency of pain behaviours. Between-groups differences in these variables remained significant even when accounting for pain duration and years of education. In another study of African American and Caucasian responses to chronic pain, Green, Ndao-Brumblay, Nagrant, Baker, and Rothman (2004) found that African Americans were more likely to have symptom presentations that suggested difficulties dealing with pain and negative emotional outcomes. African Americans have also been found to report more suffering, higher levels of disability, and more sleep disturbance than Caucasians, and to have more comorbid conditions in addition to chronic pain (Green, Baker, Sato, Washington, & Smith, 2003). In a survey of individuals experiencing chronic pain, Nguyen, Ugarte, Fuller, Haas, and Portenoy (2005) found that African Americans and Hispanics reported higher levels of pain severity than Caucasian Americans.

Looking beyond the United States, researchers have also explored the experience of chronic pain across different countries. In a 1992 survey of lower back pain patients in the United States, Japan, Mexico, Colombia, Italy, and New Zealand, Sanders noted differences across certain pain-related variables. For instance, pain patients in Mexico and New Zealand had fewer physical findings to explain their pain than patients in other countries, and patients in the United States, New Zealand, and Italy reported a greater degree of pain-related impairment in psychosocial, recreational, and vocational functioning than those in other countries. American patients endorsed the highest levels of dysfunction of all those surveyed. Sanders indicated that his findings were not due to differences in social class, age, gender, level of pain intensity, pain duration, or differences in medical findings. Overall, he attributed the differences in pain experience across countries to cultural differences in social expectations regarding pain and chronic pain in particular. However, Sanders also noted that attitudes or expectations regarding health care and health care availability may have influenced the results of his survey, and that differences in methods of dealing with pain were likely implicated as well.

Cleeland and colleagues (1996) conducted a survey regarding the impact of cancer pain in the United States, France, the Philippines, and China. These researchers found that pain severity and interference ratings did not differ across countries and that a spectrum of mild to severe pain was present across all groups surveyed with patients at the mild end reporting minimal interference and emotional distress, and those at the severe end reporting significant interference and distress. In contrast, a study by Nayak, Shiflett, Eshun, and Levine (2000) found that people in India had higher levels of pain tolerance than Caucasian Americans. Furthermore, Galanti (2000) found that Filipinos tended to be more stoic and non-expressive with regard to pain in comparison with Caucasian Americans. In summary, studies regarding chronic pain severity and the chronic pain experience across ethnic groups and in different counties have produced mixed results. Some studies have found differences in pain severity, pain interference, and other pain-related factors, whereas others have found fewer or no differences. Clearly, more work remains to be done before a consensus is reached.

In 2002, Edwards pointed out that most research up to that point was focused on describing ethnic/cultural differences in pain experience and suggested that efforts should be redirected toward studying why these differences existed. More recently, studies have begun to answer this question, and three main areas of focus have emerged: differences in pain perception across ethnic/cultural groups, differences in methods of dealing with pain across groups, and differences in the quality of and access to health care across groups. These areas will be explored in the following sections of this review.

**Influence of Culture/Ethnicity on Pain Perception**

One of the possible explanations regarding the differences in pain experience across cultural groups is biological diversity in pain perception. These differences have been observed across various cultural groups and various experimental protocols. For instance, Campbell, Edwards, and Fillingim (2005) assessed the experimental pain tolerance (time until discontinue requested) of 62 African Americans and 58 Caucasians in tourniquet ischemia (pressure), thermal heat, and cold pressor tests and found that African Americans had significantly lower pain tolerance across all three protocols. They also found that African Americans rated identical pain stimuli as more unpleasant and intense than Caucasian participants. A review by Edwards, Fillingim, and Keefe (2001) corroborated these findings across multiple studies. These findings were extended by

Mechlin, Maixner, Light, Fisher, and Girdler (2005), who found that the lower pain tolerance of African Americans relative to Caucasians remained constant whether the participants had a rest period prior to pain tolerance testing or whether they engaged in a challenging mental mathematics test shown to induce changes in endogenous and cardiovascular stress responses. Mechlin and colleagues measured participants' blood pressure, norepinepherine levels, and cortisol levels during the pain tolerance tasks. Previous studies had shown that stress-induced increases in these endogenous factors were associated with increased pain tolerance, and this held true in their study. However, physiological stress indicators were associated with less increase in pain tolerance for African Americans relative to Caucasians. The researchers suggested that this meant that endogenous pain regulation is less effective in African Americans than Caucasians, possibly because stress responses are decreased in African Americans due to habituation caused by higher overall levels of life stress.

Other researchers have linked responses to experimental pain procedures to cultural factors such as ethnic identity. Rahim-Williams (2007) tested the pain tolerance of 63 African Americans, 61 Hispanic Americans, and 82 Caucasian Americans across multiple experimental procedures, and also had them complete a self-report measure of ethnic identity. Rahim-Williams defined ethnic identity as the extent to which membership in an ethnic group is important in shaping an individual's self-concept. African Americans and Hispanic Americans demonstrated lower pain tolerance than Caucasians, but statistically controlling for the level of endorsed ethnic identity reduced the magnitude of the differences rendering some of them no longer significant. Stronger ethnic identity was associated with greater pain sensitivity, but only in the African

American and Hispanic groups. The findings of this study by Rahim-Williams suggest that stronger adherence to cultural values and attitudes within an ethnic minority group (i.e., less acculturation to the majority group) is associated with greater pain sensitivity.

In a study of experimental pain tolerance in individuals with chronic pain by Edwards, Daniel, and colleagues (2001), African American clients reported higher levels of clinical pain, as well as lower tolerance to experimental pain procedures. A small association was also observed between lower experimental pain tolerance and higher clinical pain severity. Interestingly, the magnitude of ethnic differences was greater for experimental pain procedures than for chronic pain severity ratings. This suggests that differences in chronic pain experience across ethnic/cultural groups are not entirely explained by physiological differences. As such, ethnic/cultural differences in pain-related beliefs and attitudes must be considered.

**Influence of Culture/Ethnicity on Beliefs and Attitudes**

As noted previously, certain beliefs and attitudes have been found to influence the chronic pain experience. Specifically, an external locus of control/low sense of control over pain (Jensen et al., 1991), low levels of support from others (Lee et al., 2007), and solicitousness of others (Newton-John, 2002) have been linked with negative physical and psychological outcomes. Since individualist and collectivist cultures differ with respect to locus of control (Hamid, 1994), and locus of control has been associated with differences in chronic pain outcomes (Jensen et al., 1991), it stands to reason that culture can affect chronic pain outcomes. Findings that cultural differences in beliefs and attitudes account for ethnic/cultural differences in experimental pain perception (Evans, Lu, Tsao, & Zelter 2009) also suggest a role of cultural in the chronic pain experience. A number of studies have explored this role.

In a 1998 study of women with rheumatoid arthritis attending an outpatient pain clinic, Jordan, Lumley, and Leisen examined beliefs regarding control in the pain experience of 48 African American women and 52 Caucasian women. Although no difference was found in self-reported pain severity or negative affect related to pain, African American women also reported a lower sense of control over pain than Caucasian women. Potentially related to this, Caucasian women tended to engage in more active methods of dealing with pain, such as exercise and ignoring pain while going about their daily activities, whereas African American women were more passive and used techniques such as distraction, prayer, and hoping for positive outcomes. Distraction-based methods of dealing with pain were associated with higher pain reports across both groups, and prayer was associated with lower activity levels. Although Caucasians and African Americans did not differ with respect to pain severity, these results suggest that African Americans may be more likely to use methods of dealing with pain that put them at risk for negative outcomes. Interestingly, Jordan and colleagues found that cognitive re-interpretations of pain were associated with lower pain and negative affect for Caucasians, but higher levels of pain and negative affect for African Americans. This suggests that not only do strategies of dealing with pain vary across ethnic/cultural groups, but the effectiveness of a given strategy can also be influenced by culture.

A similar conclusion was reached by Bates and Rankin-Hill (1994), who studied the association between locus of control and chronic pain outcomes in Old Americans, Hispanic Americans, Irish Americans, Italian Americans, French Canadians, Polish Americans, and Puerto Ricans. They found that the Hispanic American and Puerto Rican groups were most likely to endorse an external locus of control, and that external locus of control was associated with higher reports of pain intensity across most groups. However, in Old Americans and Polish Americans with chronic pain, an internal locus of control was associated with greater pain severity. Locus of control also impacted attitudes toward pain and treatment: an internal locus of control tended to be associated with less expression of pain and lower intensity of negative affect, whereas an external locus of control was associated with more negative attitudes toward treatment outcome and lower self-ratings of healthiness. In a follow-up of participants after 6-24 months of treatment, Bates and Rankin-Hill found that an increased sense of self control was beneficial for all participants, and that those who managed to gain a greater sense of control over pain reported decreases in pain severity and negative affect.

Perceived control over pain has been shown to be important in a number of multicultural studies of chronic pain. For example, Vallerand, Hasenau, Templin, and Collins-Bohler (2005) surveyed 98 African Americans and 183 Caucasian cancer patients regarding their chronic pain experience and found that although African Americans reported higher pain intensity, emotional distress, and pain-related interference, they also reported lower perceived control over their pain. When perceived control was held constant, between-group differences in emotional distress and pain-related interference were eliminated.

The role of perceived control over pain was further explored by Tan, Jensen, Thornby, and Anderson (2005) through the study of 128 African American and 354 Caucasian patients in a pain management program. African American participants reported lower perceived control over their pain, the use of more passive methods of dealing with pain, and a stronger belief that others should provide assistance when they were in pain. In addition, they endorsed higher levels of depression, disability, and pain interference even with pain severity controlled. The researchers found that passive methods of dealing with pain were associated with negative outcomes in both groups, and that generally speaking the coping factors that predicted physical and psychological well-being were similar across groups when demographic factors (age, gender, marital status, and education) were entered into their regression model. It appears that a sense of control over pain is important across ethnic/cultural groups, and that demographic factors must be accounted for when investigating cultural differences in chronic pain.

The importance of demographic factors in cross-cultural pain experience was emphasized in a study of 58 African Americans and 69 Caucasian Americans with lower back pain conducted by Cano, Mayo, and Ventimiglia (2006). Consistent with other studies, these researchers found that African Americans reported higher levels of pain severity, interference, and disability than Caucasians and also engaged in more avoidant and distraction-based methods of dealing with pain. However, between-groups differences in methods of dealing with pain were almost entirely eliminated when controlling for education, with the exception of the use of prayer/hoping. Cano and colleagues found that avoidant strategies, such as prayer, were associated with negative pain outcomes, whereas problem-focused strategies including ignoring pain and making positive self-statements were associated with better outcomes. Persons with chronic pain who had higher levels of education were more likely to use problem-focused methods of dealing with pain than those with lower levels of education, and in turn education was associated with better outcomes. Interestingly, re-interpreting pain was linked with reduced pain for those with higher education, but increased pain for those with lower education, a finding that once again suggests that methods of dealing with pain may be differentially effective across education levels as well as cultural groups.

Access to education can vary based on ethnicity and SES (Sue & Sue, 2007), which puts some minority groups such as African Americans and Hispanic Americans at greater risk for negative pain-related outcomes. Similarly, access to health care and quality of health care services received has been shown to vary across ethnic groups. This could also have a negative impact on pain outcomes, and will be explored in the following section.

**Ethnic/Cultural Differences in Access to Treatment and Treatment Process**

Access to and use of health care is important in determining health outcomes. If one is not able to make use of adequate health care services, it stands to reason that one will not have optimal health-related outcomes. Lower access to health care is associated with a higher risk of complications, unnecessary suffering, delayed healing, higher rates of disability, longer hospitalization, and increased medical costs (McNeill, Sherwood, & Starck, 2004). Unfortunately, a considerable amount of research has shown that ethnic differences exist with regard to access to and quality of health care services in the United States. Green and colleagues conducted a review of relevant literature in 2003 and found that ethnic minority pain patients were less likely to be prescribed medication, more likely to be prescribed lower doses of medication and to be given less powerful medication, and were more likely to face longer waits for pain services. Differences in access to care were noted across all settings reviewed, including post-operative care, emergency room care, and chronic pain clinics.

Another review by Ezenwa, Ameringer, Ward, and Serlin (2006) found that minorities had less access to health care than Caucasians in 10 of the 11 studies examined. In a study of patients admitted to a chronic pain treatment program in Canada, European groups were over-represented in the patient population, whereas the percentage of Indo-Pakistani and Chinese patients was lower than would be expected based on census results (Mailis-Gagnon et al., 2007). Overall, numerous researchers have suggested that minorities are more likely than Caucasians to have under-treated pain (Cintron & Morrison, 2006), to experience more unrelieved pain, and to be less satisfied with their treatment (Shavers, Bakers, & Sheppard, 2010).

In a telephone survey regarding chronic pain treatment, Nguyen and colleagues (2005) contacted 454 Caucasian Americans, 447 African Americans, and 434 Hispanic Americans and asked them questions regarding their usage of health care services and perceived access to services. Overall, Caucasians had the highest rate of perceived access to and actual usage of pain-related health care services, whereas Hispanics had the lowest level of access. Reduced health care access and use was associated with speaking primarily Spanish, male gender, younger age, single marital status, low income, low education, being employed, and concerns regarding finances. Conversely, higher rates of access and use were associated with being Caucasian or African American, older age, female gender, suburban residence, having health insurance, higher income, higher education, and unemployment. With that said, the gender differences observed in this study may reflect the fact that females tend to make more use of health care service than males (Bertakis, Azari, Helms, Callahan, & Robbins, 2000) instead of differences in access to services. Overall, Nguyen and colleagues found that both ethnic and demographic factors influenced access to care for chronic pain.

In a similar telephone survey, Meghani and Cho (2009) found that ethnicity was not related to health care access in chronic pain patients, and that demographic factors were more associated with usage than ethnicity. However, other studies have shown that controlling for SES does not completely eliminate ethnic group differences in health care access (Dressler, Oths, & Gravlee 2005), and it must also be noted that individuals from minority groups are more likely to have risk factors for low access (e.g., low education and low income) than Caucasian Americans (Fuentes, Hart-Johnson, & Green, 2007). Ethnicity and demographic factors both appear to play a role in access to health care services for persons with chronic pain, and therefore both should be taken into account when considering the influence of inadequate treatment in chronic pain outcomes. Investigation into other factors that account for ethnic differences in health care access have produced mixed results: Ezenwa and colleagues (2006) found that low patient expectations, communication barriers, and inadequate assessment techniques did not seem to account for differences, whereas others such as Bonham (2001) have suggested that differences in communication and assessment may be important in determining access to pain services. Two factors which have emerged as being important across studies are differences in treatment adherence and health care provider attitudes/prejudices (Green et al., 2003).

**Ethnicity/Culture, Attitudes toward Health Care, and Adherence**

Ethnic differences in attitudes toward treatment and treatment adherence have been observed in several studies. To explore these factors, Green, Baker, and Ndao-Brumblay (2004) conducted a mail survey of 101 African American and 136 Caucasian American individuals with chronic pain. They found that although both groups were likely to request referral to a pain specialist, African Americans were more likely to cite their pain as a major reason for money problems. Notably, even though the groups were superficially equivalent in terms of health coverage and possession of insurance, African Americans were more likely to have Medicaid, which is less likely to cover pain management treatment. As such, their financial concerns may have been related to a lack of coverage for pain treatment. Green and colleagues also found that African Americans were more likely to visit the emergency room for pain concerns, and that they were more likely to agree that ethnicity and culture influence access to health care and pain management. In a study of treatment adherence of 118 Caucasian and 68 African American patients undergoing headache treatment, Heckman and colleagues (2008) found that African Americans were less likely to complete the course of treatment than Caucasians. Although these results were not fully accounted for by SES differences, Caucasians with high SES had the highest rates of treatment completion. This was interpreted to mean that high SES makes it easier for Caucasians to remain in treatment, but the same is not necessarily true of African Americans. Overall, African American ethnicity, younger age, and lower SES were associated with early termination.

In a review of pain treatment with culturally diverse clients, Goldberg and Remy-St. Louis (1998) presented evidence that increased fear of pain (i.e., anxiety sensitivity) may lead to less willingness to pursue medical treatment. Villaruel (1995) found that Mexican Americans were less likely to seek treatment for pain due to their tendency to have an external locus of control and view pain as unavoidable, whereas Kodiath and Kodiath (1992) noted that Indian and American individuals with chronic pain attributed different meanings to their pain and therefore experienced it differently. Indian pain patients expressed the belief that it would be in poor character to be distracted by pain or hardship, and therefore continued to go about their activities to the extent possible. On the other hand, American patients tended to emphasize the search for a cure and expressed frustration that it had not yet been found. With respect to counseling and psychological treatment, Sue and Sue (2005) noted that minority clients may mistrust mental health professionals who are predominately of the majority group and can be viewed as discriminatory or insensitive to cultural differences. They indicated that treatment adherence tends to be better when the ethnicity of the client matches the ethnicity of the treatment provider. However, given that minority groups are under-represented in health care providers, this is often not possible.

Attitudes toward medication-based treatment have also received some study. For instance, Monsivais and McNeill (2007) reviewed the literature regarding this topic and found that non-adherence to medication correlated with high levels of concern regarding side effects, beliefs that medication should be effective quickly, and beliefs that medications become less effective when they are taken more often. They also presented evidence that certain ethnic groups, notably Asians in the United Kingdom and Mexican Americans, view medications as more harmful and therefore are less likely to adhere to prescribed medication regimens. Similarly, there is evidence that individuals from ethnic minority groups have more fear of addiction than Caucasian Americans (Shavers et al., 2010). This may be due to a tendency for minority individuals with an external locus of control to have lower perceived control over medication use and in turn elevated perceptions of potential for addiction. It is apparent that demographic and cultural factors affect access to treatment, and that patient beliefs and attitudes can affect their likelihood of treatment adherence. However, it is also important to consider the attitudes of health care providers in treating individuals from different ethnic/cultural groups.

**Attitudes and Prejudice of Treatment Professionals**

In their 2003 review of inequalities in pain treatment across ethnic groups, Green and colleagues noted that health care disparities are not attributable to any one factor: patient attitudes play a role, as noted above, as do the attitudes of health care providers. Health care providers are not free of culture themselves – they approach treatment and patient interactions with their own attitudes and biases, which are shaped partly through life experiences but also through their training. Given that the North American medical system is primarily focused on physical and biomedical aspects of health problems, it is perhaps not surprising that health care professionals can be insensitive to cultural differences in symptom presentation (Bonham, 2001). Lasch (2000) points out that medical personnel are generally not trained regarding cultural differences and their impact on treatment, and that attitudes toward health services vary depending on cultural perspectives. Minorities may view health care professionals as enforcers of majority beliefs and practices, and this can be viewed as oppressive by patients from minority groups (Sue & Sue, 2007). Feelings of being oppressed can result in distress on the part of the minority patient, who may be more likely to discontinue treatment (Goldberg & Remy-St. Louis, 1998). Unfortunately, beyond lack of training regarding the role of culture in symptom presentation, many studies also suggest that health care providers may treat ethnic minority patients differently due to racial prejudice or reduced sensitivity to the problems of individuals of different cultural backgrounds.

In a survey of patient and physician ratings of pain at 12 hospitals, Staton and colleagues (2007) found that physicians were twice as likely to underestimate pain in African American patients than Caucasians, and more likely to over-estimate pain in

Caucasians. This discrepancy suggests a bias in judging pain severity. Furthermore, Lasch (2000) cited nursing studies which have shown that in spite of equal reports of pain severity by Mexican American and Caucasian American clients, predominately Caucasian nurses tended to rate Caucasians as experiencing greater levels of pain. These results may have been due to differences in pain communication styles across ethnic groups or differences in sensitivity to symptom presentations and non-verbal cues presented by different ethnicities. However, health care providers have also been shown to differ in their treatment of ethnic groups in situations that do not involve communication styles or non-verbal cues. Nampiaparampil, Nampiaparampil, and Harden (2009) presented 90 physicians with treatment vignettes involving a patient experiencing lower back pain and lower extremity pain, and asked them to describe a treatment plan. Although the description of the client's symptoms was identical for all of the physicians, in half of the vignettes the client was a Caucasian man with Blue Cross insurance, whereas in the other half he was an African American with Medicaid. Overall, Nampiaparampil and colleagues found that physicians were less likely to prescribe opioid medications to the African American client. In addition, physician specialty, gender, ethnicity, and professional status were also shown to influence their treatment decisions.

Although patient/provider communication did not account for the results of the study of Nampiaparampil and colleagues (2009), communication between patients and providers is nevertheless important in chronic pain treatment and outcomes. Chang and Harden (2002) described a treatment situation in which a Chinese immigrant to the United States who had undergone a significant surgery did not ask for pain medication all day. Treatment providers assumed that he was not experiencing significant pain, but when his family came to visit in the evening they angrily confronted his nurse and asked why she had not given him medication. The client had not wanted to risk looking weak by asking for medication and chose to tell his family about his pain rather than his physician or nurse. Clearly this patient's stoic communication style negatively influenced his treatment – though overly expressive styles of pain communication can also have negative outcomes, as treatment providers sometimes assume that such clients are exaggerating and view their pain reports as less credible (Goldberg & Remy-St. Louis, 1998). Differences in pain expressiveness have been observed in a number of studies. Nayak and colleagues (2000) surveyed 110 students at American colleges and 119 students at Indian colleges and found that Indians were less accepting of pain expression; interestingly, they also showed higher pain tolerance than Americans on laboratory testing. The same pattern of stoicism regarding pain expression and increased pain tolerance relative to Americans was shown in Nepalese porters in a study by Clark and Clark (1990). In another study by Lipton and Marbach (1984), Jewish and Italian Americans were found to be more expressive of pain, whereas Old Americans and Irish Americans were more stoic and reticent. Native Americans have also been shown to be stoic regarding the expression of pain (Jiminez et al., 2011).

Difficulties in communication of pain severity and quality can also be the result of cultural differences in communication style. Cooper, Beach, Johnson, and Inul (2006) presented a review of observational studies of communication between Caucasian care providers and patients of minority ethnicity, and found some notable differences. For instance, physicians displayed less non-verbal attention, empathy, and courtesy in communicating with African American clients. They also tended to adopt a narrower biomedical attitude with African Americans, and were rated as more dominating and more negative in emotional tone. On the other hand, African Americans were noted to ask fewer questions, provide less information, and seek less clarification than Caucasian patients. Differences in language expression may also reflect differences in cultural conceptions of pain. Moore and Dworkin (1988) performed a survey of Chinese and American pain patients and health care providers regarding pain descriptors, and found that although all respondents agreed on some descriptors (e.g., severity, duration, and location), cross-cultural differences were also apparent. Most notably, American respondents were more likely to refer to physical and psychological aspects of pain, whereas Chinese respondents did not mention this dichotomy. Similar findings were noted by Bates, Rankin-Hill, and Sanchez-Avendez (1997), who found that mainland American pain patients and physicians tended to take a biomedical perspective on pain, whereas Puerto Rican patients and practitioners had a more biopsychosocial conceptualization. Consistent with these viewpoints, American patients and providers focused more on physical treatments (e.g., physical therapy and nerve blockers) than Puerto Ricans, who considered factors such as family, social situations, and emotions in the course of pain treatment. Patients at the Puerto Rican treatment centre were noted to be more satisfied with the care that they were receiving than those at the American clinic.

Overall, research suggests that is important to consider the patient's communication style (Goldberg & Remy-St. Louis, 1998), their conceptualization of the cause of her or his pain and the impact on the individual's life, as well as each person's treatment goals and desires (Lasch, 2000). Failure to do so may result in lower adherence to treatment or negative outcomes. Increased training regarding cultural differences would produce health care professionals with a higher degree of cultural competence, which would in turn be helpful in improving care for individuals from minority groups (e.g., Green et al., 2003, Sue & Sue, 2007).

CHAPTER 2

# Rationale, Design, and Methodology

## The Present Study

Current literature shows that chronic pain influences cognition (Hart et al., 2000) and emotion (e.g., Lumley et al., 2011), that ethnocultural differences are evident on neuropsychological tests and measures of emotional distress (Pedraza & Mungas, 2008), that culture influences beliefs and attitudes related to pain and response to pain (Edwards, Fillingim, & Keefe, 2001), and that acculturation influences methods of dealing with stressors (Noh & Kaspar, 2003). In addition, perceived control has been identified as an important determinant of pain-related outcomes (Jordan et al., 1998), as have perceived support from others (Lee et al., 2007), solicitous partner behaviour (Romano et al., 2002), age (Reitsma et al., 2012), gender (Ramage-Morin, 2008), level of education (Dionne et al, 2001), and SES (Dionne et al., 2001). However, it does not appear that any research has been conducted with respect to ethnocultural differences in chronic pain outcomes (pain severity, affective distress, and activity level) and pain-related variables (perceived control, perceived support, and partner solicitousness) in a neuropsychological assessment setting. Furthermore, most research concerning ethnocultural differences in chronic pain presentation has focused on African American or Hispanic individuals – data regarding pain outcomes of other ethnocultural groups is sparse. Finally, no research has been conducted regarding the degree to which ethnocultural differences in perceived control, perceived support, partner solicitousness, and demographic factors (age, gender, years of education, educational quality, and SES) influence chronic pain outcomes (pain severity, affective distress, and activity level). In order to provide optimal neuropsychological services to clients of minority ethnic status, a better understanding of these interactions is necessary.

To address these apparent gaps in the literature, the present study investigated ethnocultural differences in chronic pain outcomes (pain severity, affective distress, and activity level), pain-related variables (perceived control, perceived support, and partner solicitousness), and overall pain profiles in a sample of individuals who underwent neuropsychological assessment following closed head injury and who reported chronic pain at the time of assessment. When appropriate, demographic variables (age, gender, years of education, educational quality, and SES) were taken into account in the investigation of inter-group differences. Additional analyses determined whether the influence of pain-related variables (perceived control, perceived support, and partner solicitousness) and demographic variables (age, years of education, educational quality, and SES) on chronic pain outcomes (pain severity, affective distress, activity level, and processing speed) varies across ethnocultural groups. For example, the analyses addressed whether perceived life control has a greater impact on pain severity for Caucasian clients or for African American clients? The roles of acculturation-related variables and client nativity (i.e., Canadian-born vs. foreign-born) in determining chronic pain outcomes, pain-related variables, and overall pain profiles also were explored, as were ethnocultural group differences on performance validity measures and a self-report validity measure. The archival data set used in this study was collected at two sites: an outpatient neuropsychological assessment facility in Novi, Michigan, and a private neuropsychological practice in Edmonton, Alberta.

## Hypotheses

**Note regarding hypotheses.** The hypotheses of the present study are non-directional in nature. Directional hypotheses were not generated because there did not seem to be sufficient evidence from past research with which to make specific directional predictions. For example, few, if any studies appear to have been conducted with respect to chronic pain presentation in individuals of Aboriginal Canadian, East Asian, South Asian, Southeast Asian, and Middle Eastern clients. As such, it did not seem reasonable to make predictions regarding the pain presentation of individuals from these ethnocultural groups.

Although variables associated with chronic pain have been studied in some of the ethnocultural groups involved in the present study, evidence relating to these variables once again did not seem sufficient to inform directional hypotheses. For instance, while locus of control has been shown to have an effect on chronic pain presentation (Jensen et al., 1991) and to vary across ethnocultural groups (e.g., Hamid, 1994), the influence of locus of control with respect to how individuals from different ethnocultural groups deal with stress has been shown to vary on a situational basis (Lu et al., 2000). With these facts in mind, making predictions regarding chronic pain presentation based only on knowledge of locus of control in some ethnocultural groups did not seem prudent.

Given that using multiple non-directional hypotheses increases the risk of type 1 error (Bender & Lange, 2001) methods for reducing the possibility of type 1 error were employed in the statistical analyses employed in this study. These methods will be discussed in detail in the section regarding statistical analyses. Nevertheless, it is acknowledged that the use of multiple non-directional hypotheses increases the risk of type 1 error and that this is a limitation of the present study.

**Hypothesis 1.** Based on the results of past studies regarding ethnocultural differences in the chronic pain experience and studies of experimental pain, it was expected that ethnocultural differences would exist on measures of chronic pain outcomes (pain severity, emotional distress, and general activity). It was expected that these differences would exist even when taking into account demographic factors, specifically age, gender, years of education, educational quality, and/or SES. Cognitive outcomes of chronic pain were not compared across ethnocultural groups in this study because there is evidence that cognitive tests often are biased against ethnocultural groups other than the ones to which the test developers and the individuals making up the normative sample belong (Walker et al., 2009). As such, ethnocultural group differences in processing speed in individuals experiencing chronic pain would likely be attributable to factors other than chronic pain (i.e., bias).

**Hypothesis 2.** Given previous findings regarding ethnocultural differences in locus of control (Vallerand et al., 2005) and perceived support (Lincoln et al., 2003), it was expected that ethnocultural differences would exist on measures of pain-related factors, specifically perceived control, perceived support, and partner solicitousness. It was expected that these differences would exist even when taking into account demographic factors, specifically age, gender, years of education, educational quality, and SES.

**Hypothesis 3.** Given that ethnocultural group differences were expected on pain outcome measures (Hypothesis 1) and measures of pain-related factors (Hypothesis 2), it was also predicted that overall pain profiles would differ across ethnocultural groups.

**Hypothesis 4.** Based on the results of studies concerning ethnocultural differences in the influence of perceived control with regard to pain outcomes (Vallerand et al., 2005), it was expected that the influence of pain-related factors (perceived control, perceived support, and partner solicitousness), and demographic factors (age, years of education, educational quality, and SES) in predicting pain-related outcomes (pain severity, emotional distress, general activity, and processing speed) would vary across ethnocultural groups. In addition, pain outcomes (severity, affective distress) were used as predictors in some analyses when there was a theoretical reason to suggest that one pain outcome might influence another and the outcomes were correlated. For example, pain severity was used as a predictor of emotional distress, since pain has been shown to be associated with negative emotional outcomes (McWilliams et al., 2003). Processing speed is not addressed in Hypothesis 1 because ethnocultural group differences in cognitive test performance are not central to the research questions and any such differences likely would be due to potential bias, but it is addressed in Hypothesis 4 because differences in the influence of various factors on pain-related outcomes (including processing speed) are of interest.

**Hypothesis 5.** Given that level of acculturation has been associated with differences in methods of dealing with stressful situations (Noh & Kaspar, 2003), it was expected that differences on measures of chronic pain outcomes (pain severity, emotional distress, and general activity) would exist when comparing clients of East Asian, South Asian, Southeast Asian, and Middle Eastern background based on nativity (i.e., Canadian-born vs. foreign-born). It was expected that these differences would exist even when taking into account demographic factors, specifically age, gender, years of education, educational quality, and/or SES.

**Hypothesis 6.** Given that level of acculturation has been associated with differences in methods of dealing with stressful situations (Noh & Kaspar, 2003), it was expected that differences on measures of pain-related factors (perceived control, perceived support, and partner solicitousness) would exist when comparing clients of East Asian, South Asian, Southeast Asian, and Middle Eastern background based on nativity (i.e., Canadian-born vs. foreign-born). It was expected that these differences would exist even when taking into account demographic factors, specifically age, gender, years of education, educational quality, and/or SES.

**Hypothesis 7.** Since differences on pain outcome measures (Hypothesis 5) and measures of pain-related factors (Hypothesis 6) were expected when comparing clients of East Asian, South Asian, Southeast Asian, and Middle Eastern background based on nativity (i.e., Canadian-born vs. foreign-born), it was also predicted that overall pain profiles would differ across these groups.

**Hypothesis 8.** Given that level of acculturation has been associated with differences in emotional outcomes (Greene, 2000) and cognitive test performance (Boone et al., 2007), and methods of dealing with stressful situations (Noh & Kaspar, 2003), it was expected that acculturation-related variables would play a role in pain-related outcomes (pain severity, emotional distress, and general activity).

**Hypothesis 9.** Based on limited data regarding ethnocultural differences on performance-based validity tests (Salazar et al., 2007), it was expected that differences would be found on these measures across the ethnocultural groups in the current sample.

# Method

## Participants

Archival data were collected from existing databases at two sites: an outpatient neuropsychology clinic at the Rehabilitation Institute of Michigan Novi Center in Novi, Michigan and a private neuropsychology practice in Edmonton, Alberta. Approval to collect data from the Novi site was granted by the Rehabilitation Institute of Michigan/Wayne State University Institutional Review Board (IRB) and the University of Windsor Research Ethics Board (REB). Approval to collect data in Edmonton was granted by the clinician in possession of the data and the University of Windsor REB. Neuropsychological assessments conducted at both sites included an extensive battery of tests designed to detect impairment in a number of cognitive areas, as well as questionnaires to quantify emotional distress and chronic pain experience. Most clients at each site completed a similar battery of tests which were generally administered in a similar order, with variation based on factors such as fatigue, referral questions, availability of test materials, time constraints, or severe pain. Standard test lists for the Novi and Edmonton neuropsychological practices can be found in Appendix A.

## Demographic and Injury-Related Data

In addition to data from the measures described in the following section, demographic and injury-related information was also collected from each client's record. The data available varied somewhat by site, but generally included their self-reported ethnicity and heritage, age, gender, time since injury, years of education, marital status, native language, age at immigration (when relevant), country of birth, occupation, employment status, referral source, litigation status, insurance status (i.e., whether they were receiving benefits), type of injury (e.g., car accident vs. fall), duration of loss of consciousness (when available), length of post-traumatic amnesia (when available), Glasgow Coma Scale score (when available; Teasdale & Jennett, 1974), whether or not imaging results was available, initial and post-acute imaging results (when available), injuries sustained, location of chronic pain, and comorbid health conditions. Occupation class was used to code SES for both American and Canadian clients based on an index created by Ganzeboom, de Graaf, Treiman, and de Leeuw (1992) which was generated through analysis of educational and income characteristics of 73,091 workers in 16 countries. Some aspects of the demographic information that was collected were used as independent variables in data analysis and others aspects were used as screening variables. In cases in which English was not a client's first language, a note also was made if questionnaires and test instructions were translated by a professional interpreter during the assessment. Typically, the interpreter would read questionnaire items directly to the client, who would then respond orally. Questionnaires may have also been read to English-speaking clients when clients were not able to read them independently (e.g., due to low reading achievement or impaired visual acuity); however, this information was not recorded in the database. When applicable, data regarding the age at which clients began to learn English and their years of formal education in English were included.

Institutional Review Board approval from the Rehabilitation Institute of Michigan and Research Ethics Board approval from the University of Windsor was granted to collect data directly from physical client files at the Novi site. These files included an interview summary sheet containing information provided by clients in response to specific questions about their background and their closed head injury, as well as a neuropsychological report integrating self-report information along with information derived from other sources (i.e., medical record, past reports, correspondence with physicians, etc.). In some more recent files, copies of the medical record or other documentation were included in the files reviewed, but in most cases these documents were destroyed to minimize the space occupied by files. To ensure the accuracy of the demographic and injury-related data coded in the present study, both the interview summary sheet and the neuropsychological report were reviewed in the data collection process. In cases where self-report information conflicted with information derived from other sources, the information from other sources was coded. For example, if the client stated that they sustained a loss of consciousness during the interview but the neuropsychological report cited an ambulance record which denied a loss of consciousness, no loss of consciousness was coded in the data set.

Research Ethics Board approval to collect data directly from physical client files or to review neuropsychological reports was not granted for the Edmonton site. Research Ethics Board approval was granted to use information from a pre-existing electronic database with the permission of the practitioner who owns that database. As such, information was derived solely from this existing electronic database. This database included an extensive section summarizing demographic and injury-related information obtained primarily in the course of a clinical interview. Consultation with the neuropsychologist in possession of the data suggested that in some cases, especially when inconsistencies existed between self-report data and other sources or the client was uncertain of details (e.g., the length of their loss of consciousness), information from other sources, such as medical records, was also integrated into the database. However, the source of the information was not coded into the database. As such, it was not possible for the researcher to determine which information was obtained through the client's self-report and which was derived from other sources. Based on first-hand knowledge of data entry procedures at the Edmonton site and consultation with the clinician in possession of the data, it appears that most of the demographic and injury-related information coded in the database was obtained directly from clients during the interview.

**Inclusion and Exclusion Criteria.**

Data regarding the presence or absence of demographic and injury-related information were recorded for all clients at both sites. When the information available suggested uncertainty regarding a given demographic or injury-related variable (i.e., client stated they were unsure of duration of loss of consciousness), this was recorded in the database. Similarly, when the information available suggested that a given demographic or injury-related variable was not applicable to a particular client (i.e., no neuroimaging performed), this was reflected in the data coding. On the other hand, in cases when information was not available for a given demographic (i.e., field for duration of posttraumatic amnesia left blank) it was coded as missing data.

All clients included in the sample sustained a closed head injury and reported chronic pain. If the individual did not sustain a head injury, but rather was referred for assessment due to mental health concerns (i.e., post-traumatic stress disorder), chronic pain, or other neurological conditions (e.g., stroke, anoxia, toxin exposure) that individual was not included. Clients were only selected for inclusion in this database if they had sustained at most a mild TBI, as differences in chronic pain experience have been identified in individuals who sustained mild TBI and those who sustained moderate or severe TBI (Nampiaparampil, 2009). As such, clients were excluded if a review of available information suggested that they met any of the following criteria indicative of a more severe TBI: evidence that they sustained a skull fracture, a record of neuroimaging suggesting brain lesions, evidence of a loss of consciousness greater than 30 minutes in duration, evidence of post-traumatic amnesia more than 24 hours in duration, or evidence of an initial Glasgow Coma Scale of less than 13 (Ruff, Iverson, Barth, Bush, Broshek, & NAN Policy and Planning Committee, 2009).

In cases where information was inconclusive or unavailable regarding any one indicator of TBI severity (i.e., loss of consciousness, post-traumatic amnesia, skull fracture, neuroimaging, or Glasgow Coma Scale), clients were included in the sample as long as all other indicators suggested at most a mild TBI. For example, if a client reported that they were unsure of the duration of their loss of consciousness, they would be included if there was no evidence of skull fracture or brain lesions and they did not report a Glasgow Coma Scale score of below 13 or post-traumatic amnesia of more than 24 hours in duration. If information regarding multiple indicators of TBI severity was absent or inconclusive for a given client, data from that client were not included in the sample.

Clients were only included if they were at least six months post-injury. This was done to ensure that their pain was chronic rather than acute (Merideth, Ownsworth, & Strong, 2008) and because any cognitive deficits which may have resulted directly from their head injuries, which were mild at most, should have resolved by this point (Carroll et al., 2004). This was done in an attempt to ensure that the client's chronic pain experience and neuropsychological test performance were not primarily influenced by the head injury. Essentially, it was assumed that any negative pain-related, emotional, or cognitive outcomes were not due to direct cognitive effects of head injury, but instead due to other factors, including ethnocultural group status and other injuries sustained at the time of the head injury. With that said, factors aside from the actual blow to the head, such as chronic pain, emotional difficulties, and external incentives to perform poorly have been shown to prolong the presentation of cognitive problems following closed head injury (Reitan & Wolfson, 2000).

Clients were also excluded if they reported a previous head injury, or prior history of chronic pain, neurological condition, disability, learning problems, or significant psychological problems, or if they had previously undergone neuropsychological assessment as these factors may have influenced their chronic pain experience and neuropsychological test performance. Finally, only clients between the ages of 18 and 65 were included. Data from clients older than 65 were not included due to the higher possibility of age-associated neurodegenerative disorders in these individuals, which could impact the results of analyses regarding cognitive functioning (Kolb & Whishaw, 2009). Data from clients younger than 18 were not included as the cognitive abilities of these individuals are still developing, which could also affect results (Kolb & Whishaw, 2009), and because the test battery differed for younger clients.

The Novi and Edmonton samples will be described in detail at the outset of the Results section of this document.

**Measures**

**Pain measure.** The West Haven-Yale Multidimensional Pain Inventory (MPI; Kerns, 1985) – Version 2 was used to quantify clients' experiences of chronic pain across a number of dimensions. The MPI is a 61-item self-report questionnaire which includes 13 scales evaluating the impact of pain on a person's life, the responses of significant others to pain behaviour, and the respondent's present level of activity (Kerns, Turk, &

Rudy, 1985). Of particular relevance to the present study are the Pain Severity scale, which includes items regarding current and general pain intensity, the Affective Distress scale, which includes items quantifying emotional distress, the General Activity Level scale, which assesses the frequency that respondents perform a number of activities of daily living, the Life Control scale, which includes items regarding perceived control over pain and life in general, the Support scale, which includes items related to the client's perceived support from those close to them, and the Solicitousness scale, which includes items relating to solicitous partner behaviour. Raw scores from these six scales were used in the statistical analyses of the present study.

Responses to individual MPI items are made on seven-point Likert scales, with 0 representing low endorsement and 6 representing high endorsement (Kerns, Turk, & Rudy, 1985). No MPI scales or items are reverse-scored. That is to say, higher scores on a given scale or item represent higher levels of what that scale or item is measuring, regardless of whether high scores would be interpreted as favourable or unfavourable findings. For example, high scores on the Pain Severity scale indicate higher levels of pain severity, which would be viewed as an unfavourable finding, whereas high scores on the Life Control scale indicate higher levels of life control, which would be viewed as a favourable finding. The interpretation of MPI scales is quite qualitative and descriptive in nature, with consideration of elevations on each scale as well as the overall profile. Normative data were derived from a heterogeneous group of 6,532 individuals experiencing chronic pain (UPMC Pain Medicine Program, 2005). The normative data are not scaled by age, gender, or education. Using this normative data, it is possible to determine how a given client's MPI scale scores compare to those of other individuals experiencing chronic pain. To provide the reader with a metric for understanding the value of raw MPI scores, data demonstrating how raw scores for the MPI scales used in this study compare to mean scores from the normative data set (UPMC Pain Medicine Program, 2005) can be found in Table 1.

Table 1

*Z-Scores for Raw Multidimensional Pain Inventory Scores Based on Normative Data*

| | Raw Score | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Pain Severity | -3.40 | -2.60 | -1.80 | -1.00 | -.21 | .59 | 1.39 |
| Life Control | -2.24 | -1.50 | -.76 | -.02 | .73 | 1.47 | 2.21 |
| Affective Distress | -2.54 | -1.80 | -1.06 | -.31 | .43 | 1.18 | 1.92 |
| Support | -2.73 | -2.11 | -1.48 | -.86 | -.23 | .39 | 1.01 |
| Solicitousness | -2.19 | -1.55 | -.91 | -.27 | .37 | 1.01 | 1.65 |
| General Activity | -2.20 | -1.21 | -.22 | .77 | 1.76 | 2.74 | 3.73 |

*Note*. Normative data are freely available from "UPMC Pain Medicine Program. (2005). *MPI norms*. Retrieved from: http://www.pain.pitt.edu/mpi/MPI_Norms.pdf" and used with the permission of D.C. Turk. Normative data were derived from a heterogeneous group of 6,532 individuals experiencing chronic pain. This table does not include data from the present study and is only presented in order to provide a means of better understanding what raw scores mean in the context of pain assessment. For example, a raw score of 2 on the Pain Severity scale would convert to a *Z*-score of -1.82, or nearly two standard deviations lower than the mean for the normative sample of individuals experiencing chronic pain.

In addition to scale scores, overall profiles have also been derived for the MPI based on cluster analysis (Turk & Rudy, 1988). The three main clusters are labeled Dysfunctional, Interpersonally Distressed, and Adaptive Coper. Clients in the Dysfunctional cluster obtain high scores on Pain Severity, Interference, and Affective Distress, with low scores on Life Control and General Activity, and average scores on the Support and Solicitousness scales. Clients in the Interpersonally Distressed cluster have a similar profile and also obtain low scores on the Support scale. Clients in the Adaptive

Coper cluster, on the other hand, obtain low scores on Pain Severity, Interference, and Distress, with high scores on Life Control and General Activity, and average scores on the Support and Solicitousness scales. In addition to these three main clusters, three other profiles have been identified: Hybrid, which refers to a profile sharing characteristics of two main clusters, Anomalous, which refers to a profile that is significantly different from all three of the main clusters, and Unanalyzable, which refers to a profile which lacks the necessary scaled scores to assign a profile. Based on the researcher's experience using the MPI in a clinical setting, Unanalyzable profiles tend to occur when a client does not have a significant other and thus does not respond to items loading on interpersonal scales (including the Support and Solicitousness scales).

MPI construction was based on cognitive-behavioural conceptions of pain, and scales were constructed using factor analysis, with adjustments made when items did not load onto the intended scale. MPI scale scores were found to correlate well with those of other conceptually linked questionnaires – for instance, the Affective Distress scale score correlated with the Beck Depression Inventory and the State-Trait Anxiety Inventory scores - but not with results of pain severity questionnaires. Kerns and colleagues (1985) cited this as evidence of convergent and discriminant validity. Tan and colleagues (2002) found a strong correlation between the Life Control scale and pain-related outcomes, and noted that this scale was a better predictor of outcomes than scales specifically designed to address perceived control over pain. Internal consistency values for the MPI scales ranged from .70 to .90, and test-retest stability values ranged from .62 to .91, providing evidence of reliability (Kerns et al., 1985).

In a review of other studies regarding the factor structure of the MPI, Deisinger, Cassisi, Lofland, Cole, and Bruehl (2001) cited two studies which supported the factor structure proposed by the authors of the MPI. In another study, Wittink, Turk, Carr, Sukiennik, and Rogers (2004) studied the responses of 424 patients at a chronic pain treatment facility and found that Cronbach's alpha coefficients for the MPI scales ranged from .69 to .92, indicating good internal consistency. They noted that some MPI scales were sensitive to change following treatment and recommended it as a self-report pain questionnaire with good psychometric properties. Furthermore, the MPI profiles generated by Turk and Rudy (1988) have been replicated in other studies (Rudy, Turk, Zaki, & Curtin, 1989, Strategier, Chwalisz, Altamair, Russell, & Lehmann, 1997) and have been found to be generalizable to other instruments measuring the same constructs as the MPI (Jamieson, Rudy, Penzien, & Mosley, 1994; Strong, Ashton, & Stewart, 1994). Kerns and colleagues (1985) stated that the brevity, clarity, theoretical rationale, and multidimensional focus of the MPI are all assets, and Bradley, Haile, and Jaworski (1992) recommended the MPI as the best instrument for the assessment of chronic pain across multiple aspects of functioning.

Limited research regarding MPI responses of clients from diverse cultural backgrounds has produced varying findings. Some studies have found that African American respondents report higher levels of pain severity than Caucasian respondents (Edwards et al., 2001; Green, Baker, Sato, Washington, & Smith, 2003; Green, Baker, Smith, & Sato, 2003, Green et al., 2004; Tan et al., 2005; Cano, Mayo, & Ventimiglia, 2006), whereas other studies have shown no differences in pain severity (Edwards et al., 2005). Similarly, some studies have found that African American respondents report lower levels of life control than Caucasian respondents (Edwards et al., 2001; Green, Baker, Sato, Washington, & Smith, 2003; Green Baker, Smith, & Sato, 2003, Green et al., 2004), whereas other studies have shown no differences in life control (Tan et al., 2005). Finally, some studies have found that African American respondents report lower levels of activity or higher levels of life interference than Caucasian respondents (Jordan, Lumley, & Leisen, 1998; Cano, Mayo, & Ventimiglia, 2006), while other studies have shown no differences on these measures (Edwards et al., 2001). One study including Hispanic Americans, African Americans, and Caucasian Americans found no differences with respect to pain severity, life interference, or activity levels (Edwards et al., 2005). MPI profiles or scale scores from other ethnocultural groups were not found during the literature review for the present study.

**Summary measure of cognitive ability.** The Wechsler Adult Intelligence Scale (WAIS) Full Scale IQ (FSIQ; Wechsler, 1997) was used as an overall measure of cognitive ability for descriptive purposes. The majority of clients at both sites were administered the WAIS. All clients tested with the WAIS at the Novi site and most clients at the Edmonton site were administered the Wechsler Adult Intelligence Scale – 3rd Edition (WAIS-III; Wechsler, 1997), although clients at the Edmonton site assessed before the release of the WAIS-III were administered the Wechsler Adult Intelligence Scale – Revised (WAIS-R; Wechsler, 1981). The FSIQ is a composite score derived from scores on WAIS subtests tapping verbal, visuospatial, working memory, and processing speed abilities (Sattler & Ryan, 2008). It has been found to have high internal consistency ($r$ = .98) and test-retest reliability ($r$ = .96), as well as high criterion validity in the form of correlations with other overall measures of overall intellectual ability, including the

Stanford-Binet 4 ($r$ = .88; Wechsler, 1997). Overall, the WAIS has been described as "the gold standard in intelligence testing" (Strauss et al., 2006, p. 283).

Meta-analyses and reviews of FSIQ scores across ethnocultural groups have shown significant variability (Roth et al., 2001; Walker et al., 2009), with individuals of non-Caucasian background typically obtaining lower scores. Lower FSIQ scores have been demonstrated in African American participants (Dickens & Flynn, 2006), Hispanic American, and Native American participants (Neisser et al., 1996), whereas Asian Americans have been found to obtain higher FSIQ scores than Caucasian Americans (Neisser et al., 1996). Years of education, educational quality, and English language familiarity appear to play a role in determining FSIQ scores (McCurry et al., 2001).

**Processing speed measure.** Processing speed has been shown to be affected by chronic pain (e.g., Hart et al., 2000), and performance on the Wechsler Adult Intelligence Test (WAIS) Digit-Symbol Coding subtest has specifically been shown to be influenced by acute and chronic pain (Etherton, Bianchini, Heinley, & Greve, 2006). As such, age-scaled scores from this subtest were used as a measure of processing speed in the present study. As with the FSIQ, data generated using the version of Digit-Symbol Coding from the Wechsler Adult Intelligence Scale – 3rd Edition (WAIS-III) were collected for all clients administered the WAIS in Novi and most clients in Edmonton, while data from the version of Digit-Symbol Coding from the Wechsler Adult Intelligence Scale – Revised (WAIS-R) were collected for clients who were assessed before the release of the WAIS-III in Edmonton. Digit-Symbol Coding is a timed task requiring the test taker to copy symbols paired with numbers as quickly as possible (Sattler & Ryan, 2008). Although there is a memory component to this task with regard to remembering the pairings of symbols and numbers, performance on Digit-Symbol Coding has been shown to be more associated with speed than memory skills. Sattler and Ryan (2008) cited test-retest reliability coefficients of .84 for Digit-Symbol Coding, whereas Strauss and colleagues (2006) noted that this subtest has moderate correlations with other processing speed measures. Overall, Digit-Symbol Coding appears to be a reliable and valid measure of processing speed, which may be affected by chronic pain.

Although Digit-Symbol Coding is a non-verbal task, that does not necessarily mean that it is not culturally biased (Rosselli & Ardila, 2008). With that said, ethnocultural group performance will not be compared on this measure as differences in cognitive functioning are not central to the present study. Therefore any cultural bias which may exist in Digit-Symbol Coding should not affect analyses. As noted previously, given the wide range of years from which client data were collected in Edmonton (1991-2011), some clients were administered the Wechsler Adult Intelligence Scale – Revised (WAIS-R), whereas others were administered the Wechsler Adult Intelligence Scale – 3rd Edition (WAIS-III). Since age-scaled scores for the WAIS-R and WAIS-III versions of Digit-Symbol Coding correlate highly with one another ($r$ = .77; Wechsler, 1997) and Digit-Symbol Coding scores were used only in regression analyses, not direct comparisons, this was not thought to be a major concern. Analysis of data from other cognitive domains such as verbal memory and verbal working memory was considered, but many tests requiring verbal responses were not administered to individuals with English as a second language due to concerns that the results would have been invalid. As such, there was not sufficient data to conduct such analyses with most of the minority ethnocultural groups.

**Measures of word-reading ability.** Word reading has been identified as a good proxy measure for quality of education (Noble et al., 2007), which has been shown to affect chronic pain outcomes (Dionne et al., 2001). The Wechsler Test of Adult Reading (WTAR; The Psychological Corporation, 2001) was used as a measure of word reading at the Novi site and the Wide Range Achievement Test – 3rd Edition (WRAT-3; Wilkinson, 1993) Reading subtest was used at the Edmonton site. Raw scores for the WTAR and scaled scores for the WRAT-3 Reading subtest were used for statistical analyses in this study. Raw scores were used for the WTAR, as scaled scores are normed by ethnicity and this would minimize the sensitivity to differences in educational quality. On the other hand, WRAT-3 scores are not normed by ethnicity, and therefore such differences would not be minimized. In addition, raw WRAT-3 Reading scores were not coded into the Edmonton database and as such were not available to the researcher. Given that the word reading scores of clients at each site were not directly compared, this discrepancy should not present a concern in terms of data analysis.

In both the WTAR and the WRAT-3 Reading subtest, the test taker is presented with a list of English words and told to read as many as possible until they make a certain number of consecutive errors or reach the end of the list (Strauss et al., 2006). The WTAR has excellent internal consistency, ranging from .90 to .97 depending on age group, and the WRAT-3 Reading subtest has high internal consistency at .86. Both the WTAR and WRAT-3 Reading are stable after TBI and correlate highly with measures of premorbid VIQ and FSIQ; as such, they are commonly used to provide estimates of intellectual functioning prior to brain injury (Strauss et al., 2006). WTAR and WRAT-3 scores can be influenced by regional differences in pronunciation, as well as differences in language background (i.e., level of experience with English; Strauss et al., 2006).

**Measures of emotional distress.** The MMPI-2 Welsh Anxiety (A) Scale was used to provide one measure of emotional distress. The MMPI-2 is the most widely used and researched personality inventory and is viewed as the "gold standard" for personality assessment (Greene, 2000). The MMPI-2 consists of 567 true or false questions which load onto 10 clinical scales, four validity scales, and a wide variety of additional scales. The A scale was developed through factor analysis of MMPI items and represents the first factor which was derived. This scale is made up of 39 items and has been variously described as capturing anxiety and general maladjustment (Greene, 2000). It correlates strongly with a number of MMPI-2 clinical scales and is viewed as the best single measure of emotional distress on the MMPI-2 (Nichols, 2001). Although specific findings regarding scores on the A scale across ethnocultural groups were not found in the literature review, ethnocultural differences in MMPI and MMPI-2 scores have been found in a number of studies. With that said, differences generally have not been consistent across studies, with variability in which scales differ and the magnitude of the differences (Hall et al., 1999; Greene, 2000). Some studies have found that respondents who endorsed lower levels of acculturation to American culture produced profiles which differed more markedly from those of Caucasian respondents (e.g., Tsai & Pike, 2000).

Unfortunately, the MMPI-2 was not administered to many individuals with English as a second language due to concerns that the results would have been invalid, and therefore data from the A scale are limited in these groups. As such, the MPI Affective Distress scale was employed as another measure of emotional distress, as the MPI was administered to all of the clients in the sample. Correlations between the

MMPI-2 A scale and the MPI Affective Distress scale for clients who completed both measures were moderate in both the Novi ($r = .61$, $p < .0005$; Dunn- Šidák correction) and Edmonton samples ($r = .42$, $p < .0005$; Dunn- Šidák correction), which suggests that these scales are measuring similar factors.

**Validity measures.** Consistent data regarding stand-alone performance validity measures were not available in the data collected, as the measures used varied on a case-by-case basis and changed over the years at both sites. In addition, stand-alone performance validity test data were not input into the electronic database in Edmonton. However, data available from both the Novi and Edmonton test batteries included results from tests from which useful intra-test performance validity measures can be derived.

The first of these measures, Reliable Digit Span, is derived from the WAIS Digit Span subtest by summing the length of the longest digit strings successfully recalled on both trials of the forward and backward subcomponents (Greve, Bianchini, & Brewer, 2013). Low scores on this measure (cutoff ≤7; Etherton, Bianchini, Greve, & Heinly, 2005) are associated with suboptimal effort. Reliable Digit Span has been validated as a measure of performance validity in a number of clinical samples, including chronic pain and TBI (Etherton et al., 2005). Digit Span performance has been shown to vary somewhat with age; individuals aged 16-44 tend to recall spans of seven digits in length forward and five digits in length backwards, whereas those aged 45-65 recall spans of six digits in length and four digits in length backwards (Wechsler, 1997). Males have been shown to perform slightly better on Digit Span than females in a meta-analysis (Lynn & Irwing, 2008), and education and ethnicity have been shown to affect performance on the

WAIS (Strauss et al., 2006). As such, age, gender, education, and ethnocultural group membership could potentially influence scores obtained on Reliable Digit Span.

The second performance validity indicator employed in this study was the Trails A raw score. Trails A is a pencil-and-paper processing speed task in which the client must connect numbered circles in order as quickly as possible (Strauss et al., 2006), and particularly slow completion of this task is associated with invalid neuropsychological performance (cutoff ≥63 seconds; Berry & Schipper, 2008). Time to complete Trails A increases significantly with age, but gender has been shown to have little impact on this test (Strauss et al., 2006). Lower levels of education have been associated with worse scores on Trails A, and performance on this measure has also been shown to vary across ethnocultural groups. As such, age, education, and ethnocultural group membership could potentially influence performance on Trails A when it is used as a measure of performance validity.

The third performance validity measure, Finger Tapping Combined raw score, is calculated by summing raw scores for each hand on the Finger Tapping Test, a measure of motor speed (Backhaus, Fichtenberg, & Hanks, 2004). Especially low scores on this measure are associated with invalid neuropsychological test performance (cutoff ≤71 taps; Backhaus et al., 2004). Older age has been associated with slower performance on the Finger Tapping Test, and males have been found to outperform females on this task (Strauss et al., 2006). Education has a small effect on Finger Tapping Test scores. Some ethnocultural group differences have been found, with Caucasians outperforming African Americans in one study, while another study with Mexican and Caucasian American participants did not find group differences (Strauss et al., 2006). With these findings in mind, age, gender, and ethnocultural group membership could potentially influence scores on Finger Tapping Combined.

The fourth performance validity measure, California Verbal Learning Test (CVLT) Recognition Hits, is derived from the recognition trial of a verbal list-learning task (Curtis, Greve, Bianchini, & Brennan, 2006). As with the previously noted measures, low scores on this measure are associated with invalid test performance (cutoff ≤10 out of 16 correct; Curtis et al., 2006). Although data from both the CVLT and CVLT- 2nd Edition (CVLT-2) were included in the Edmonton data set, researchers have found that Recognition Hits is a reliable indicator of performance validity on both editions of this test (Curtis, Greve, Bianchini, & Brennan, 2006). CVLT scores have been shown to decline with age, and education has a moderate correlation with CVLT scores (Strauss et al., 2006). Although females tend to outperform males on many aspects of the CVLT, no differences were found with respect to recognition measures. Ethnicity has not been found to affect CVLT scores (Strauss et al., 2006), though it could be assumed that since the test is administered in English, individuals with English as a second language would be at a disadvantage. As such, age, education, and ethnocultural group membership could potentially influence scores on CVLT Recognition Hits.

Details regarding the score cutoffs used for each performance validity measure and the sensitivity and specificity of each measure in detecting suboptimal effort at these cutoffs is contained in Table 2.

Table 2

*Validity Measures Embedded in Test Battery*

| | *Cutoff* | *Sensitivity* | *Specificity* |
|---|---|---|---|
| Reliable Digit Span [a] | ≤7 | .82-.90 | 42-76% |
| Trails A raw score [b] | ≥63 | 11-40% | 92-100% |
| Finger Tapping Combined raw score [c] | ≤71 | 100% | 32% |
| CVLT Recognition Raw Hits [d] | ≤10 | 34% | 90% |

*Note*. Sensitivity and specificity in the present study may vary from the values in this table due to demographic differences between the present study and the studies in which these values were obtained [a] Data from "Etherton, J.L., Bianchini, K.J., Greve, K.W., & Heinly, M.T. (2005). Sensitivity and specificity of Reliable Digit Span in malingered pain-related disability. *Assessment, 12(2),* 130-136. Copyright 2008 by the American Psychological Association. [b] Data from "Berry, D.T. & Schipper, L.J. (2008). Assessment of feigned cognitive impairment using standard neuropsychological tests. In R. Rogers (Ed.), *Clinical Assessment of Malingering and Deception (3rd Ed;* pp 237-254*).* New York: Guildford Press." Copyright 2008 by the Guildford Press. [c] Data from "Backhaus, S.L., Fichtenberg, N.L., & Hanks, R.A. (2004). Detection of sub-optimal performance using a floor effect strategy in patients with traumatic brain injury. *The Clinical Neuropsychologist, 18*, 591-603." Copyright 2004 by Taylor & Francis. [d] Data from "Curtis, K.L., Greve, K.W., Bianchini, K.J., & Brennan, A. (2006). California Verbal Learning Test Indicators of Malingered Neurocognitive Dysfunction. *Assessment, 13(1),* 46-61." Copyright 2006 by the American Psychological Association.

Limited research regarding ethnocultural differences in scores on performance validity measures suggests that non-Caucasian respondents generally obtain lower scores. African American clients have been found to score below cutoff on more performance validity measures than Caucasian clients (Salazar et al., 2007), as have Hispanic American clients (Salazar et al., 2007; Johnson-Greene et al., 2012). On the other hand, one study found that the scores of Asian American clients on performance validity measures did not differ from the scores of Caucasian Americans (Salazar et al., 2007).

Performance validity data were used in two ways. First, in an attempt to ensure that the Digit-Symbol Coding scores used in the analyses were valid and not unduly influenced by suboptimal effort, an overall index of performance validity was generated. Each participant's score on the validity measures was coded as above cutoff (0) or below cutoff (1), and the total number of scores below cutoff was calculated for each client. Since not all clients completed all of the validity measures, the sum of scores below cutoff was divided by the number of validity measures administered to produce a score for percentage of scores below the cutoff. Based on the recommendation of Strauss et al. (2006) that scoring below cutoff on two of three (66%) of validity measures administered should raise concerns regarding suboptimal effort, the scores of clients who scored below cutoff on more than 50% of the validity measures were not included in Digit-Symbol Coding analyses. Scores of clients who had not completed any of the embedded validity measures were also omitted. Secondly, the performance validity composite was used in analyses regarding performance validity across ethnocultural groups.

Self-report scores (i.e., MPI and MMPI-2) were not screened for effort using the performance validity index for two reasons. First, validity on performance-based cognitive tasks does not appear to be strongly correlated with over-reporting of psychological symptoms on self-report measures (Van Dyke et al., 2013). As such, using a performance validity index to screen out over-reporting on self-report measures did not seem appropriate. Secondly, and more importantly, the focus of analyses regarding self-report measures was on what was reported, regardless of possible exaggeration. That is to say, response tendencies on a given self-report measure were of research interest whether they were due to legitimate concerns or due to potential exaggeration. On the other hand, Digit-Symbol Coding was being used as a measure of processing speed, and the focus of analyses using this measure was on processing speed alone, without the impact of possible exaggerated or feigned difficulties.

In addition to performance validity measures, analyses were also conducted using the MMPI-2 Symptom Validity Scale (FBS; formerly Fake Bad Scale). This scale was developed specifically to detect over-reporting of psychological and somatic consequences of an injury while minimizing psychological concerns not related to the injury, as well as minimizing pre-injury psychological concerns (Larrabee, 1998). A review by Greve, Bianchini, and Brewer (2013) suggested that the FBS is generally not elevated in patients who do not have external incentives to appear disabled due to injury, regardless of injury severity. Bianchini, Etherton, Greve, Heinly, and Meyers (2008) found that the FBS had high sensitivity (.70) and specificity (.95) in discriminating between patients who were diagnosed as malingering and those who were not. A 2010 meta-analysis of 32 studies by Nelson, Hoezle, Sweet, Arbisi, and Demakis compared FBS scores of 2218 patients who were identified as over-reporting injury-related distress and 3123 patients who were not over-reporting and found a large omnibus effect size. These researchers suggested that their results support the use of the FBS scale in forensic neuropsychological assessment.

Studies of ethnocultural differences on MMPI and MMPI-2 validity scales, including the FBS, have produced inconsistent results. Some studies have found that clients of minority ethnocultural groups produce higher scores than Caucasian respondents on validity scales (Cheung et al., 1991; Hall et al., 1999; Pace et al., 2006), while other studies have found no such differences (DuAlba & Scott, 1993; Dean et al. 2008; Tsushima & Tsushima, 2009). One study found that acculturation played a role in scores on validity scales, with Asian American respondents who reported greater acculturation to American culture obtaining scores similar to Caucasians, while those who reported less acculturation obtained higher scores than Caucasians (Sue et al., 1996).

**Measure of somatization.** The MMPI-2 Hypochondriasis (Hs) T-score was used as a proxy measure for somatization in this study, as it has been shown to correlate with tendencies to somatize (Wetzel et al., 1999). The MMPI-2 Hs scale is thought to capture excessive concerns regarding bodily functioning (Greene, 2000). The Hs scale has high test-retest reliability and has been shown to correlate highly with other measures of physical and somatic concerns (Greene, 2000). Past research on MMPI and MMPI-2 responses of individuals experiencing chronic pain has found elevations on the Hs scale (Deardorff, Chino, & Scott, 1992; Strassberg et al., 1992), and the Hs scale has been shown to effectively discriminate between individuals experiencing chronic pain and matched controls (Slesinger, Archer, & Duane, 2002).

### Procedures

As noted previously, data from the Novi site were collected directly from the files of patients – permission to conduct this study, including a Health Insurance Portability and Accountability Act (HIPAA) waiver was obtained from the Rehabilitation Institute of Michigan/Wayne State University IRB to allow for collection of data from confidential files. Files of clients who met the inclusion criteria and completed the relevant measures were identified and data were coded by this researcher. No identifying information was coded into the database: client names and dates of birth were omitted, and each client was assigned an identification number for the purposes of this study. An electronic spreadsheet listing client names and associated identification numbers was maintained on a computer at the Rehabilitation Institute of Michigan Novi Center until data collection was completed, at which time it was deleted. Data from clients assessed between January

1, 2001 and June 30, 2011 were collected.

Client demographics and test scores at the Edmonton site are stored in password-protected electronic databases. Before data collection began, the neuropsychologist in possession of the data exported all of the data into a spreadsheet and removed identifying information including names and dates of birth. Client numbers previously assigned by the neuropsychologist at the Edmonton site initially remained in the database, but new identification numbers were assigned for the purposes of this study. Once this process was completed, the original client numbers were deleted from the new research database. An electronic spreadsheet listing original client numbers and associated new identification numbers was maintained on a computer at the Edmonton site until data collection was completed, at which time it was deleted. Once the anonymized database was generated, cases relevant to the present study were identified based on whether the clients in question fit inclusion criteria and completed the relevant measures. Data from clients assessed between January 1, 1991 and December 31, 2011 were collected.

**Ethnocultural group assignment.** For the Novi sample, ethnocultural group assignment was straightforward. Only clients who were born in America were included in this sample. Clients who described themselves as Caucasian or White were placed in one group, whereas those who identified themselves as African American or Black were placed in the other group. Although clients from other ethnocultural groups were also tested in Novi (i.e., Hispanic, Asian American), there were not sufficient numbers to form other groups.

The process of ethnocultural group assignment was somewhat more involved for the Edmonton sample. Clients born in Canada who self-identified as Caucasian or White and spoke English as a first language were assigned to one group. Those who were born in Canada and self-identified as Aboriginal or Native Canadian were assigned to another group. Clients who identified their ethnicity as Asian were divided into East Asian and Southeast Asian groups based on their self-reported heritage (i.e., country of origin or parents' country of origin) using United Nations (2013) area divisions. Clients who identified as Indian or Pakistani in ethnicity and heritage were placed into a South Asian group, again using United Nations (2013) criteria. Finally, clients who identified their heritage as Middle Eastern were assigned to another group. Some of the clients in the East Asian, Southeast Asian, and Middle Eastern groups were foreign-born, whereas others were Canadian-born. In an attempt to avoid introducing even more complexity into the group assignment, minority clients who were born and/or raised in countries not associated with their heritage were not included in the sample with the exception of clients born in Canada. For example, a client who identified as East Asian who was born in Germany and subsequently immigrated to Canada would not be included. Additional details regarding client heritage and language characteristics will be provided in the results section.

To avoid potential confounding effects related to country of residence and differing measures of reading ability at the Novi and Edmonton sites, separate statistical analyses were conducted for each site.

CHAPTER 3

# Analysis of Results

## Statistical Analyses

Given the large number of statistical analyses conducted in this study, a significance level of $p < .01$ was used for most analyses instead of the conventional $p < .05$ in order to reduce the chance of type I error. For Hypothesis 4, which was exploratory in nature and in which interaction effects were difficult to detect due to the relatively small size of some of the ethnocultural group samples, a significance level of $p < .05$ was employed so that potentially meaningful interactions would not be overlooked. When multiple comparisons were conducted at once (i.e., correlation tables), the Dunn- Šidák correction was employed to further reduce the chance of type I error. This correction was applied analysis-by-analysis and corrected *p* values are dependent on the number of comparisons conducted in a given analysis. Therefore, the *p* values employed in each multiple comparison analysis were variable and will be presented in this document accompanying the analyses in question. All *p* values are two-tailed. Effect sizes for ANOVAs are reported as Pearson's *r*, with $r = .10$ generally considered to represent a small effect, $r = .30$, a medium effect, and $r = .50$, a large effect, as suggested by Cohen (1988).

Although some data were missing from the data sets used in this study, missing values were not imputed because the missing data were not random in nature. Missing data tended to occur for two reasons: first, clients who did not have a significant other often did not respond to the questions comprising the MPI Support and Solicitousness scales, which ask about the responses of a significant other when the client is in pain. As such, it did not seem prudent to impute scores on scales based on relationships with significant others for clients who denied having significant others. The second principal reason for missing data was that clients undergoing assessment at the Edmonton site who had English as a second language and were not fluent in English often did not complete measures known to be biased against individuals with low English fluency. For example, many clients with English as a second language were not administered the WRAT Reading subtest, as the results of this test would be biased due to their language background. It did not seem prudent to impute data which may have varied depending on level of English fluency when limited information regarding fluency was available.

**Description of Samples**

First, demographic information, injury-related information, pain outcomes, reading test results, FSIQ, and pain-related variables were explored in order to determine whether any trends existed in the overall sample or in the various ethnocultural groups. Specifically, the demographic and injury-related variables in question were: age, gender, years of education, job classification based on Ganzeboom and colleagues' (1992) index, referral source, litigation status, mechanism of closed head injury, length of loss of consciousness, and length of post-traumatic amnesia. Pain outcome and pain-related variables considered in this section included raw scores from the MPI scales described above (Severity, Life Control, Affective Distress, Support, Solicitousness, and General Activity), as well as duration of chronic pain, location of pain based on sites defined by the International Association for the Study of Pain (IASP; Kerns, 1985), the Digit-Symbol Coding age-scaled score, and the MMPI-2 A T-score.

Differences in demographics between ethnocultural groups were quantified using independent samples t-tests for numeric variables in the Novi sample and analyses of variance (ANOVAs) for the Edmonton sample, and chi-squared analyses for nominal variables in both samples. For Edmonton demographic ANOVAs which revealed a significant main effect of ethnocultural group, pairwise comparisons were employed to ascertain which specific groups differed from the others. Caucasian clients were used as the reference group for these comparisons, given that they made up the majority of the sample and most pain research has been geared at understanding pain in Caucasian clients of European origin. Although this approach could be viewed as ethnocentric, there did not appear to be compelling evidence to suggest using another group as the reference group, and conducting pairwise comparisons using each group as the reference group would have required a number of analyses judged to be excessive.

Following the completion of demographic analyses, Pearson product-moment correlations were used to identify relationships between demographic variables, pain outcomes, and pain-related variables, and to assist in selecting covariates for analyses of covariance (ANCOVAs), as well as predictors for regression analyses.

**Novi Sample Characteristics**

The Novi sample was composed of 79 Caucasian clients and 74 African American clients. The Caucasian and African American groups from the Novi sample did not differ in terms of age, percentage of male and female clients, years of education, job classification, or duration of pain. Differences were observed in WTAR raw score and Full Scale IQ. The Caucasian sample had significantly higher scores on both variables Refer to Table 3 for additional information.

Table 3

*Novi Sample Characteristics with p-values for Comparisons*

| | Caucasian American ($n$ = 79) | African American ($n$ = 74) | *p-value* |
|---|---|---|---|
| Age | 44.23 (10.92) | 44.80 (10.91) | .747 |
| Percent female | 60% | 62% | .735 |
| Years of education | 12.52 (2.15) | 12.81 (2.21) | .408 |
| Job classification [a] | 43.63 (14.03) | 42.39 (15.82) | .608 |
| Duration of pain (months) | 38.29 (61.99) | 30.61 (44.04) | .381 |
| WTAR [b] raw score | 28.71 (8.77) | 23.24 (8.36) | <.001 |
| Full Scale IQ [c] | 93.88 (12.68) [d] | 82.66 (10.49) [e] | <.001 |

*Note.* With exception of percent female scores are represented as Mean (SD).
[a] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. Social Science Research, 21, 1-56." Copyright 1992 by Elsevier. [b] Wechsler Test of Adult Reading. [c] Based on Wechsler Adult Intelligence Scale – 3rd Edition. [d] $n$ = 77. [e] $n$ = 70.

More clients at the Novi site were referred by medical staff (i.e., a physician or nurse care manager; 48% of Caucasian clients and 45% of African American clients) than by other referral sources (i.e., lawyers or insurance companies), and the Caucasian and African American groups did not differ with respect to referral source, $\chi^2$ (3) = 2.60, $p$ = .457. A large proportion of clients were engaged in litigation regarding their injuries (49% of Caucasian clients and 44% of African American clients) and the Caucasian and African American groups did not differ with respect to litigation status, $\chi^2$ (3) = 1.89, $p$ = .595. Refer to Tables 19 and 20 in Appendix B for details.

**Pain Characteristics for Novi Clients**

More clients in both ethnocultural groups reported pain in multiple IASP sites (37% of Caucasian clients and 43% of African American clients) than in any single site, and the Caucasian and African American groups did not differ with respect to location of pain, $\chi^2$ (7) = 4.30, $p$ = .745. Refer to Table 21 in Appendix B for additional details. Unadjusted scores for the pain outcomes and pain-related measure of interest are presented in Table 4.

Table 4

*Novi Sample Unadjusted Scores on Pain Outcomes and Pain-Related Measures*

| | Caucasian American ($n$ = 79) | | African American ($n$ = 74) | |
|---|---|---|---|---|
| | Male ($n$ = 32) | Female ($n$ = 47) | Male ($n$ = 28) | Female ($n$ = 46) |
| MPI [a] Pain Severity | 4.24 (1.38) | 4.21 (1.19) | 4.11 (1.46) | 4.63 (1.05) |
| MPI Affective Distress | 4.02 (1.32) | 4.08 (1.21) | 3.45 (1.53) | 3.86 (1.19) |
| MPI General Activity | 1.36 (.73) | 1.61 (.95) | 1.66 (1.05) | 1.16 (.89) |
| MMPI A [b] T-score | 64.07 (13.57) [e] | 59.74 (10.42) [f] | 64.87 (14.09) [g] | 61.74 (11.47) [h] |
| MPI Life Control | 2.13 (1.34) | 2.61 (1.30) | 3.24 (1.43) | 2.55 (1.32) |
| MPI Support | 4.25 (2.00) [i] | 4.52 (1.67) [j] | 4.37 (1.72) [k] | 4.21 (1.79) [l] |
| MPI Solicitousness | 3.91 (1.41) [m] | 4.10 (1.51) [n] | 3.37 (1.91) [o] | 4.33 (1.61) [p] |
| WAIS [c] Coding SS [d] | 8.25 (2.66) | 8.62 (3.47) | 6.14 (1.20) | 7.15 (2.49) |

[a] Multidimensional Pain Inventory. [b] Minnesota Multiphasic Personality Inventory – 2nd Edition Welsh's Anxiety T-score. [c] Wechsler Adult Intelligence Scale – 3rd Edition. [d] Digit-Symbol Coding scaled score. [e] $n$ = 28. [f] $n$ = 46. [g] $n$ = 23. [h] $n$ = 43. [i] $n$ = 28. [j] $n$ = 42. [k] $n$ = 23. [l] $n$ = 40. [m] $n$ = 27. [n] $n$ = 40. [o] $n$ = 21. [p] $n$ = 36.

**Head Injury Characteristics for Novi Clients**

The majority of clients sustained their head injuries in motor vehicle accidents (72% of Caucasian clients and 60% of African American clients), and the Caucasian and African American groups did not differ with respect to mechanism of injury, $\chi^2$ (3) = 3.60, $p$ = .165. Refer to Table 22 in Appendix B for additional details. Information regarding absence of skull fracture was available for all clients. Reference to negative neuroimaging findings was found in 30 of 79 cases in the Caucasian group and 26 of 74 cases in the African American group; the availability of this information did not vary by group, $\chi^2$ (1) = .13, $p$ = .716. The extent of missing information regarding neuroimaging raises the possibility that some clients may have experienced undiagnosed mild complicated TBI, which could lead to lingering cognitive or behavioural problems that would not be present in a typical case of mild TBI (Kashluba, Hanks, Casey, & Millis, 2008). However, given that there was no difference in the amount of missing neuroimaging information for African American and Caucasian clients, there is no reason to suspect differences in the rate of possible mild complicated TBI across groups.

Information regarding duration of loss of consciousness and post-traumatic amnesia was converted to a nominal scale for analysis. This was done because clients reported a wide range of values on these variables, and because some clients stated that they were uncertain regarding the exact duration. When clients reported a range of values for duration of loss of consciousness or post-traumatic amnesia, data were coded to reflect the highest value that they reported (i.e., 5 to 10 minutes would be coded in the nominal category including 10 minutes). Most clients sustained no loss of consciousness (43% of Caucasian clients and 35% of African American clients) or a brief loss of consciousness (less than one minute; 30% of Caucasian clients and 29% of African

American clients), and the Caucasian and African American groups did not differ with respect to duration of loss of consciousness, $\chi^2$ (5) = 5.42, $p$ = .367. Refer to Table 23 in Appendix B for additional details. Most clients experienced no post-traumatic amnesia (47% of Caucasian clients and 40% of African American clients) or a brief period of post-traumatic amnesia (less than one minute; 27% of Caucasian clients and 25% of African American clients), and the Caucasian and African American groups did not differ with respect to duration of post-traumatic amnesia, $\chi^2$ (3) = 5.19, $p$ = .159. Refer to Table 24 in Appendix B for additional details.

**Novi Correlations**

Statistically significant correlations were observed between a number of descriptive, pain outcome, and pain-related variables; see Table 11 for details. Due to the large number of correlations calculated, the Dunn-Šidák correction was employed to reduce the probability of Type 1 error. Demographic variables including age, years of education, job classification, and WTAR raw score did not correlate strongly with pain-related variables, nor with the MMPI A T-Score, but the WTAR raw score correlated significantly with the Digit-Symbol Coding scaled score. Duration of pain did not correlate significantly with any outcome variables. Scores on MPI Severity, Life Control, Affective Distress, and General Activity correlated highly with each other, and Severity, Life Control, and Affective Distress correlated strongly with the MMPI A T-Score. The MPI Support and Solicitousness scales correlated highly only with each other. None of the pain-related factors and outcomes aside from MPI Severity correlated significantly with Digit-Symbol Coding scaled score.

Table 5

*Novi Sample Correlations between Demographic Variables and Variables of Interest (N = 153)*

| | MPI Severity | MPI Control | MPI Distress | MPI Support | MPI Solicit | MPI Activity | Coding SS | MMPI A |
|---|---|---|---|---|---|---|---|---|
| Age | -.05 | .05 | -.16 | .15 | -.06 | -.04 | -.03 | -.14 |
| Years of education | -.23 | .06 | -.08 | -.09 | -.14 | .03 | .10 | -.13 |
| Job classification [a] | -.16 | -.02 | -.01 | -.02 | -.02 | -.03 | .23 | -.11 |
| WTAR [b] raw score | -.19 | -.03 | .02 | -.04 | -.13 | .15 | .29* | -.12 |
| Duration of pain (months). | -.04 | -.04 | -.001 | -.05 | -.07 | .05 | -.05 | .15 |
| MPI [c] Severity | - | -.30* | .47* | .03 | .27 | -.46* | -.31* | .30* |
| MPI Control | -.30* | - | -.56* | .07 | -.11 | .40* | -.03 | -.46* |
| MPI Affective Distress | .47* | -.56* | - | -.16 | .20 | -.31* | -.02 | .61* |
| MPI Support | .03 | .07 | -.16 | - | .65* | .01 | -.05 | -.21 |
| MPI Solicitousness | .27 | -.11 | .20 | .65* | - | -.13 | -.09 | .05 |
| MPI General Activity | -.47* | .40* | -.31* | .01 | -.13 | - | .24 | -.26 |
| WAIS [d] Coding SS [e] | -.31* | -.03 | -.02 | -.05 | -.09 | .24 | - | -.07 |
| MMPI A [f] T-score | .30* | .-.46* | .61* | -.21 | .05 | -.26 | -.07 | - |

*Note.* Age, years of education, job classification, and WTAR raw score are demographic factors. Duration of pain, MPI Control, MPI Support, MPI Solicitousness are pain-related factors. MPI Severity, MPI Affective Distress, MPI General Activity, Coding SS, and MMPI A T-score are chronic pain outcomes.
[a] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56." Copyright 1992 by Elsevier. [b] Wechsler Test of Adult Reading. [c] Multidimensional Pain Inventory. [d] Wechsler Adult Intelligence Scale – 3rd edition. [e] Digit-Symbol Coding scaled score. [f] Minnesota Multiphasic Personality Inventory – 2nd Edition Welsh's Anxiety T-score.
* correlation significant at p < .0005 (Dunn-Šidák correction)

### Edmonton Sample Characteristics

The Edmonton sample consisted of 681 Caucasian clients, 61 Aboriginal Canadian clients, 41 East Asian clients, 62 South Asian clients, 37 Southeast Asian clients, and 54 Middle Eastern clients. The ethnocultural groups from the Edmonton sample differed with respect to percentage of male and female clients, years of education, job classification, WRAT Reading scaled score, and FSIQ. Pairwise comparisons using Caucasian clients as the reference group revealed that Aboriginal clients had fewer years of education than Caucasian clients, while East Asian clients had more years of education than Caucasian clients. Aboriginal clients had lower job classifications than Caucasian clients; and Aboriginal, South Asian, and Middle Eastern clients had lower WRAT Reading scaled scores than Caucasian clients. With regard to FSIQ, the scores of Aboriginal, South Asian, Southeast Asian, and Middle Eastern clients were lower than those of Caucasian clients. Visual inspection of the data suggested that the percentage of female clients was relatively higher in the East Asian group, while it was relatively lower in the Middle Eastern group. Refer to Table 6 on the following page and Tables 25 to 28 in Appendix B for additional information.

Table 6

*Edmonton Sample Characteristics with p-values for Comparisons*

| | Caucasian ($n$ = 681) | Aboriginal ($n$ = 61) | E Asian ($n$ = 41) | S Asian ($n$ = 62) | SE Asian ($n$ = 37) | Middle East ($n$ = 54) | $p$-value |
|---|---|---|---|---|---|---|---|
| Age | 37.31 (11.85) | 33.02 (12.79) | 40.60 (13.56) | 38.76 (11.48) | 38.38 (10.59) | 36.08 (10.98) | .025 |
| Percent female | 53% | 44% | 63% | 48% | 49% | 22% | <.001 |
| Years of education | 12.34 (2.38) | 10.10 (2.07) | 13.88 (3.89) | 12.81 (3.37) | 11.51 (3.04) | 12.52 (3.14) | <.001 |
| Job classification [a] | 48.03 (20.98) [d] | 36.96 (15.42) [e] | 53.13 (15.61) [f] | 45.23 (16.36) | 40.83 (13.01) [g] | 45.23 (14.70) [h] | <.001 |
| Duration of pain (months) | 36.14 (29.54) | 26.81 (17.43) | 37.88 (30.45) | 36.22 (21.84) | 30.76 (22.29) | 27.91 (17.73) | .044 |
| WRAT Reading SS [b] | 94.64 (10.61) [i] | 87.47 (12.31) [j] | 90.69 (16.88) [k] | 85.71 (13.59) [l] | 90.53 (10.96) [m] | 82.71 (13.45) [n] | <.001 |
| Full Scale IQ [c] | 97.82 (11.67) [o] | 89.09 (9.71) [p] | 97.50 (13.81) [q] | 86.16 (13.89) [r] | 86.57 (15.00) [s] | 82.36 (10.70) [t] | <.001 |

*Note.* With exception of number of participants and gender, scores are represented as *M (SD).*
[a] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56." Copyright 1992 by Elsevier.
[b] Wide Range Achievement Test Reading subtest – 3rd edition scaled score.
[c] Based on Wechsler Adult Intelligence Scale – Revised or 3rd Edition.
[d] $n$ = 677. [e] $n$ = 57. [f] $n$ = 40. [g] $n$ = 36. [h] $n$ = 53. [i] $n$ = 569. [j] $n$ = 55. [k] $n$ = 26. [l] $n$ = 41. [m] $n$ = 19.
[n] $n$ = 45. [o] $n$ = 661. [p] $n$ = 58. [q] $n$ = 28. [r] $n$ = 44. [s] $n$ = 21. [t] $n$ = 55.

The vast majority of the Edmonton clients were referred for assessment for legal purposes (94% of Caucasian clients, 97% of Aboriginal clients, 100% of East Asian clients, 100% of South Asian clients, 95% of Southeast Asian clients, and 100% of Middle Eastern clients), and no difference in referral source was observed by ethnocultural group, $\chi^2$ (15) = 11.300, $p$ = .731. Refer to Table 29 in Appendix B for additional details.

More clients in all ethnocultural groups reported pain in multiple IASP sites (48% of Caucasian clients, 54% of Aboriginal clients, 46% of East Asian clients, 37% of South Asian clients, 46% of Southeast Asian clients, and 43% of Middle Eastern clients) than in any single site, and the ethnocultural groups did not differ with respect to location of pain, $\chi^2$ (35) = 34.378, $p$ = .498. Refer to Table 30 in Appendix B for additional details. Unadjusted scores for the pain outcomes and pain-related measure of interest are presented in Table 7.

Table 7

*Edmonton Sample Unadjusted Scores on Pain Outcomes and Pain-Related Measures*

| | Caucasian (*n* = 681) | | Aboriginal (*n* = 61) | | E Asian (*n* = 41) | | S Asian (*n* = 62) | | SE Asian (*n* = 37) | | Middle Eastern (*n* = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male (*n* = 323) | Female (*n* = 358) | Male (*n* = 34) | Female (*n* = 27) | Male (*n* = 15) | Female (*n* = 26) | Male (*n* = 32) | Female (*n* = 30) | Male (*n* = 19) | Female (*n* = 18) | Male (*n* = 42) | Female (*n* = 12) |
| MPI [a] Pain Severity | 3.46 (1.31) | 3.84 (1.18) | 3.47 (1.37) | 3.78 (.98) | 3.56 (1.34) | 3.86 (1.48) | 4.20 (1.21) | 4.19 (1.15) | 3.91 (1.12) | 4.91 (.77) | 4.59 (.83) | 4.53 (.99) |
| MPI Affective Distress | 3.49 (1.10) | 3.66 (1.11) | 3.61 (.81) | 3.51 (1.32) | 3.89 (1.28) | 3.81 (1.10) | 3.64 (.99) | 3.97 (1.25) | 3.77 (1.04) | 3.80 (1.13) | 4.00 (.94) | 4.238 (.74) |
| MPI General Activity | 2.55 (.95) | 2.59 (.84) | 2.87 (1.00) | 2.46 (.80) | 2.54 (1.02) | 2.27 (1.07) | 1.77 (1.06) | 1.94 (.94) | 2.37 (1.15) | 2.08 (1.00) | 1.73 (.95) | 1.74 (.98) |
| MMPI A T-score [b] | 56.17 (12.62) | 54.97 (11.36) | 61.62 (12.85) | 58.69 (11.81) [i] | 62.43 (10.61) | 52.69 (10.17) | 56.65 (15.87) | 55.35 (11.54) | 59.00 (11.34) | 54.30 (13.06) | 65.12 (12.56) | 55.80 (14.10) |
| MPI Life Control | 3.13 (1.24) | 2.95 (1.25) | 2.78 (1.16) | 2.64 (1.34) | 2.62 (.99) | 2.82 (1.16) | 2.79 (1.29) | 2.73 (1.41) | 2.63 (1.44) | 2.31 (1.44) | 2.44 (1.23) | 2.38 (1.27) |
| MPI Support | 4.19 (1.47) | 4.16 (1.37) | 4.20 (1.38) | 4.40 (1.47) | 4.33 (1.38) | 4.16 (1.59) | 4.38 (1.65) | 4.97 (1.42) | 4.20 (1.40) | 4.33 (1.36) | 4.59 (1.19) | 4.60 (1.12) |
| MPI Solicit. [c] | 3.07 (1.46) | 3.40 (1.44) | 3.24 (1.11) | 3.98 (1.51) | 3.36 (1.56) | 4.01 (1.32) | 4.02 (1.73) | 4.60 (1.26) | 3.84 (1.33) | 3.83 (1.23) | 3.81 (1.34) | 4.22 (1.31) |
| WAIS [d] Coding SS [d] | 8.25 (2.52) | 9.87 (2.74) | 7.21 (2.38) | 8.40 (2.20) | 10.85 (2.79) | 9.65 (3.50) | 6.20 (2.01) | 8.17 (2.48) | 7.44 (2.98) | 6.50 (2.58) | 6.83 (2.68) | 7.18 (2.44) |

*Note*. There were missing values within each gender and ethnicity group. The observed *n* for pain outcomes and pain-related measures for Caucasian males ranged from 278 to 323; for Caucasian females, from 321 to 358; for Aboriginal males ranged from 26 to 34; for Aboriginal females from 16 to 27; for East Asian males from 7 to 15; for East Asian females from 13 to 26; for South Asian males from 17 to 32; for South Asian females from 20 to 30; for Southeast Asian males from 5 to 19; for Southeast Asian females from 10 to 18; for Middle Eastern males from 25 to 42; and for Middle Eastern females from 5 to 12.

[a] Multidimensional Pain Inventory. [b] Minnesota Multiphasic Personality Inventory – 2$^{nd}$ Edition Welsh's Anxiety T-score. [c] Solicitousness. [d] Wechsler Adult Intelligence Scale – Revised or 3$^{rd}$ Edition. [e] Digit-Symbol Coding scaled score.

**Head Injury Characteristics for Edmonton Clients**

Most clients sustained their head injuries in motor vehicle accidents (94% of Caucasian clients, 98% of Aboriginal clients, 98% of East Asian clients, 94% of South Asian clients, 95% of Southeast Asian clients, and 100% of Middle Eastern clients), and the ethnocultural groups did not differ with respect to mechanism of injury, $\chi^2$ (10) = 14.29, $p$ = .160. Refer to Table 31 in Appendix B for additional details. Information regarding absence of skull fracture was available for all clients. The presence of neuroimaging data was not found to vary by ethnocultural group, $\chi^2$ (10) = 21.89, $p$ = .016. Refer to Table 32 in Appendix B for additional information. As with the Novi data set, the extent of missing information regarding neuroimaging raises the possibility that some clients may have experienced undiagnosed mild complicated TBI, but given that there was no difference in the amount of missing neuroimaging information across ethnocultural groups, there is no reason to suspect differences in the rate of possible mild complicated TBI across groups.

Information regarding duration of loss of consciousness and post-traumatic amnesia was converted to a nominal scale for analysis, as described in the section regarding head injury characteristics for Novi clients. The duration of loss of consciousness was variable in the Edmonton sample, but the ethnocultural groups did not differ with respect to duration of loss of consciousness, $\chi^2$ (35) = 50.69, $p$ = .042. Refer to Table 33 in Appendix B for additional details. Duration of post-traumatic amnesia was quite variable in the Edmonton sample as a whole, though there was a tendency for relatively brief periods of post-traumatic amnesia. The ethnocultural groups did not differ with respect to duration of post-traumatic amnesia, $\chi^2$ (30) = 41.03, $p$ = .086. Refer to Table 34 in Appendix B for additional details.

**Additional Demographics for Edmonton Clients of Minority Ethnocultural Status**

All clients in the Caucasian and Aboriginal ethnocultural groups were born in Canada and reported Canadian heritage. Information regarding the self-reported heritage (i.e., country of birth or family background) of clients from the East Asian, South Asian, Southeast Asian, and Middle Eastern clients can be found in Table 35 in Appendix B. All clients in the Caucasian group spoke English as a first language. Information regarding the first language of clients from the other five ethnocultural groups can be found in Table 36 in Appendix B.

Clients in the East Asian, South Asian, Southeast Asian, and Middle Eastern ethnocultural groups differed with respect to nativity, $\chi^2$ (3) = 13.14, $p$ = .004. It appears that more clients in the East Asian group were Canadian-born in comparison to clients of the other ethnocultural groups (34% of East Asian clients, 8% of South Asian clients, 11% of Southeast Asian clients, and 19% of Middle Eastern clients). Refer to Table 37 in Appendix B for additional details. Clients in the aforementioned ethnocultural groups also differed with respect to whether or not an interpreter was used during the assessment, $\chi^2$ (3) = 13.05, $p$ = .005. It appears that more clients in the Southeast Asian group underwent assessment with the assistance of an interpreter in comparison to clients of the other ethnocultural groups (24% of East Asian clients, 19% of South Asian clients, 41% of Southeast Asian clients, and 9% of Middle Eastern clients). Refer to Table 38 in Appendix B for additional details.

Analyses regarding differences in pain presentation related to nativity were conducted using only clients from the East Asian, South Asian, Southeast Asian, and Middle Eastern groups, who were divided into two groups of mixed ethnocultural background based on nativity (i.e., Canadian-born vs. foreign-born). These two groups did not differ with respect to percentage of females and males, years of education, job classification, or duration of pain. However, in comparison to foreign-born clients, Canadian-born clients were younger and obtained higher WRAT Reading scaled scores and FSIQ scores. This suggests that Canadian-born clients may have been more acculturated to Canadian culture than foreign-born clients. Refer to Table 8 for additional information. The number of clients from the East Asian, South Asian, Southeast Asian, and Middle Eastern clients who were Canadian-born and foreign-born is listed in Table 39 in Appendix B. The two groups differed with respect to ethnocultural makeup, $\chi^2$ (3) = 13.14, $p$ = .004. It appears that a higher proportion of the Canadian-born group was accounted for by East Asian clients, whereas a higher proportion of the foreign-born group was accounted for by South Asian clients.

Table 8

*Edmonton Sample Demographic Information Based on Nativity with p-values for Comparisons*

| | Canadian-born ($n$ = 32) | | Foreign-born ($n$ = 155) | | $p$-value |
|---|---|---|---|---|---|
| | $n$ | $M(SD)$ | $n$ | $M(SD)$ | |
| Age | 33 | 26.51 (8.77) | 161 | 40.75 (10.70) | <.001 |
| Percent female | 33 | 55% | 161 | 42% | .195 |
| Years of education | 33 | 13.76 (2.31) | 161 | 12.49 (3.58) | .012 |
| Job classification [a] | 32 | 47.69 (14.22) | 159 | 45.72 (15.85) | .488 |
| Duration of pain (months) | 33 | 27.57 (20.79) | 161 | 34.38 (23.56) | .100 |
| WRAT Reading SS [b] | 29 | 98.38 (11.91) | 102 | 82.95 (12.87) | <.001 |
| Full Scale IQ [c] | 32 | 100.84 (13.63) | 111 | 83.15 (11.37) | <.001 |

*Note.* Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.
[a] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56." Copyright 1992 by Elsevier. [b] Wide Range Achievement Test Reading subset scaled score. [c] Based on Wechsler Adult Intelligence Scale – Revised or 3rd Edition.

The majority of clients in the sub-sample used for nativity-based analyses were referred for legal purposes (100% of Canadian-born clients and 99% of foreign-born clients), and the Canadian-born and foreign-born groups did not differ with respect to referral source, $\chi^2$ (3) = .414, $p$ = .813. Refer to Table 40 in Appendix B for additional information. All clients in both groups were engaged in litigation regarding their injuries.

**Pain Characteristics for Edmonton Nativity-Based Sub-Sample**

Most clients in both nativity-based groups reported pain in multiple IASP sites (33% of Canadian-born clients and 44% of foreign-born clients), and the Canadian-born and foreign-born groups did not differ with respect to location of pain, $\chi^2$ (6) = 6.05, $p$ = .418. Refer to Table 41 in Appendix B for additional details. Unadjusted scores for the pain outcomes and pain-related measure of interest are presented in Table 9.

Table 9

*Edmonton Nativity-Based Sub-Sample Unadjusted Scores on Pain Outcomes and Pain-Related Measures*

| | Canadian-Born | | Foreign-Born | |
|---|---|---|---|---|
| | Male (*n* = 18) | Female (*n* = 15) | Male (*n* = 68) | Female (*n* = 93) |
| MPI [a] Pain Severity | 3.13 (1.51) | 3.59 (1.45) | 4.38 (.95) | 4.47 (1.08) |
| MPI Affective Distress | 3.67 (1.37) | 3.91 (1.15) | 3.89 (.96) | 3.93 (1.11) |
| MPI General Activity | 2.96 (.94) | 2.64 (1.13) | 1.81 (1.00) | 1.89 (.90) |
| MMPI A [b] T-score | 66.91 (9.15) [e] | 57.60 (10.76) [f] | 60.16 (14.26) [g] | 53.03 (11.63) [h] |
| MPI Life Control | 2.73 (1.18) | 2.75 (.98) | 2.58 (1.27) | 2.58 (1.40) |
| MPI Support | 4.05 (1.12) [i] | 4.35 (1.67) [j] | 4.48 (1.42) [k] | 4.60 (1.40) [l] |
| MPI Solicitousness | 3.32 (1.23) [m] | 3.72 (1.05) [n] | 3.90 (1.52) [o] | 4.34 (1.33) [p] |
| WAIS [c] Coding SS [d] | 10.00 (2.51) | 10.33 (2.87) | 6.79 (2.72) [q] | 7.30 (2.66) [r] |

*Note.* Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.
[a] Multidimensional Pain Inventory. [b] Minnesota Multiphasic Personality Inventory – 2nd Edition Welsh's Anxiety T-score. [c] Wechsler Adult Intelligence Scale – 3rd Edition. [d] Digit-Symbol Coding scaled score.
[e] *n* = 11. [f] *n* = 15. [g] *n* = 43. [h] *n* = 33. [i] *n* = 13. [j] *n* = 17. [k] *n* = 90.
[l] *n* = 63. [m] *n* = 15. [n] *n* = 17. [o] *n* = 90. [p] *n* = 64. [q] *n* = 87. [r] *n* = 52.

**Head Injury Characteristics for Edmonton Nativity-Based Sub-Sample**

The nativity-based sub-sample consisted of East Asian, South Asian, Southeast Asian, and Arabic clients. The majority of clients sustained their head injuries in motor vehicle accidents (97% of Canadian-born clients and 96% of foreign-born clients), and the Canadian-born and foreign-born groups did not differ with respect to mechanism of injury, $\chi^2$ (2) = .443, $p$ = .801. Refer to Table 42 in Appendix B for additional details. Information regarding absence of skull fracture was available for all clients. Reference to negative neuroimaging findings was found in 15 of 33 cases in the Canadian-born group and 71 of 161 cases in the foreign-born group; the availability of this information did not vary by group, $\chi^2$ (2) = 1.38, $p$ = .500. Given that there was no difference in the amount of missing neuroimaging information for Canadian-born and foreign-born clients, there is no reason to suspect differences in the rate of mild complicated TBI across groups.

Information regarding duration of loss of consciousness and post-traumatic amnesia was converted to a nominal scale for analysis as described in the section regarding head injury characteristics for Novi clients. Most clients sustained no loss of consciousness (31% of Canadian-born clients and 44% of foreign-born clients) or a brief loss of consciousness (less than one minute; 46% of Canadian-born clients and 27% of foreign-born clients), and the Canadian-born and foreign-born groups did not differ with respect to duration of loss of consciousness, $\chi^2$ (6) = 5.13, $p$ = .528. Refer to Table 43 in Appendix B for additional details. Most clients experienced no post-traumatic amnesia (31% of Canadian-born clients and 45% of foreign-born clients) or a brief period of post-traumatic amnesia (less than one minute; 41% of Canadian-born clients and 18% of foreign-born clients), and the Canadian-born and foreign-born groups did not differ with respect to duration of post-traumatic amnesia, $\chi^2$ (6) = 9.45, $p$ = .150. Refer to Table 44 in Appendix B for additional details.

**Edmonton Correlations**

Statistically significant correlations were observed between a number of demographic variables, pain outcomes, and pain-related variables; see Table 10 for details. Due to the large number of correlations calculated, the Dunn-Šidák correction was employed to reduce the probability of Type 1 error. Age was significantly correlated with MPI Severity and Support, as well as the MMPI A T-score. Years of education were significantly correlated with the MMPI A T-score, whereas job classification only correlated significantly with the Digit-Symbol Coding scaled score. The WRAT Reading scaled score correlated significantly with MPI Severity and General Activity, as well as the Digit-Symbol Coding scaled score. Duration of pain did not significantly with any pain outcome or pain-related variables. Generally, MPI scores tended to correlate amongst each other and with the MMPI A T-score, though the Support and Solicitousness scales appeared to be less related to other scales. The Digit-Symbol Coding scaled score correlated significantly with MPI Severity, Life Control, and General Activity, as well as with the MMPI A T-score.

Table 10

*Edmonton Sample Correlations between Demographics and Variables of Interest (N = 936)*

| | MPI Severity | MPI Control | MPI Distress | MPI Support | MPI Solicit | MPI Activity | Coding SS | MMPI A |
|---|---|---|---|---|---|---|---|---|
| Age | .15* | .06 | .03 | .13* | .07 | -.12 | -.08 | -.15* |
| Years of education | -.14 | .10 | -.001 | -.06 | -.09 | .06 | .24* | -.18* |
| Job classification [a] | .00 | .04 | .040 | -.01 | .02 | -.05 | .18* | -.08 |
| WRAT Reading SS [b] | -.29* | .09 | -.10 | -.13 | -.13 | .18* | .32* | -.10 |
| Duration of pain (months). | .08 | .08 | -.08 | .01 | .04 | .02 | -.05 | -.05 |
| MPI [c] Severity | - | -.32* | .34* | .29* | .25* | -.28* | -.16* | .15* |
| MPI Control | -.32* | - | -.51* | -.03 | -.06 | .30* | .15* | -.47* |
| MPI Distress | .34* | -.51* | - | .13* | .14* | -.17* | -.12 | .42* |
| MPI Support | .29* | -.03 | .13* | - | .63* | -.01 | -.11 | .01 |
| MPI Solicit | .25* | -.06 | .14* | .63* | - | -.002 | -.11 | .06 |
| MPI Activity | -.28* | .30* | -.17* | -.01 | -.002 | - | .19* | -.12 |
| WAIS [d] Coding SS [e] | -.16* | -.15* | -.12 | -.11 | -.11 | .19* | - | -.25* |
| MMPI A [f] T-score | .15* | -.47* | .42* | .01 | .06 | -.12 | -.25* | - |

*Note.* Age, years of education, job classification, and WRAT Reading SS are demographic factors. Duration of pain, MPI Control, MPI Support, MPI Solicitousness are pain-related factors. MPI Severity, MPI Affective Distress, MPI General Activity, Coding SS, and MMPI A T-score are chronic pain outcomes.
[a] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56." Copyright 1992 by Elsevier. [b] Wide Range Achievement Test – 3rd edition Reading subset scaled score.
[c] Multidimensional Pain Inventory. [d] Wechsler Adult Intelligence Scale – Revised or 3rd edition.
[e] Digit-Symbol Coding scaled score. [f] Minnesota Multiphasic Personality Inventory – 2nd edition Welsh's Anxiety T-score.
* correlation significant at $p < .0005$ (Dunn-Šidák correction)

## Hypothesis 1: Ethnocultural Group Differences in Pain Outcomes

Hypothesis 1, that ethnocultural differences would exist on measures of chronic pain outcomes (pain severity, emotional distress, and general activity), even when taking into account demographic factors (age, gender, years of education, educational quality, and/or SES), was tested using a series of ANOVAs and ANCOVAs with ethnocultural group as a between-subjects factor. As past studies have found gender differences with regard to the expression of chronic pain (Portnoy et al., 2004), client gender (male or female) was also used as a between-subjects factor. In some analyses, when correlational data suggested a relationship between the above-noted demographic factors and the pain outcome variable in question, demographic variables were used as covariates to determine whether ethnocultural group differences existed beyond the influence of demographic factors.

## Novi Group Differences in Pain Outcomes

MPI Severity, MPI Affective Distress, MPI General Activity, and MMPI A Scale were compared across Caucasian and African American clients using a series of ANOVAs and ANCOVAs with ethnocultural group and gender as between-subjects factors. The use of age, years of education, job classification, or WTAR raw score as a covariate in the analyses was considered. However, the ethnocultural groups did not differ with respect to age, years of education, or job classification, and none of these three variables correlated significantly with the pain outcome variables. Although the African American and Caucasian groups differed with respect to WTAR raw score, this variable did not correlate significantly with any of the pain outcome variables. As such, no covariates were used in the pain outcome analyses.

**Severity.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of ethnocultural group and gender were not significant, and neither was the interaction between these variables. Refer to Table 45 in Appendix B for ANOVA values and Figure 2 for a visual representation of the data.

**Affective Distress.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of ethnocultural group and gender were not significant, and neither was the interaction between gender and ethnocultural group. Refer to Table 46 in Appendix B for ANOVA values and Figure 2 for a visual representation of the data.

**General Activity.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of ethnocultural group and gender were not significant, and neither was the interaction between these two variables. Refer to Table 47 in Appendix B for ANOVA values and Figure 1 for a visual representation of the data.

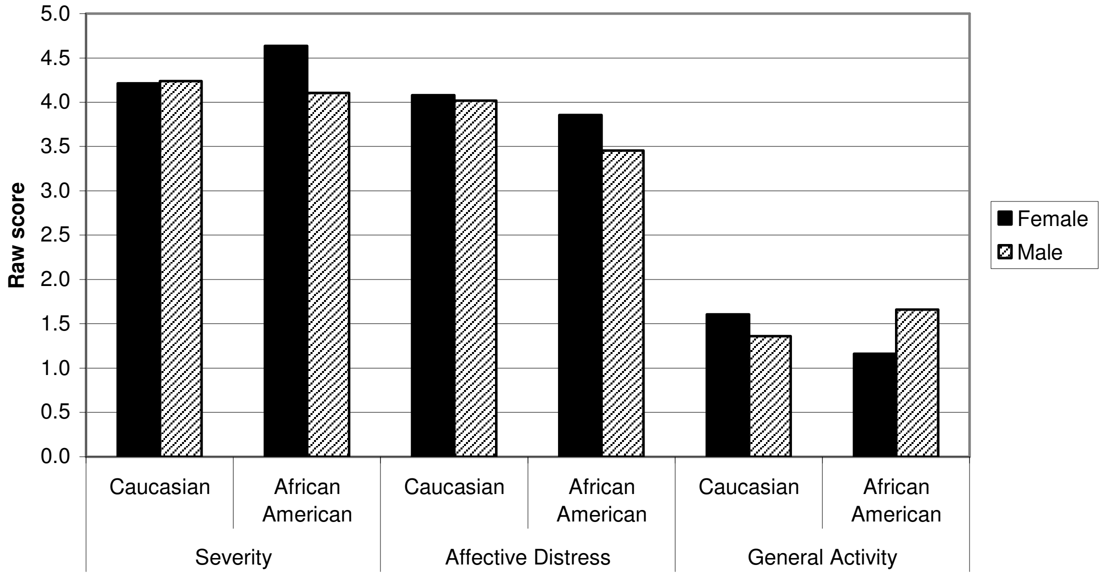


*Figure 1.* Novi Mean Multidimensional Pain Inventory (MPI) Severity, Affective Distress, and General Activity Raw Scores by Ethnocultural Group and Gender.

**MMPI A Scale.** No issues with normality, or homogeneity of variance and covariance were detected in the data set. The main effect of ethnocultural group was not significant, and since MMPI T-scores are gender-normed, the effect of gender was not examined in this analysis. Refer to Table 48 in Appendix B for ANOVA values and Figure 2 for a visual representation of the data.

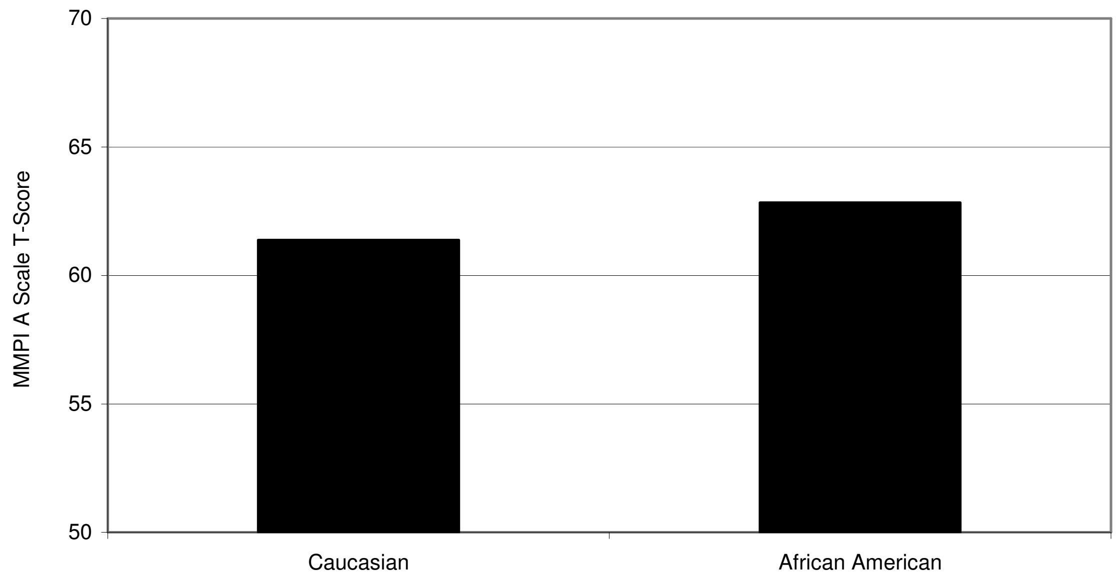


*Figure 2.* *Novi Mean Minnesota Multiphasic Personality Inventory Welsh's Anxiety Scale (MMPI A) T-score by Ethnocultural Group.*

**Summary.** No ethnocultural or gender differences were observed with respect to Severity, Affective Distress, General Activity or MMPI A T-score in the Novi sample.

**Edmonton Group Differences in Pain Outcomes**

MPI Severity, MPI Affective Distress, MPI General Activity, and MMPI A T-score were compared across the Edmonton ethnocultural groups using a series of ANCOVAs and ANOVAs with ethnocultural group and gender as between-subjects factors. As with the Novi ANOVAs, the use of age, years of education, job classification, or WRAT Reading scaled score as covariates in the analyses was considered. However, job classification did not correlate with any of the dependent variables of interest, and many clients with English as a second language were not administered the WRAT Reading subtest which would have led to inadequate sample sizes for some ethnocultural groups and loss of data from clients who were less familiar with English. As such, age and/or years of education were used as covariates in the Edmonton analyses when they were significantly correlated with the outcome variable in question. Age was used as a covariate in the analysis for Severity and age and years of education were both used as covariates in the analysis for MMPI A T-score. When neither age nor years of education was significantly correlated with the outcome variable in question (Affective Distress and General Activity), no covariate was used. For analyses which revealed a significant main effect of ethnocultural group, pairwise comparisons were employed to ascertain which specific groups differed from the others. Caucasian clients were used as the reference group for these comparisons, given that they made up the majority of the sample and most pain research has been geared at understanding pain in Caucasian clients of European origin.

**Severity.** No issues with normality, homogeneity of variance and covariance, or homogeneity of regression slopes were detected in the data set. The covariate, age, was significantly associated with MPI Severity, $F(1,923) = 26.05$, $p < .001$, $r = .16$. The main effect of ethnocultural group was significant, $F(5,923) = 8.28$, $p < .001$, $r = .21$. Pairwise comparisons revealed that Southeast Asian clients reported higher levels of Severity than Caucasian clients (mean difference = -.74, $p = .004$), and Middle Eastern clients also reported higher levels of Severity than Caucasian clients (mean difference = -.94,

$p < .001$). The main effect of gender was not significant, and neither was the interaction between ethnocultural group and gender. Refer to Tables 49 and 50 in Appendix B for ANOVA and pairwise comparison values and Figure 3 for a visual representation of the data.

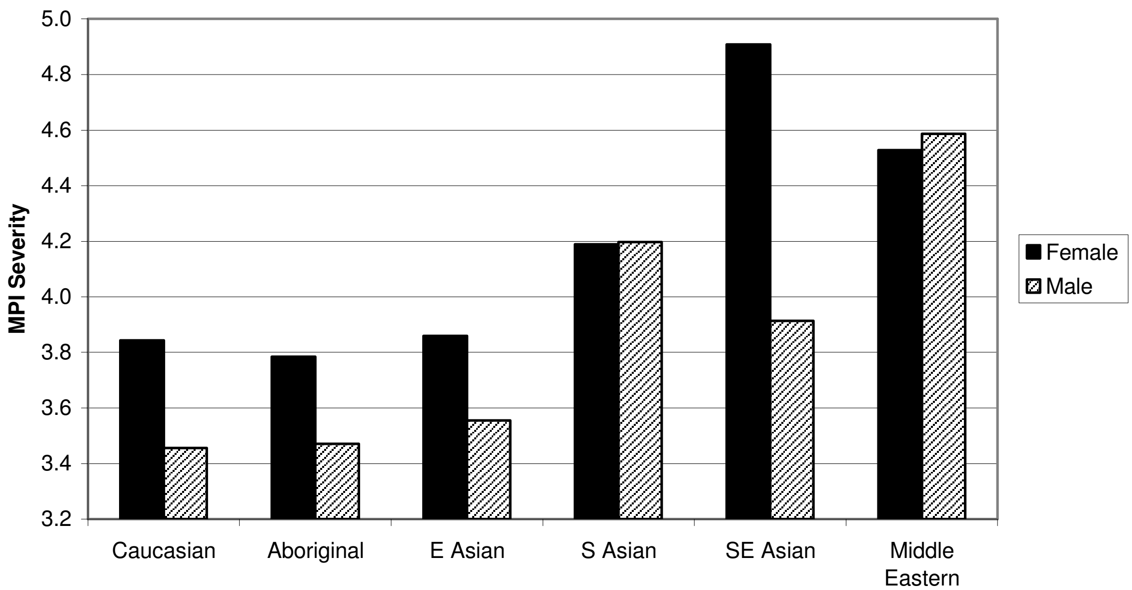


*Figure 3.* Edmonton Unadjusted Mean Multidimensional Pain Inventory (MPI) Severity Raw Score by Ethnocultural Group and Gender.

**Affective Distress.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of ethnocultural group and gender were not significant, and neither was the interaction between ethnocultural group and gender. Refer to Table 51 in Appendix B for ANOVA values and Figure 4 for a visual representation of the data.

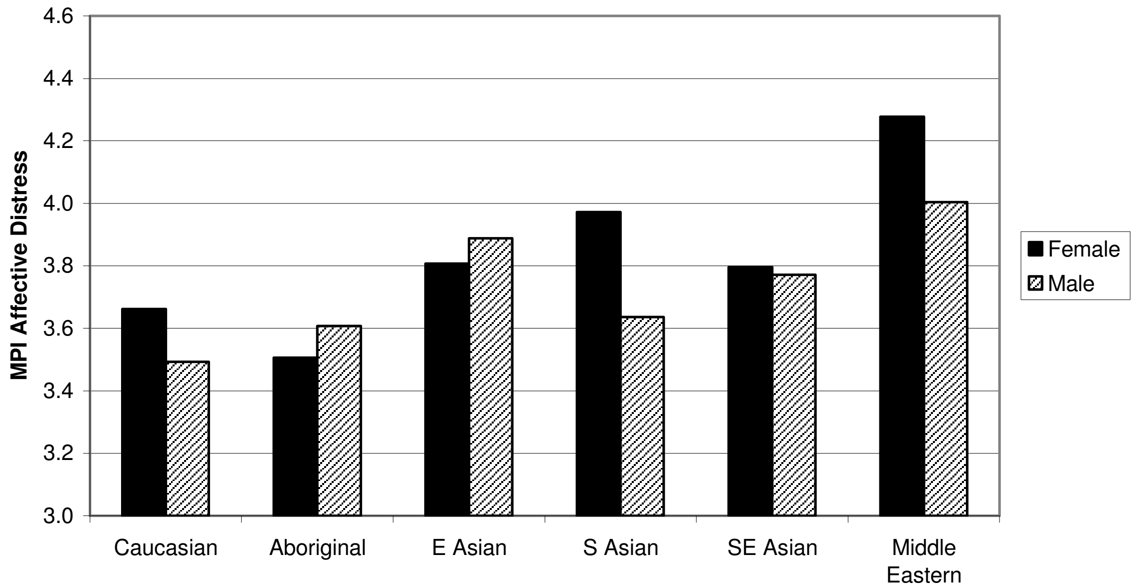


*Figure 4.* Edmonton Mean Multidimensional Pain Inventory (MPI) Affective Distress Raw Score by Ethnocultural Group and Gender.

**General Activity.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effect of ethnocultural group was significant, $F(5,924) = 11.03$, $p < .001$, $r = .26$, and pairwise comparisons revealed that South Asian clients reported lower levels of General Activity than Caucasian clients (mean difference = .72, $p < .001$), as did Middle Eastern clients (mean difference = .83, $p < .001$). The main effect of gender and the interaction between ethnocultural group and gender were not significant. Refer to Tables 52 and 53 in Appendix B for ANOVA and pairwise comparison values and Figure 5 for a visual representation of the data.

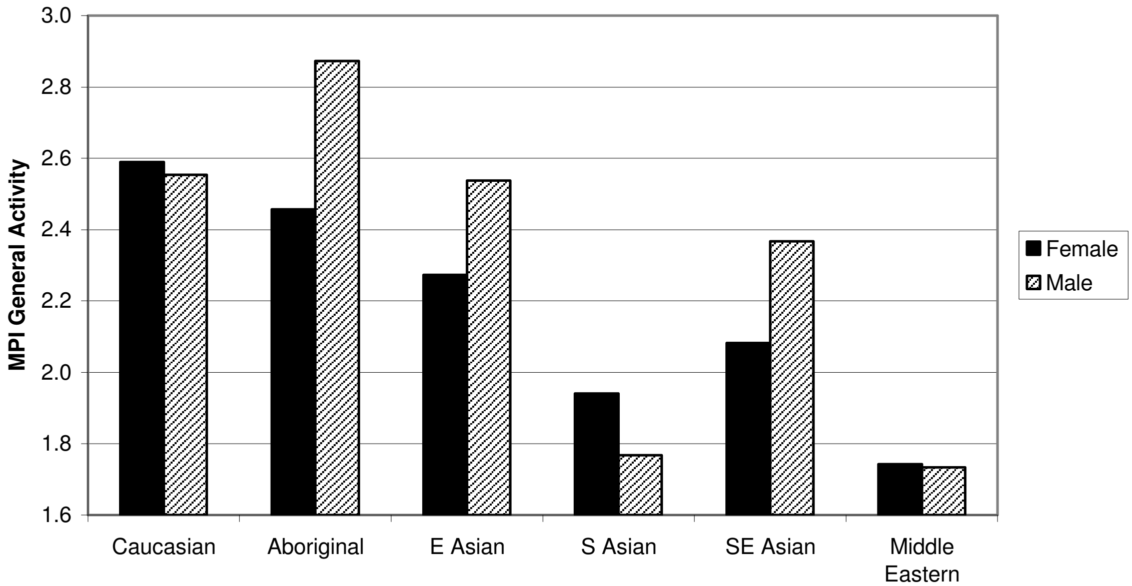


*Figure 5.* Edmonton Mean Multidimensional Pain Inventory (MPI) General Activity Raw Score by Ethnocultural Group and Gender.

**MMPI A Scale.** No issues with normality, homogeneity of variance and covariance, or homogeneity of regression slopes were detected in the data set. Age, used as a covariate, was significantly associated with MMPI A T-score, $F(1,742) = 10.69$, $p = .001$, $r = .12$), as was years of education, also used as a covariate, $F(1,742) = 23.66$, $p < .001$, $r = .18$). The main effect of ethnocultural group was significant, $F(1,742) = 3.24$, $p = .007$, $r = .15$), and pairwise comparisons revealed that Middle Eastern clients scored higher on the MMPI A scale than Caucasian clients (mean difference = -8.02, $p = .005$). Since MMPI T-scores are gender-normed, the effect of gender was not examined. Refer to Tables 54 and 55 in Appendix B for ANOVA and pairwise comparison values and Figure 6 for a visual representation of the data.

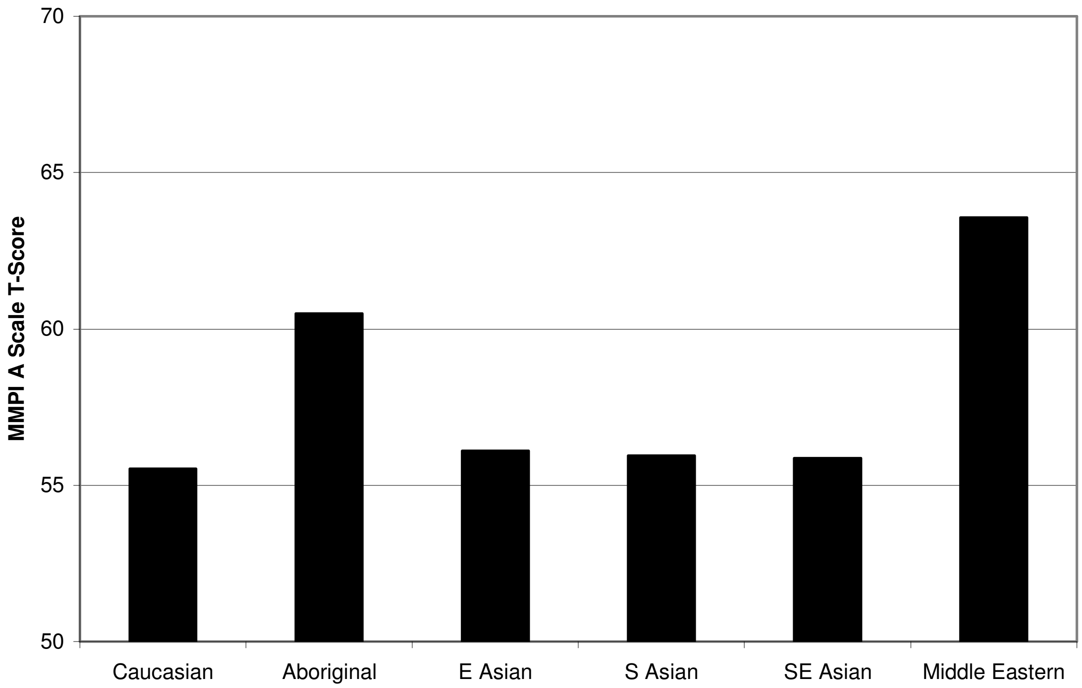


*Figure 6.* Edmonton Unadjusted Mean Minnesota Multiphasic Personality Inventory Welsh's Anxiety Scale T-score by Ethnocultural Group.

**Summary.** Ethnocultural group differences were observed on MPI Severity (adjusted for age) and General Activity, as well as MMPI A T-score (adjusted for age and years of education). Pairwise comparisons showed that Southeast Asian and Middle Eastern clients reported higher levels of Severity than Caucasian clients, that South Asian and Middle Eastern clients reported lower levels of General Activity than Caucasian clients, and that Middle Eastern clients had higher MMPI A T-scores than Caucasian clients. Overall, pain outcomes of Middle Eastern clients were the most distinct from those of the Caucasian group.

## Hypothesis 2: Ethnocultural Group Differences on Factors Related to Pain

Hypothesis 2, that ethnocultural differences would exist on measures of perceived control, perceived support, and partner solicitousness, even when taking into account demographic factors (age, gender, years of education, educational quality, and/or SES) was tested with a series of ANOVAs and ANCOVAs using ethnocultural group and gender as between-subjects factors. In some analyses, when correlational data suggested a relationship between the above-noted demographic factors and the pain related variable in question, demographic variables were used as covariates to determine whether ethnocultural group differences existed beyond the influence of demographic factors.

### Novi Differences on Factors Related to Pain

MPI Life Control, MPI Support, and MPI Solicitousness were compared across Caucasian and African American clients using a series of ANOVAs with ethnocultural group and gender as between-subjects factors. The use of age, years of education, job classification, or WTAR raw score as a covariate in the analyses was considered. However, the ethnocultural groups did not differ with respect to age, years of education, or job classification, and WTAR raw score did not correlate significantly with any of the pain-related variables. As such, no covariates were used.

**Life Control.** No issues with normality or homogeneity of variance and covariance were detected in the data set. Although the main effects of ethnocultural group and gender were not significant, the interaction between these variables was significant, $F(1,149) = 6.94$, $p = .009$, $r = .21$, as females of both ethnocultural groups reported a similar level of Life Control, whereas African American males reported higher levels of Life Control than Caucasian Americans. Refer to Table 56 in Appendix B for ANOVA values and Figure 8 for a visual representation of the data.

**Support.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of ethnocultural group and gender were not significant, and neither was the interaction between ethnocultural group and gender. Refer to Table 57 in Appendix B for ANOVA values and Figure 8 for a visual representation of the data.

**Solicitousness.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of ethnocultural group and gender were not significant, and neither was the interaction between ethnocultural group and gender. Refer to Table 58 in Appendix B for ANOVA values and Figure 7 for a visual representation of the data.

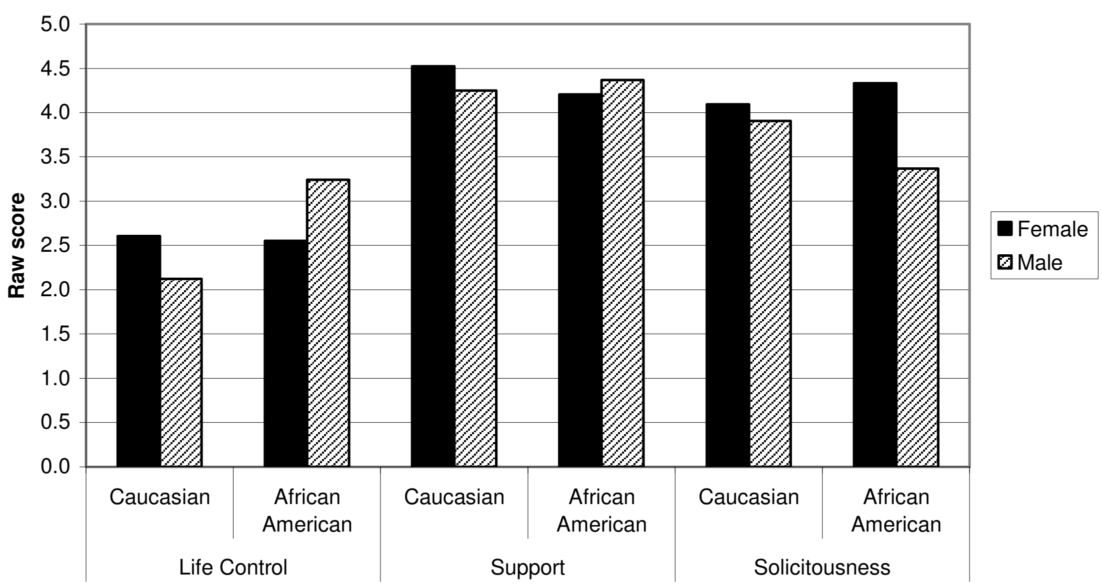


*Figure 7.* Novi Mean Multidimensional Pain Inventory (MPI) Life Control, Support, and Solicitousness Raw Scores by Ethnocultural Group and Gender.

**Summary.** An interaction between ethnocultural group and gender was observed on Life Control, as African American and Caucasian females reported similar levels of

Life Control, whereas African American males reported higher levels of Life Control than Caucasian males. No ethnocultural group or gender differences were observed with respect to Support or Solicitousness.

**Edmonton Differences on Factors Related to Pain**

MPI Life Control, MPI Support, and MPI Solicitousness were compared across the Edmonton ethnocultural groups using a series of ANOVAs and ANCOVAs with ethnocultural group and gender as between-subjects factors. The use of age, years of education, job classification, or WRAT Reading scaled score as covariates in the analyses was considered. However, job classification and years of education did not correlate with any of the dependent variables of interest, and many clients with English as a second language were not administered the WRAT Reading subtest which would have led to inadequate sample sizes for some ethnocultural groups and loss of data from clients who were less familiar with English. Age correlated significantly with Support and was used as a covariate in the corresponding analysis, but no covariates were used in the analyses for Life Control and Solicitousness. For analyses which revealed a significant main effect of ethnocultural group, pairwise comparisons were employed to ascertain which specific groups differed from the others. Caucasian clients were used as the reference group for these comparisons, given that they made up the majority of the sample and most pain research has been geared at understanding pain in Caucasian clients of European origin.

**Life Control.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effect of ethnocultural group was significant, $F(5,924) = 4.12$, $p = .001$, $r = .15$, but pairwise comparisons did not reveal specific differences. The main effect of gender and the interaction between ethnocultural group and gender were not significant. Refer to Tables 59 and 60 in Appendix B for ANOVA and pairwise comparison values and Figure 8 for a visual representation of the data.

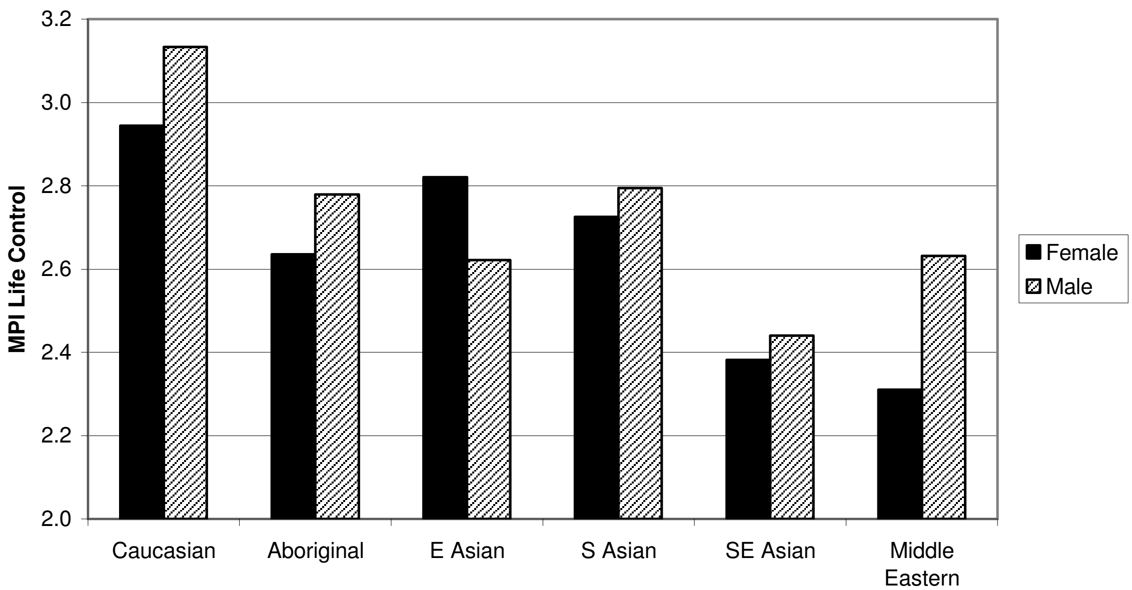


*Figure 8.* Edmonton Mean Multidimensional Pain Inventory (MPI) Life Control Raw Score by Ethnocultural Group and Gender.

**Support.** No issues with normality, homogeneity of variance and covariance, or homogeneity of regression slopes were detected in the data set. The covariate, age, was significantly associated with MPI Support, $F(1,860) = 14.91$, $p < .001$, $r = .130$. The main effects of ethnocultural group and gender were not significant, and neither was the interaction between ethnocultural group and gender. Refer to Table 61 in Appendix B for ANOVA values and Figure 9 for a visual representation of the data.

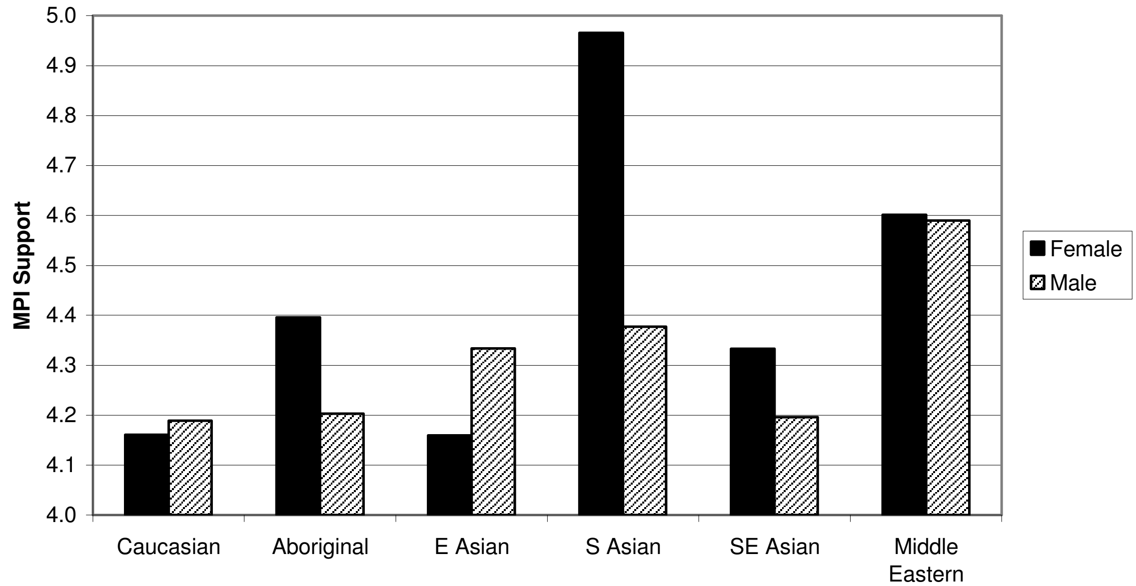


*Figure 9.* Edmonton Unadjusted Mean Multidimensional Pain Inventory (MPI) Support Raw Score by Ethnocultural Group and Gender.

**Solicitousness.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effect of ethnocultural group was significant, $F(5,871) = 18.84$, $p < .001$, $r = .22$, and pairwise comparisons revealed that South Asian clients reported higher levels of partner Solicitousness than Caucasian clients (mean difference = -1.08, $p < .001$). The main effect of gender was also significant, $F(1,871) = 15.01$, $p < .001$, $r = .09$, with female clients reporting higher levels of solicitous responding from significant others than male clients. The interaction between ethnocultural group and gender was not significant. Refer to Tables 62 and 63 in Appendix B for ANOVA and pairwise comparison values and Figure 10 for a visual representation of the data.

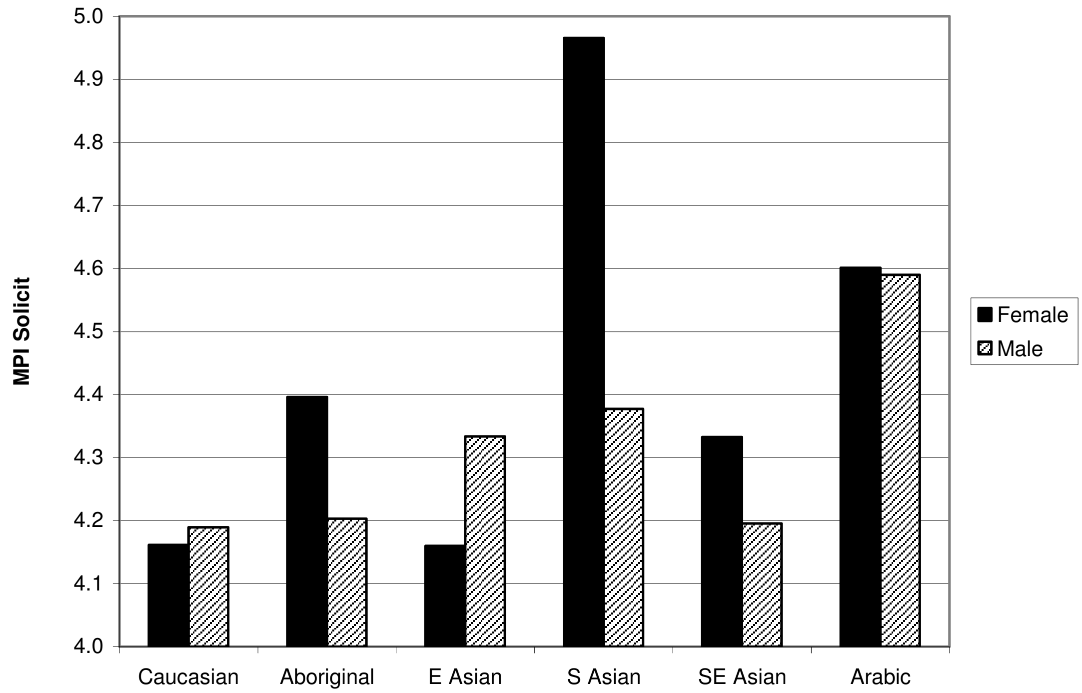


*Figure 10.* Edmonton Mean Multidimensional Pain Inventory (MPI) Solicitousness Raw Score by Ethnocultural Group and Gender.

**Summary.** Ethnocultural group differences were observed with respect to Life Control and partner Solicitousness, and gender differences were also found with respect to partner Solicitousness, with female clients reporting higher levels of Solicitousness. Pairwise comparisons showed that South Asian clients reported higher levels of partner Solicitousness than Caucasian clients. In spite of the overall difference on Life Control, pairwise comparisons showed that no ethnocultural groups differed significantly from Caucasian clients on this variable. In addition, no ethnocultural group or gender differences were observed with respect to Support (adjusted for age).

### Hypothesis 3: Differences in Overall Pain Profiles

Hypothesis 3, that overall pain profiles would differ across ethnocultural groups, was tested by conducting a chi-square analysis of MPI profile classifications.

### Novi Differences in Overall Pain Profiles

Most clients in both ethnocultural groups were classified as having Dysfunctional pain profiles, and the Caucasian and African American groups did not differ with respect to classification, $\chi^2$ (4) = 6.95, $p$ = .138. Refer to Table 11 for additional details.

Table 11

*Novi Multidimensional Pain Inventory Profile Classifications by Ethnocultural Group*

| | Caucasian American ($n$ =79) | | African American ($n$ =74) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| Dysfunctional | 36 | 54 | 29 | 51 |
| Interpersonally Distressed | 12 | 18 | 7 | 12 |
| Adaptive Coper | 15 | 22 | 10 | 18 |
| Hybrid | 3 | 5 | 4 | 7 |
| Anomalous | 1 | 2 | 7 | 12 |

### Edmonton Differences in Overall Pain Profiles

Most clients were classified as having either Dysfunctional or Adaptive Coper pain profiles, and the ethnocultural groups differed with respect to classification, $\chi^2$ (20) = 51.24, $p$ <. 001. It appears that Middle Eastern clients were more likely to be classified as having a Dysfunctional MPI profile than clients from other ethnocultural groups. Refer to Table 12 for additional details.

Table 12

*Edmonton Multidimensional Pain Inventory Profile Classifications by Ethnocultural Group*

| | Caucasian ($n$ = 639) | | Aboriginal ($n$ = 59) | | E Asian ($n$ = 40) | | S Asian ($n$ = 61) | | SE Asian ($n$ = 33) | | Middle East ($n$ = 53) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Dysfunctional | 178 | 28 | 15 | 25 | 16 | 40 | 21 | 34 | 17 | 32 | 32 | 60 |
| Interpersonally Distressed | 157 | 25 | 6 | 10 | 6 | 15 | 8 | 13 | 6 | 21 | 5 | 9 |
| Adaptive Coper | 202 | 32 | 24 | 41 | 10 | 25 | 18 | 30 | 7 | 31 | 11 | 21 |
| Hybrid | 50 | 8 | 5 | 9 | 4 | 10 | 8 | 13 | 3 | 8 | 3 | 6 |
| Anomalous | 52 | 8 | 9 | 15 | 4 | 10 | 6 | 10 | 0 | 8 | 2 | 4 |

**Hypothesis 4: Ethnocultural Differences in Predictive Value of Pain-Related and Demographic Variables**

Hypothesis 4, that the influence of pain-related factors (perceived control, perceived support, partner solicitousness), and demographic factors (age, years of education, educational quality, and SES) in predicting pain-related outcomes (pain severity, emotional distress, general activity, and processing speed) would vary across ethnocultural groups was tested using dummy-coded multiple regression analyses with interaction terms using a procedure described by Cohen, Cohen, West, and Aiken (2003).

The selection of predictors for each outcome variable was based on whether or not the predictors were significantly correlated with the outcome in question. Because Hypothesis 4 was made under the assumption that the predictive value of some variables might vary across ethnocultural groups, this suggested that correlations between predictors and variables might vary across groups as well, and overall correlations for each sample could obscure correlations for the individual groups (i.e., the correlation might be significant for one group but not the other, causing the overall correlation to cancel out). As such, new correlations were generated between potential predictors and outcome variables for each ethnocultural group. If the correlation between a potential predictor variable and a given outcome was significant for any of the ethnocultural groups in either sample, the variable was used as a predictor for regression analyses for that outcome. If the correlation between a potential predictor variable and a given outcome was not significant for any of the groups under study, then that variable was not tested as a predictor. As noted in the Hypotheses section, in cases when correlations existed between two pain outcomes and there was a theoretical reason to suggest that one outcome might influence the other, one of these outcomes was used as a predictor with respect to the dependent outcome. For example, pain severity was used as a predictor when affective distress was being used as dependent variable as these variables were significantly correlated and intensity of pain could conceivably influence a client's level of affective distress. The MMPI A T-score was not used as an outcome variable in the regression analyses as the sample size for some groups was insufficient.

In the dummy-coded regression analyses, each ethnocultural group was assigned a dummy code, and interaction terms were generated by multiplying the dummy code by the predictor variables. The predictors and dependent variables were centered around the grand mean so that interaction graphs could be generated by entering low and high values of the dependent variable into the regression equation in the event that significant interactions were detected. For each dependent variable, one predictor variable, the ethnocultural group dummy codes, and the interaction terms with the predictor in question were entered into the regression equation in one block. Given that these analyses were exploratory in nature, only one predictor and dependent variable were entered into each regression equation at a time to increase power to detect interaction effects. Although this resulted in a large number of analyses, it was thought to be a better option than entering all variables at once and thereby reducing statistical power.

Ethnocultural group differences based on dummy coded ethnocultural groups will not be described in this section, as they were covered in the previous two sets of analyses.

In addition to the regression analyses, correlations between each predictor and outcome variable were generated for each ethnocultural group. This was done to provide further descriptive data regarding relationships between predictors and outcomes and how they may differ across ethnocultural groups.

**Novi Differences in Predictive Value of Pain-Related and Demographic Variables**

To determine whether the effect of chronic pain-related and demographic variables on chronic pain outcomes differed across ethnocultural groups, multiple regression analyses were performed with ethnocultural group entered into the regressions using dummy codes. The demographic variables used as potential predictors were age, years of education, job classification, and WTAR raw score, and the pain-related variables used as potential predictors were MPI Life Control, Support, and Solicitousness. The outcome variables used were MPI Severity, MPI Affective Distress, MPI General Activity, and Digit-Symbol Coding scaled score. As noted above, pain outcomes were also used as predictors in cases when there was a significant correlation between the two outcomes.

**Severity.** MPI Affective Distress (Caucasian, $r$ = .40; African American, $r$ = .58), MPI General Activity (Caucasian, $r$ = -.38; African American, $r$ = -.52), MPI Life

Control (Caucasian, $r = -.19$; African American, $r = -.46$), and MPI Solicitousness (African American, $r = .38$) were significantly correlated with MPI Severity for at least one of the Novi ethnocultural groups, and these variables were therefore used as predictors in regression analyses. Data regarding correlations can be found in Table 64 in Appendix B.

MPI General Activity ($B = -.55$, $p < .001$) was a significant negative predictor of MPI Severity, while MPI Affective Distress was a positive predictor ($B = -.41$, $p < .001$). None of the dummy code/predictor interactions were significant. This suggests that the relationship between the predictors and MPI Severity was similar for Caucasian and African American clients. Refer to Tables 65-68 in Appendix B for additional details regarding data from multiple regression analyses.

**Affective Distress.** MPI Severity (Caucasian, $r = .40$; African American, $r = .58$), MPI General Activity (Caucasian, $r = -.35$), MPI Life Control (Caucasian, $r = -.51$; African American, $r = -.59$), and MPI Solicitousness (African American, $r = .39$) were significantly correlated with MPI Affective Distress for at least one of the Novi ethnocultural groups, and these variables were therefore used as predictors in regression analyses. Data regarding correlations can be found in Table 69 in Appendix B.

MPI Life Control ($B = -.48$, $p < .001$) and MPI General Activity ($B = -.50$, $p = .002$) were significant negative predictors of MPI Affective Distress, while MPI Severity ($B = .40$, $p < .001$) was a significant positive predictor. Although MPI Solicitousness was not a significant overall predictor of MPI Affective Distress, the interaction between the ethnocultural group dummy code and MPI Solicitousness was significant ($B = .35$, $p = .016$), suggesting that this variable had a different association with Affective Distress in Caucasian and African American clients. When the regression slopes were graphed for each ethnic group, as shown in Figure 11, it was found that high levels of Solicitousness were more predictive of high levels of Affective Distress for African American clients than Caucasian clients. No other interactions were significant, which suggests that the relationship between most predictors and MPI Affective Distress was similar for Caucasian and African American clients. Refer to Tables 70-73 in Appendix B for additional details.

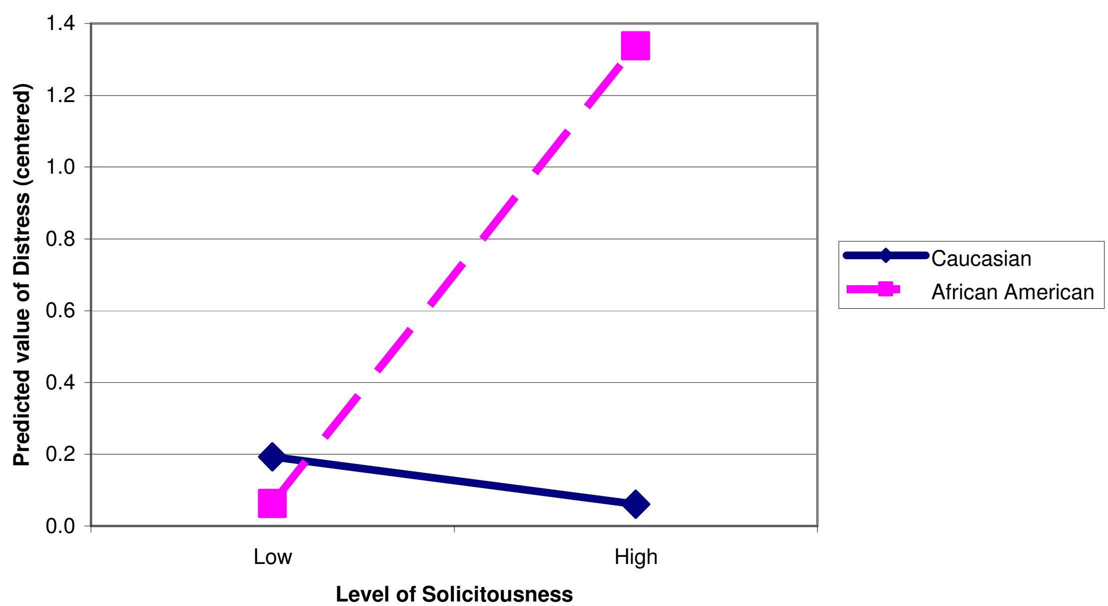


*Figure 11.* Novi Interaction between Ethnocultural Group and Multidimensional Pain Inventory (MPI) Solicitousness Raw Score in Predicting MPI Affective Distress Raw Score.

**General Activity.** MPI Severity (Caucasian, $r = -.38$; African American, $r = -.53$), MPI Affective Distress (Caucasian, $r = -.35$, and MPI Life Control (Caucasian, $r = .44$; African American, $r = .41$) were significantly correlated with MPI General Activity for at least one of the Novi ethnocultural groups, and these variables were therefore used as predictors in regression analyses. Data regarding correlations can be found in Table 74 in Appendix B.

MPI Severity ($B = -.26$, $p < .001$) and MPI Affective Distress ($B = -.24$, $p = .003$) were significant negative predictors of MPI General Activity, while MPI Life Control was a significant positive predictor ($B = .29$, $p < .001$). None of the dummy code/predictor interactions were significant. This suggests that the relationship between the predictors and MPI General Activity was similar for Caucasian and African American clients. Refer to Tables 75-77 in Appendix B for additional details.

**Digit-Symbol Coding.** Digit-Symbol Coding data were screened for scores below performance validity cutoffs as described in the Measures section (p. 106-107). MPI Severity (Caucasian, $r = -.37$) was the only potential predictor that was significantly correlated with Digit-Symbol Coding scaled score for either of the Novi ethnocultural groups, and this variable was therefore used as a predictor in a regression analysis. Data regarding correlations can be found in Table 78 in Appendix B.

MPI Severity was a significant negative predictor of Digit-Symbol Coding scaled score ($B = -.89$, $p < .001$), and the interaction between MPI Severity and the dummy coded ethnicity variable was not significant. This suggests that the relationship between MPI Severity and Digit-Symbol Coding was similar for Caucasian and African American clients. Refer to Table 79 in Appendix B for additional details.

**Summary.** Years of education, WTAR raw score, MPI General Activity, and MPI Affective Distress were significant predictors of MPI Severity, while MPI Severity, MPI General Activity and MPI Life Control were found to be significant predictors of Affective Distress. Although partner Solicitousness was not a significant overall predictor of Affective Distress for the entire sample, ethnic group differences were observed with regard to its predictive value as Solicitousness was significantly associated with Affective Distress for African American clients but not for Caucasian clients. MPI Severity, MPI Affective Distress, and MPI Life Control were found to be significant predictors of General Activity, and only Severity predicted Digit-Symbol Coding scaled score.

**Edmonton Differences in Predictive Value of Pain-Related and Demographic Variables**

To determine whether the effect of chronic pain-related and demographic variables on chronic pain outcomes differed across ethnocultural groups, multiple regression analyses were performed with ethnocultural group entered into the regressions using dummy codes. The demographic variables used as potential predictors were age, years of education, job classification, and WTAR raw score, and the pain-related variables used as potential predictors were MPI Life Control, Support, and Solicitousness. The outcome variables used were MPI Severity, MPI Affective Distress, MPI General Activity, and Digit-Symbol Coding scaled score. As noted above, pain outcomes were also used as predictors in cases when there was a significant correlation between the two outcomes.

**Severity.** Age (Caucasian, $r$ = .13), years of education (Caucasian, $r$ = -.17), WRAT Reading scaled score (Caucasian, $r$ = -.25), MPI Affective Distress (Caucasian,

$r = .30$; East Asian, $r = .52$; South Asian, $r = .44$), MPI General Activity (Caucasian, $r = -.23$), MPI Life Control (Caucasian, $r = -.29$; South Asian $r = -.54$), MPI Support (Caucasian, $r = .30$), and MPI Solicitousness (Caucasian, $r = .22$; Middle Eastern, $r = .44$) were significantly correlated with MPI Severity for at least one of the Edmonton ethnocultural groups, and these variables were therefore used as predictors in regression analyses. Data regarding correlations can be found in Table 80 in Appendix B.

Years of education ($B = -.09$, $p < .001$), WRAT Reading scaled score ($B = -.03$, $p < .001$), MPI General Activity ($B = -.32$, $p < .001$), and MPI Life Control ($B = -.29$, $p < .001$) were significant negative predictors of MPI Severity. Age ($B = .01$, $p = .001$), MPI Affective Distress ($B = .34$, $p < .001$), MPI Support ($B = .26$, $p < .001$), and MPI Solicitousness ($B = .20$, $p < .001$) were significant positive predictors. No interactions between ethnocultural group dummy codes and the predictors were significant, which suggests that the relationships between the predictors and MPI Severity were similar for clients of all ethnocultural groups. Refer to Tables 81-88 in Appendix B for details.

**Affective Distress.** MPI Severity (Caucasian, $r = .30$; East Asian, $r = .52$; South Asian, $r = .44$), MPI General Activity (Caucasian, $r = -.15$), MPI Life Control (Caucasian, $r = -.51$; East Asian, $r = -.52$; South Asian, $r = -.61$; Middle Eastern, $r = -.61$), MPI Support (Southeast Asian, $r = .35$), and MPI Solicitousness (Southeast Asian, $r = .46$) were significantly correlated with MPI Affective Distress for at least one of the Edmonton ethnocultural groups, and these variables were therefore used as predictors in regression analyses. Data regarding correlations can be found in Table 89 in Appendix B.

MPI General Activity ($B = -.18$, $p < .001$) and MPI Life Control ($B = -.46$, $p < .001$) were significant negative predictors of MPI Affective Distress. MPI Severity ($B = .26$, $p < .001$), MPI Support ($B = .10$, $p = .001$), and MPI Solicitousness ($B = .08$, $p < .010$) were significant positive predictors. The interactions between the Aboriginal vs. Others dummy code and MPI Life Control ($t = 2.76$, $p = .006$) and the Southeast Asian vs. Others dummy code and Solicitousness ($t = 2.02$, $p = .044$) were significant, suggesting that the association between these predictors and Affective Distress was different for these groups relative to the other groups. Regression slopes were graphed for each ethnic group on these variables, as shown in Figures 12-13. It was found that higher levels of Life Control were associated with lower Affective Distress for all ethnocultural groups, but that the relationship was weaker for Aboriginal Canadian clients. Furthermore, the positive association between partner Solicitousness and Affective Distress was stronger for Southeast Asian clients than clients of other ethnocultural groups. No other interactions were significant, which suggests that the relationships between most predictors and MPI Affective Distress were similar for clients of all ethnocultural groups. Refer to Tables 90-94 in Appendix B for additional details.

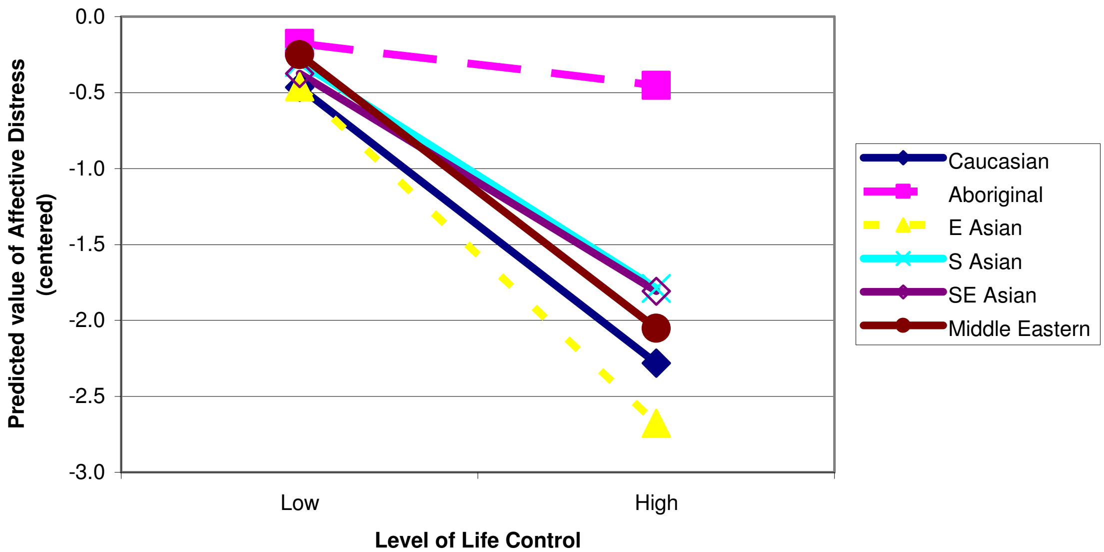


*Figure 12.* Edmonton Interaction between Ethnocultural Group and Multidimensional Pain Inventory (MPI) Life Control Raw Score in Predicting MPI Affective Distress Raw Score.

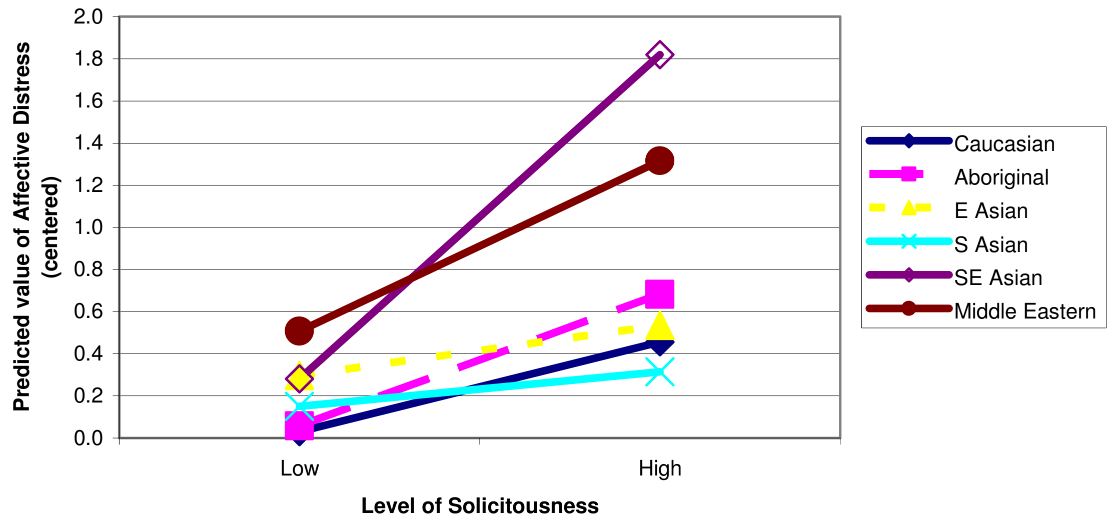


*Figure 13.* Edmonton Interaction between Ethnocultural Group and Multidimensional Pain Inventory (MPI) Solicitousness Raw Score in Predicting MPI Affective Distress Raw Score.

**General Activity.** MPI Severity (Caucasian, $r = -.23$), MPI Affective Distress (Caucasian, $r = -.15$), and MPI Life Control (Caucasian, $r = .26$; Southeast Asian, $r = .50$), were significantly correlated with MPI General Activity for at least one of the Edmonton ethnocultural groups, and these variables were therefore used as predictors in regression analyses. Data regarding correlations can be found in Table 95 in Appendix B.

MPI Life Control ($B = .19$, $p < .001$) was a significant positive predictor of MPI General Activity, whereas MPI Severity ($B = -.16$, $p < .001$), and MPI Affective Distress ($B = -.12$, $p < .001$) were significant negative predictors. No interactions between ethnocultural groups and predictors were significant, which suggests that the relationships between the predictors and MPI General Activity were similar for clients of all ethnocultural groups. Refer to Tables 96-98 in Appendix B for additional details.

**Digit-Symbol Coding.** Digit-Symbol Coding data were screened for scores below performance validity cutoffs as described in the Measures section (p. 106-107). Years of education (Caucasian, $r = .22$), WRAT Reading scaled score (Caucasian, $r = .25$), job classification (Caucasian, $r = .13$), MPI Severity (Caucasian, $r = -.08$; East Asian, $r = -.42$; Middle Eastern, $r = -.44$), MPI Affective Distress (Caucasian, $r = -.08$; South Asian, $r = -.27$), and MPI Life Control (Middle Eastern, $r = .39$) were significantly correlated with MPI Severity for at least one of the Edmonton ethnocultural groups, and these variables were therefore used as predictors in regression analyses. Data regarding correlations can be found in Table 99 in Appendix B.

Years of education ($B = .25$, $p < .001$), WRAT Reading scaled score ($B = .06$, $p < .001$), job classification ($B = .02$, $p = .001$), and MPI Life Control ($B = .25$, $p < .001$) were all significant positive predictors of Digit-Symbol Coding scaled score. The interactions between the East Asian vs. Others dummy code and job classification ($t = 2.16$, $p = .031$), the Southeast Asian vs. Others dummy code and job classification ($t = 2.11$, $p = .035$), the Middle Eastern vs. Others dummy code and MPI Severity ($t = -2.34$, $p = .020$), the East Asian vs. Others dummy code and MPI Life Control ($t = 2.22$, $p = .027$), and the Middle Eastern vs. Others dummy code and MPI Life Control ($t = 2.12$, $p = .034$), were significant, suggesting that the association between the predictors in question was different for these groups relative to the other groups. Regression slopes were graphed for each ethnic group on these variables, as shown in Figures 14-16. It was found that the positive association between job classification and Digit-Symbol Coding scaled score was stronger for East Asian and Southeast Asian clients relative to clients from other ethnocultural groups, and that the negative association between Severity and Digit-Symbol Coding was stronger for Middle Eastern clients than clients from other ethnocultural groups. Furthermore, the positive association between Life Control and the Digit-Symbol Coding score was stronger for East Asian and Middle Eastern clients relative to other ethnocultural groups. No other interactions were significant, which suggests that the relationships between most predictors and Digit-Symbol Coding were similar for clients of all ethnocultural groups. Refer to Tables 100-105 in Appendix B for additional details.

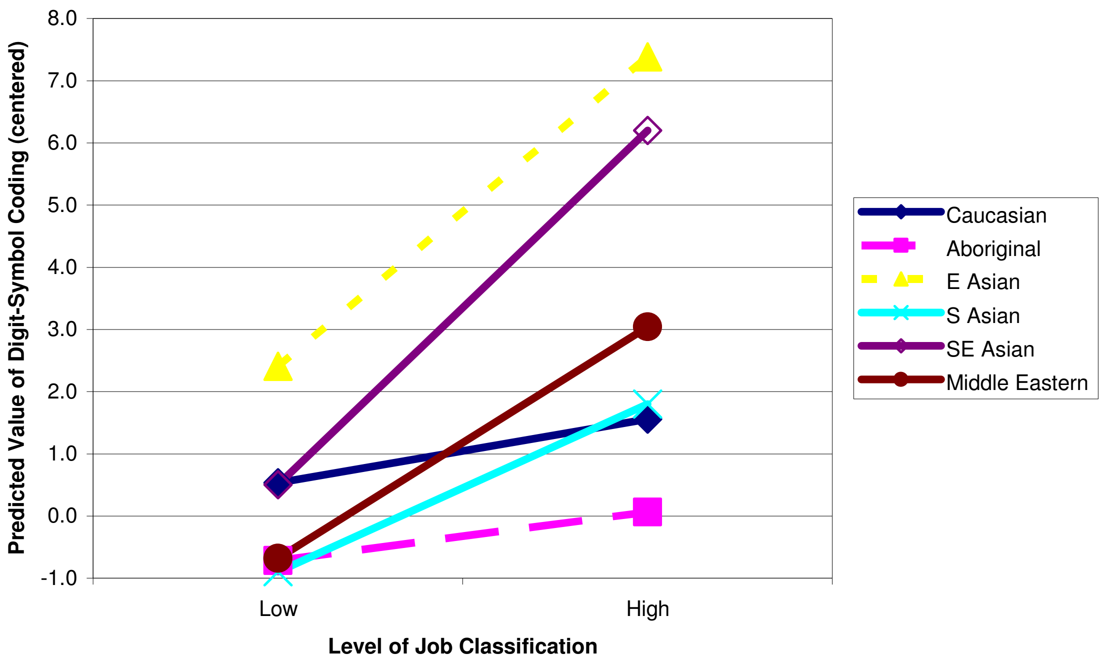


*Figure 14.* Edmonton Interaction between Ethnocultural Group and Job Classification in Predicting Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score.

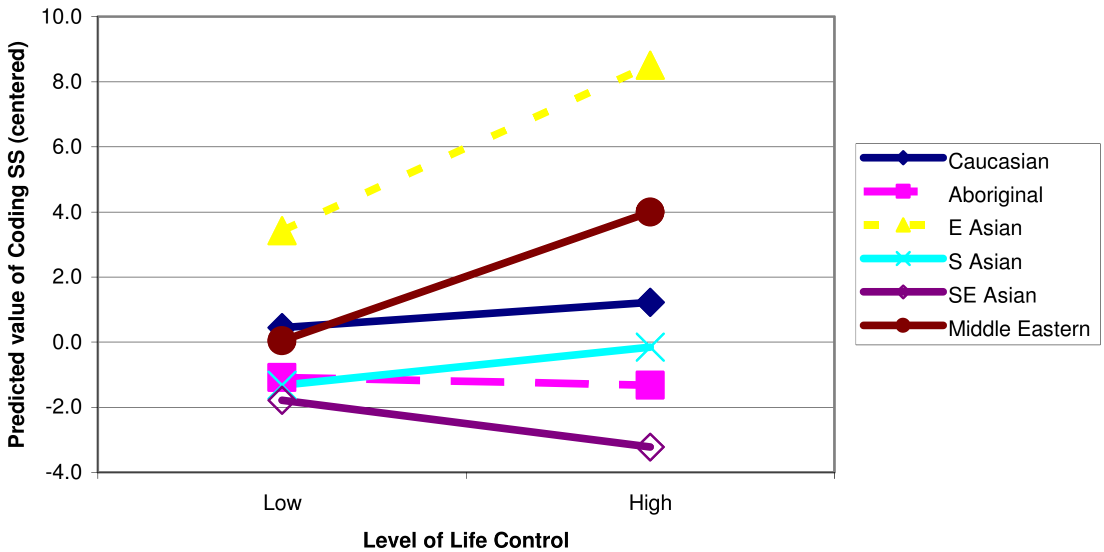


*Figure 15*. Edmonton Interaction between Ethnocultural Group and Multidimensional Pain Inventory (MPI) Life Control Raw Score in Predicting Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score.

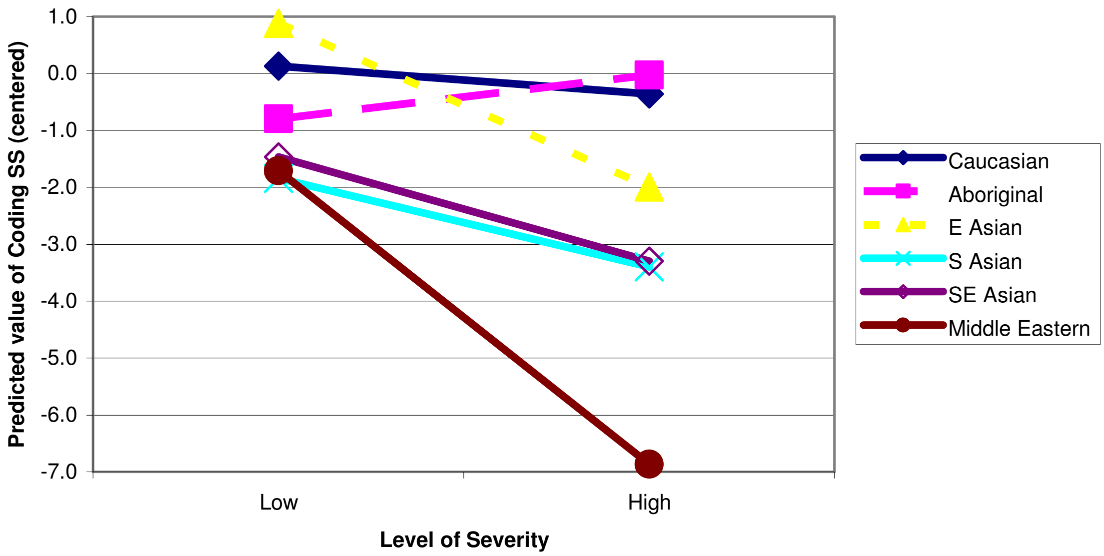


*Figure 16.* Edmonton Interaction between Ethnocultural Group and Multidimensional Pain Inventory (MPI) Severity Raw Score in Predicting Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score.

**Summary.** Age, years of education, WRAT Reading scaled score, MPI Affective Distress, MPI General Activity, MPI Life Control, MPI Support, and MPI Solicitousness were all significant predictors of MPI Severity. MPI Severity, MPI General Activity, MPI Life Control, MPI Support, and MPI Solicitousness were significant predictors of MPI Affective Distress. The predictive value of Life Control differed for Aboriginal clients relative to clients from other ethnocultural groups, and the predictive value of partner Solicitousness differed for Southeast Asian clients relative to those from other ethnocultural groups. MPI Severity, MPI Affective Distress and MPI Life Control were significant predictors of MPI General Activity. Finally, years of education, WRAT Reading scaled score, job classification, and MPI Life Control were significant predictors of Digit-Symbol Coding scaled score. The predictive value of job classification differed for East Asian and Southeast Asian clients relative to clients from other ethnocultural groups, the predictive value of Severity differed for Middle Eastern clients relative to those from other groups, and the predictive value of Life Control differed for East Asian and Aboriginal clients relative to clients from other ethnocultural groups. Although the predictive value of most variables was similar for most groups, some differences did emerge through these analyses, particularly with regard to Digit-Symbol Coding and these differences may have clinical and/or research implications.

### Hypothesis 5: Differences in Chronic Pain Outcomes by Nativity

Hypothesis 5, that differences on measures of chronic pain outcomes (pain severity, emotional distress, and general activity) would exist when comparing foreign-born East Asian, South Asian, Southeast Asian, and Middle Eastern clients with Canadian-born clients from the same four ethnocultural groups, even when taking into account relevant demographic variables, was tested using a series of ANOVAs. MPI Severity, MPI Affective Distress, MPI General Activity, and MMPI A T-score were used as dependent variables for these analyses, and nativity (i.e., Canadian-born vs. foreign-born) and gender were used as between-subjects factors.

The use of demographic variables other than gender (age, years of education, educational quality, and/or SES) as covariates was also considered. However, significant WRAT Reading data were missing because many clients in the East Asian, South Asian, Southeast Asian, and Middle Eastern groups learned English as a second language and therefore did not complete the WRAT Reading measure due to potential bias. As such, it was not thought to be suitable for use as a covariate. In addition, age, years of education, and job classification did not correlate significantly with any of the pain outcome variables in the sample of clients used for analyses based on nativity (refer to Table 13 below). With these considerations in mind, no covariates were employed in the analyses for Hypothesis 5.

Table 13

*Edmonton Correlations between Demographics and Variables of Interest for Sample Used in Nativity Analyses (N =194)*

| | MPI [b] Severity | MPI Distress | MPI Activity | MMPI A [d] | MPI Control | MPI Support | MPI Solicit |
|---|---|---|---|---|---|---|---|
| Age | .13 | .02 | -.08 | -.26 | .16 | .002 | .04 |
| Years of education | -.17 | -.04 | .06 | -.13 | .07 | -.001 | -.16 |
| Job classification [a] | -.11 | .06 | .01 | -.08 | .05 | .06 | -.02 |

[a] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56." Copyright 1992 by Elsevier. [b] Multidimensional Pain Inventory. [d] Minnesota Multiphasic Personality Inventory – 2nd edition Welsh's Anxiety T-score.
* correlation significant at $p < .002$ (Dunn-Šidák correction)

**Severity.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effect of nativity was significant, $F(1,190) = 25.43$, $p < .001$, $r = .34$, with foreign-born clients reporting higher levels of pain severity than those who were Canadian-born. The main effect of gender and the interaction between nativity and gender were not significant. Refer to Table 106 in Appendix B for ANCOVA values and Figure 18 for a visual representation of the data.

**Affective Distress.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of nativity and gender were not significant, and neither was the interaction between nativity and gender. Refer to Table 107 in Appendix B for ANOVA values and Figure 18 for a visual representation of the data.

**General Activity.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effect of nativity was significant, $F(1,190) = 25.77$, $p = .001$, $r = .35$, with foreign-born clients reporting lower levels of general activity than those who were Canadian-born. The main effect of gender and the interaction between nativity and gender were not significant. Refer to Table 108 in Appendix B for ANOVA values and Figure 17 for a visual representation of the data.

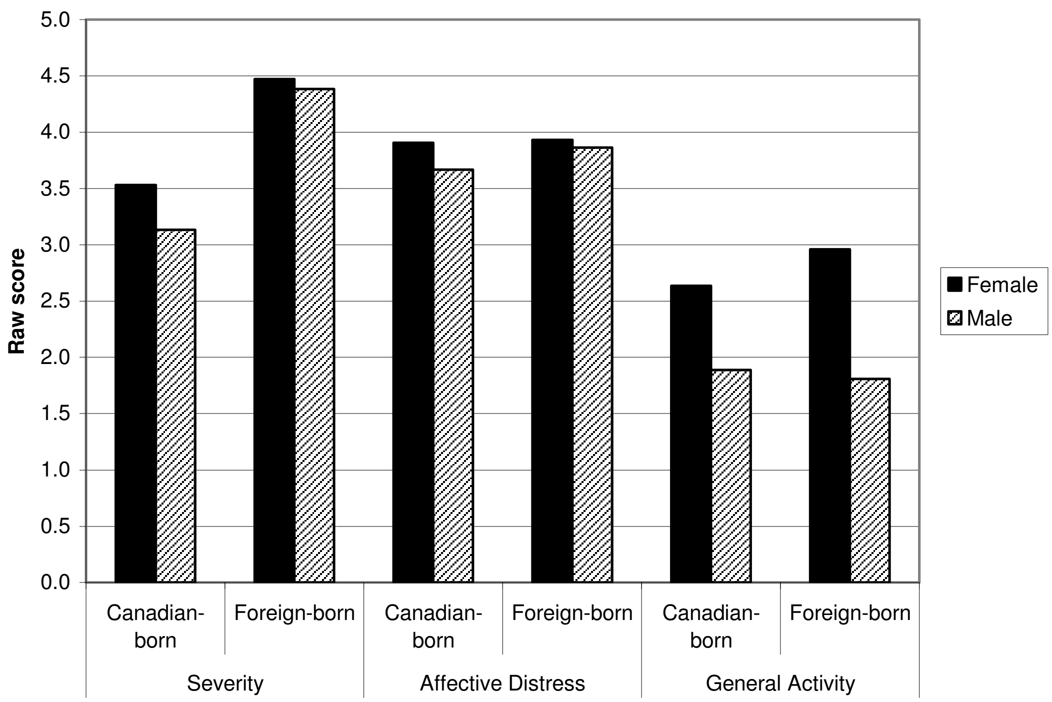


*Figure 17.* Edmonton Mean Multidimensional Pain Inventory (MPI) Severity, Affective Distress, and General Activity Raw Scores by Nativity and Gender.

**MMPI A T-score.** No issues with normality or homogeneity of variance and covariance were detected in the data set. Gender was not used as a between-subjects factor in this analysis as MMPI T-scores are gender-normed. The main effect of nativity was not significant. Refer to Table 109 in Appendix B for ANOVA values and Figure 18 for a visual representation of the data.

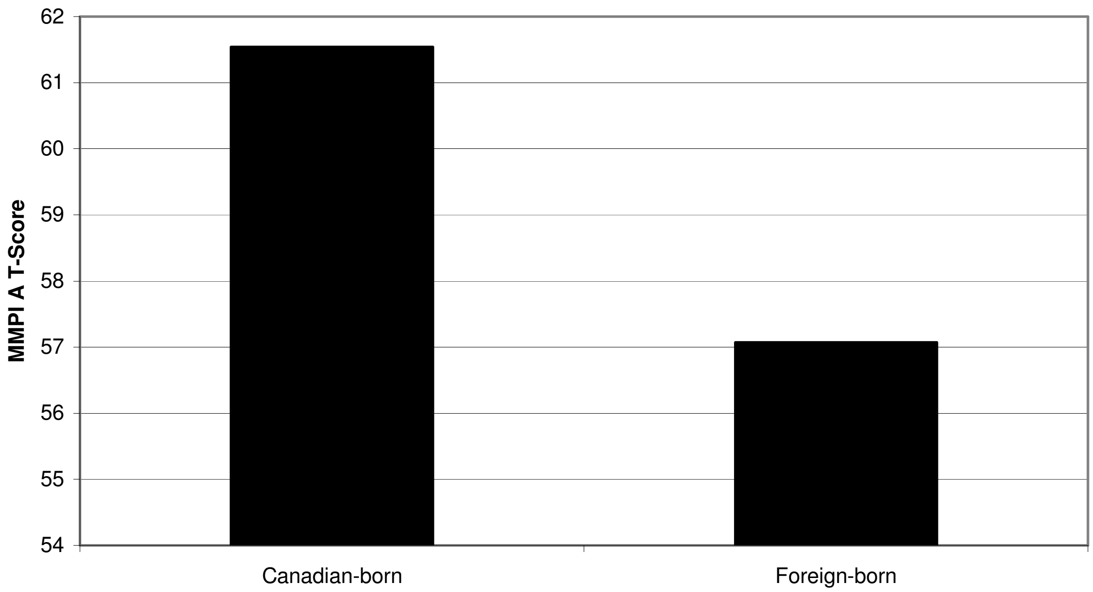


*Figure 18.* Edmonton Mean Minnesota Multiphasic Personality Inventory Welsh's Anxiety T-score by Nativity and Gender.

**Hypothesis 6: Differences in Pain-Related Variables by Nativity**

Hypothesis 6, that differences on measures of pain-related variables (life control, perceived support, partner solicitousness) would exist when comparing foreign-born East Asian, South Asian, Southeast Asian, and Middle Eastern clients with Canadian-born clients from the same ethnocultural groups, even when taking into account demographic variables, specifically gender, years of education, educational quality, and/or SES, was tested through a series of ANOVAs. MPI Life Control, MPI Support, and MPI Solicitousness were used as dependent variables for these analyses, and nativity (Canadian-born vs. foreign-born) and gender were used as between-subjects factors.

The use of demographic variables other than gender (age, years of education, educational quality, and/or SES) as covariates was also considered. However, significant WRAT Reading data were missing because many clients in the East Asian, South Asian, Southeast Asian, and Middle Eastern groups learned English as a second language and therefore did not complete the WRAT Reading measure due to potential bias. As such, it was not thought to be suitable for use as a covariate. In addition, age, years of education, and job classification did not correlate significantly with any of the pain-related variables in the sample of clients used for analyses based on nativity (refer to Table 13 on p. 165). With these considerations in mind, no covariates were employed in the analyses for Hypothesis 6.

**Life Control.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of nativity and gender were not significant, and neither was the interaction between nativity and gender. Refer to Table 110 in Appendix B for ANOVA values and Figure 20 for a visual representation of the data.

**Support.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of nativity and gender were not significant, and neither was the interaction between nativity and gender were not significant. Refer to Table 111 in Appendix B for ANOVA values and Figure 20 for a visual representation of the data.

**Solicitousness.** No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of nativity and gender were not significant, and neither was the interaction between nativity and gender. Refer to Table 112 in Appendix B for ANOVA values and Figure 19 for a visual representation of the data.

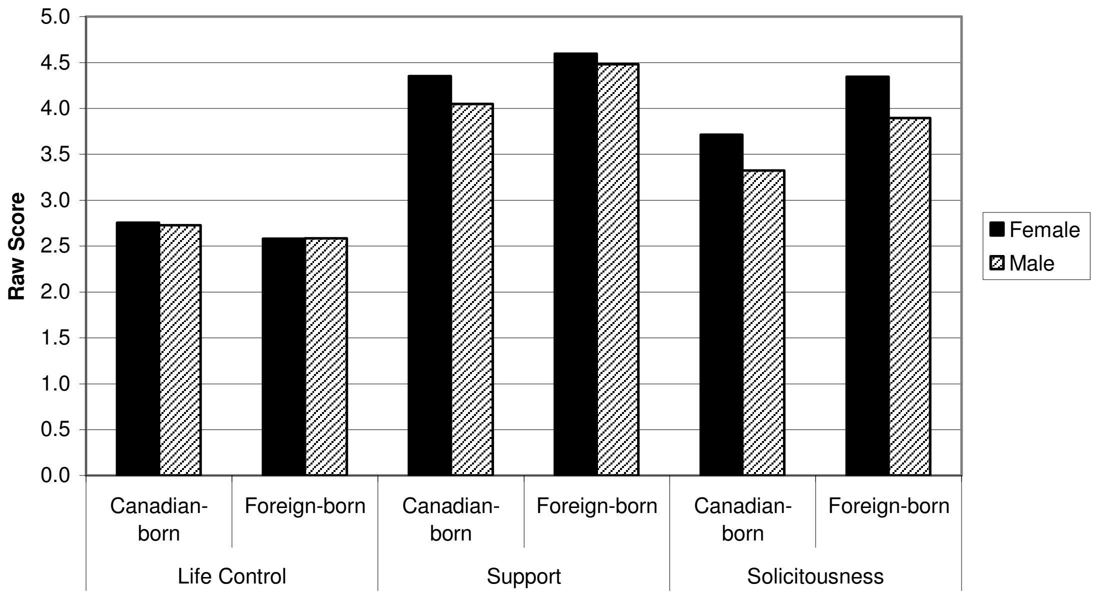


*Figure 19.* Edmonton Unadjusted Mean Multidimensional Pain Inventory (MPI) Life Control, Support, and Solicitousness Raw Scores by Nativity and Gender.

**Hypothesis 7: Differences in Overall Pain Profiles Based on Nativity**

Hypothesis 7, that overall differences in pain profiles would exist when comparing Canadian-born and foreign-born clients, was tested with a chi-square analysis. More clients in both groups were classified as having Dysfunctional pain profiles (34% of Canadian-born clients and 48% of foreign-born clients) than other pain profiles, and the groups did not differ with respect to classification, $\chi^2$ (4) = 5.91, $p$ = .248. Refer to Table 14 for additional details.

Table 14

*Edmonton Chi-Square Analysis of Pain Profiles Based on Nativity*

| | Canadian-born ($n$ = 32) | | Foreign-born ($n$ = 155) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| Dysfunctional | 11 | 34 | 75 | 48 |
| Interpersonally Distressed | 7 | 22 | 18 | 12 |
| Adaptive Coper | 8 | 25 | 38 | 25 |
| Hybrid | 2 | 6 | 16 | 10 |
| Anomalous | 4 | 13 | 8 | 5 |

**Summary of Immigration-Related Analyses**

Foreign-born clients from the East Asian, South Asian, Southeast Asian, and Middle Eastern groups reported higher MPI Severity and lower MPI General Activity than Canadian-born clients from the same ethnocultural groups. Scores on MPI Affective Distress, MPI Life Control, MPI Support, and MPI Solicitousness did not differ by nativity, nor did overall MPI profile.

**Hypothesis 8: Influence of Acculturation-Related Variables**

Hypothesis 8, that acculturation-related variables would play a role in chronic pain outcomes (severity, affective distress, and activity level) and pain-related variables (life control, support, and solicitousness), was tested by generating variables regarding the years that immigrants in the Edmonton sample had spent in Canada and years that they had been exposed to English and correlating these values with pain-related variables to determine if any relationships existed. Performance on an English reading test (WRAT Reading) as also used as an acculturation-related variable, as word reading has been found to correlate well with level of acculturation (Kuo, 2004). Although years lived in Canada and years exposed to English are not direct measures of acculturation and do not take into account that people immigrating to a new country do not necessarily integrate with the host culture, they were used as no direct measures of acculturation were available. Correlational analyses were intended to select acculturation-related predictors for multiple regression analyses which would have been conducted using acculturation-related variables and other variables related to the dependent variables as predictors.

Although no direct measures of acculturation were available in the Edmonton data set, information regarding the age at which foreign-born clients moved to Canada and the age at which these clients began learning English was available. By subtracting these ages from each client's age at the time of assessment, it was possible to determine the age at which they immigrated and the age at which they were first exposed to English. Furthermore, by dividing the ages of immigration and English exposure by the client's age at the time of assessment it was possible to determine what percent of each client's life had been spent in Canada and communicating in English. Descriptive information regarding these variables can be seen in Table 15, which shows no significant differences among immigrants from the four ethnocultural groups.

Table 15

*Edmonton Sample Characteristics with p-values for ANOVAs for Foreign-Born East Asian, South Asian, Southeast Asian, and Middle Eastern Clients (N = 161)*

| | E Asian ($n$ = 27) | S Asian ($n$ = 57) | SE Asian ($n$ = 33) | Middle Eastern ($n$ = 44) | $p$-value |
|---|---|---|---|---|---|
| WRAT Reading | 82.36 (14.58) [b] | 83.32 (11.98) [c] | 88.68 (10.36) [d] | 80.17 (13.69) [e] | .181 |
| Years since immigration | 20.78 (12.78) | 16.77 (8.71) | 15.92 (9.28) | 18.08 (8.41) | .213 |
| Age at immigration | 25.30 (9.07) | 23.38 (8.47) | 24.34 (8.83) | 20.54 (7.63) | .088 |
| Percent of life in Canada | 42.86 (21.56) | 41.42 (16.30) | 39.68 (20.43) | 47.48 (17.11) | .252 |
| Years of English exposure | 26.94 (12.76) | 23.37 (10.56) | 19.68 (11.23) | 22.55 (8.20) | .069 |
| Age at English exposure | 19.13 (9.61) | 16.78 (9.24) | 20.58 (10.23) | 16.08 (6.72) | .107 |
| Percent of life exposed to English | 57.08 (21.83) | 58.02 (19.31) | 49.05 (24.19) | 59.33 (14.03) | .115 |

*Note.* With exception of number of participants and gender, scores are represented as *M (SD).*
[a] Wide Range Achievement Test. [b] $n$ = 14. [c] $n$ = 37. [d] $n$ = 16. [e] $n$ = 35.

The acculturation-related variables were subsequently correlated with pain-related variables of interest to determine if any relationships existed. No correlations were found to be significant based on the Dunn-Šidák correction, and as such no multiple regression analyses were performed for this hypothesis. Refer to Table 16 for more details regarding the correlations in question.

Table 16

*Edmonton Correlations between Acculturation-Related Variables and Variables of Interest (N =161)*

| | MPI [a] Severity | MPI Distress | MPI Activity | MMPI A [b] | MPI Control | MPI Support | MPI Solicit [c] |
|---|---|---|---|---|---|---|---|
| WRAT [d] Reading | -.23 | -.24 | .11 | .01 | .17 | .11 | .03 |
| Years since immigration | -.04 | -.07 | .20 | -.18 | .20 | -.04 | -.06 |
| Age at immigration | -.001 | .02 | -.10 | -.18 | .07 | -.02 | .02 |
| Percent of life in Canada | -.05 | -.06 | .15 | .00 | .09 | -.03 | -.07 |
| Years of English exposure | -.01 | -.12 | .12 | -.24 | .22 | .04 | -.08 |
| Age at English exposure | -.03 | .08 | -.02 | -.08 | .02 | -.12 | .06 |
| Percent of life exposed to English | -.02 | -.11 | .06 | -.09 | .11 | .08 | -.10 |

[a] Multidimensional Pain Inventory. [b] Minnesota Multiphasic Personality Inventory – 2nd edition Welsh's Anxiety scale T-score. [c] Solicitousness. [d] Wide Range Achievement Test.
* correlation significant at $p < .001$ (Dunn-Šidák correction)

## Hypothesis 9: Ethnocultural Differences on Performance Validity Measures

Hypothesis 9, that ethnocultural group differences would be found on performance validity measures, even when taking into account demographic variables (age, gender, years of education, educational quality, and/or SES) was tested using ANCOVAs with percent of effort test scores below cutoff and gender as between-subjects factors. Covariates were selected for the Novi and Edmonton samples based on their correlations with percent of effort test scores below cutoff.

## Novi Differences on Performance Validity Measures

To determine whether there were ethnocultural differences in the rate of scores below cutoff on performance validity tests, an ANCOVA was conducted with the previously calculated percent of effort test scores below cutoff value as the dependent variable and ethnocultural group and gender as between-subjects factors. Given that the

WTAR raw score was significantly correlated with percent of effort test scores below cutoff ($r$ = -.22, $p$ <.001), it was included in the analysis as a covariate. Age ($r$ = .08, $p$ = .302) and years of education ($r$ < -.01, $p$ = .989) were not significantly correlated with percent of effort test scores below cutoff and were therefore not included as covariates.

No issues with normality, homogeneity of variance and covariance, or homogeneity of regression slopes were detected in the data set. The covariate, WTAR raw score, was significantly associated with percent of effort test scores below cutoff, $F(1,148) = 7.60$, $p$ = .007, $r$ = .22. The main effects of ethnocultural group and gender were not significant, and neither was the interaction between ethnocultural group and gender. Refer to Table 113 in Appendix B for ANOVA values and Figure 20 for a visual representation of the data.

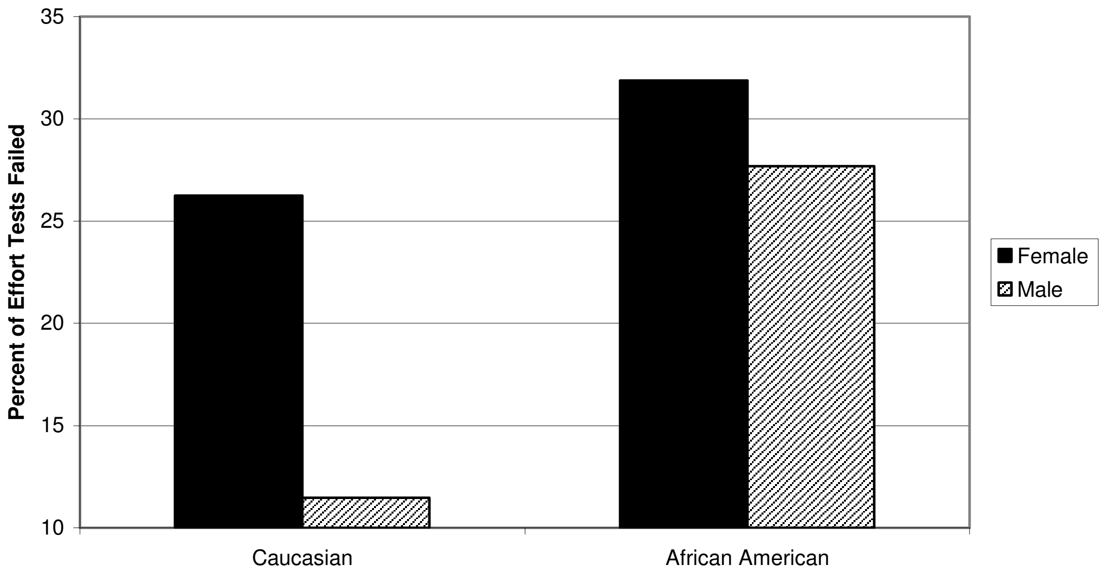


*Figure 20.* Novi Unadjusted Mean Percent of Effort Test Scores Below Cutoff by Ethnocultural Group and Gender.

**Edmonton Differences on Performance Validity Measures**

Procedures used in this analysis were the same as those employed in the analysis of Novi data. Given that age ($r$ = .11; $p$ = .001) and years of education ($r$ = -.18; $p$ <.001) were significantly correlated with percent of effort test scores below cutoff they were included in the analysis covariates. Although the WRAT Reading scaled score correlated significantly with percent of effort test scores below cutoff ($r$ = -.36, $p$ <.001), the use of this variable as a covariate would have resulted in data loss, especially in groups of minority ethnocultural status and therefore it was not used.

No issues with normality were detected; however, Levene's test suggested issues with homogeneity of variance. ANCOVA is robust to violations of this assumption when sample sizes are large and normality is intact (Field, 2005), though, so this was not thought to be a great concern. In addition, issues with homogeneity of regression slopes were detected. This suggested that the relationship between the covariates (age and years of education) and percent of effort test scores below cutoff varied across ethnocultural group, which may have impacted the results of the analysis.

Age, used as a covariate, was significantly associated with percent of effort test scores below cutoff, $F(1,902) = 16.56$, $p < .001$, $r = .13$, as was years of education, also used as a covariate, $F(1,902) = 40.21$, $p < .001$, $r = .21$. The main effect of gender on percent of effort test scores below cutoff was significant, $F(1, 902)$, = 18.10, $p < .001$, $r = .14$, with female clients tending to score below cutoff on a higher percentage of psychometric effort measures than males. The main effect of ethnocultural group was also significant, $F(5,902) = 20.18$, $p < .001$, $r = .32$. Pairwise comparisons revealed that South Asian clients scored below cutoff on more effort tests than Caucasian clients (mean difference = -18.26, $p < .001$), as did Southeast Asian (mean difference = -27.30, $p <$ .001) and Middle Eastern (mean difference = -25.44, $p < .001$) clients. The interaction between ethnocultural group and gender was also significant, $F(5,902) = 3.31$, $p = .006$, $r = 13$, with visual inspection of the data suggesting that female clients scored below cutoff on more effort tests than male clients in the East Asian, South Asian, Southeast Asian, and Middle Eastern groups, but not in the Caucasian and Aboriginal groups. Refer to Tables 114 and 115 in Appendix B for ANCOVA and pairwise comparison values, and Figure 21 for a visual representation of the data.

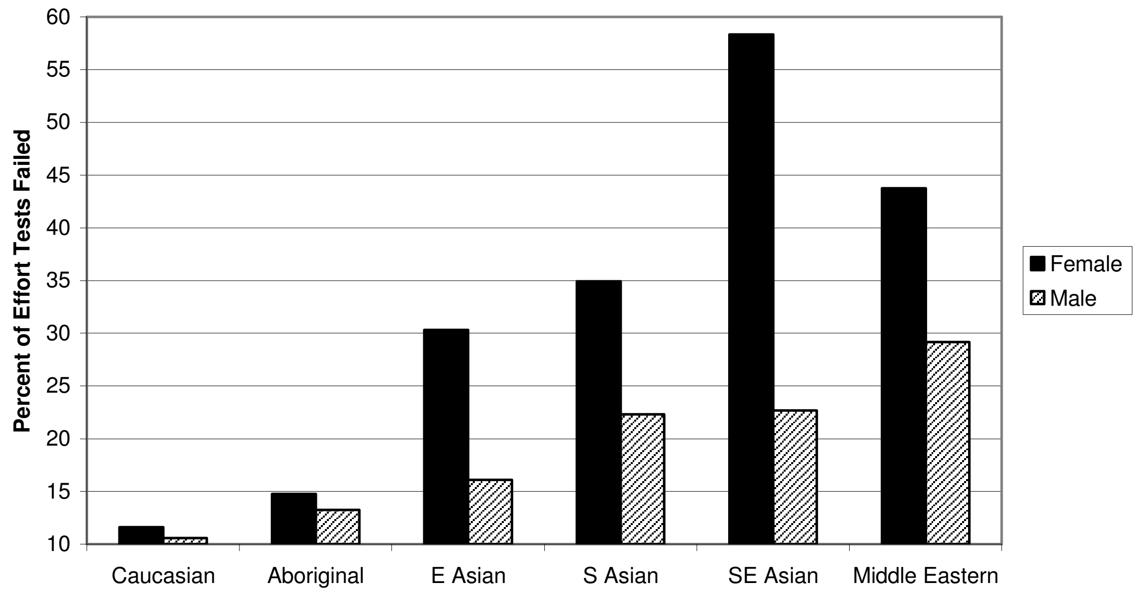


*Figure 21.* Edmonton Unadjusted Mean Percent of Effort Test Scores Below Cutoff by Ethnocultural Group and Gender.

**Summary of Performance Validity Analyses**

In the Novi sample, there were no ethnic group differences with regard to performance-based measures of response bias (adjusted for WTAR raw score). In the Edmonton sample, ethnocultural group and gender differences were found on performance-based measures of response bias (adjusted for age and years of education). However, these results must be interpreted cautiously for a number of reasons that will be presented in the Discussion.

## Summary of Main Statistical Analyses

Summaries of the results of the Novi and Edmonton analyses can be found in Tables 17 and 18.

Table 17

*Novi Summary of Results*

| | Prediction | Measures | Findings |
|---|---|---|---|
| Hypothesis 1 | Ethnocultural differences in pain outcomes | MPI [a] Severity<br>MPI Distress<br>MPI Activity<br>MMPI A [b] | No differences |
| Hypothesis 2 | Ethnocultural differences in pain-related variables | MPI Control<br>MPI Support<br>MPI Solicitousness | Interaction: African American males higher Control than Caucasian males |
| Hypothesis 3 | Ethnocultural differences in overall pain profile | MPI profile | No difference |
| Hypothesis 4 | Differences in predictive value of variables on pain outcomes | Predictors:<br>Demographics<br>Pain outcomes<br>Pain-related variables<br><br>Outcomes:<br>MPI Severity<br>MPI Distress<br>MPI Activity<br>WAIS Coding [c] | Solicitousness more positively associated with Distress for African American than for Caucasian |
| Hypothesis 9 | Ethnocultural differences on performance validity measures | Percent of performance validity scores below cutoff | No difference |

*Note.* Hypotheses 5-8 did not apply to Novi sample.
[a] = Multidimensional Pain Inventory. [b] = Minnesota Multiphasic Personality Inventory – 2nd Edition Welsh's Anxiety scale T-score. [c] = Wechsler Adult Intelligence Scale – 3rd Edition Digit-Symbol Coding scaled score. [d] = Minnesota Multiphasic Personality Inventory – 2nd Edition Symptom Validity Scale.

Table 18

*Edmonton Summary of Results*

| | Prediction | Measures | Findings |
|---|---|---|---|
| Hypothesis 1 | Ethnocultural differences in pain outcomes | MPI [a] Severity<br>MPI Distress<br>MPI Activity<br>MMPI A [b] | Southeast Asian (SEA) and Middle Eastern (ME) higher Severity than Caucasian<br>South Asian (SA) and ME lower Activity than Caucasian<br>ME higher MMPI A than Caucasian |
| Hypothesis 2 | Ethnocultural differences in pain-related variables | MPI Control<br>MPI Support<br>MPI Solicitousness | Overall difference in control<br>SA higher Solicitousness than Caucasian<br>Females higher Solicit than males |
| Hypothesis 3 | Ethnocultural differences in overall pain profile | MPI profile | Overall difference; more ME classified as "dysfunctional" |
| Hypothesis 4 | Differences in predictive value of variables on pain outcomes | <u>Predictors</u>:<br>Demographics<br>Pain outcomes<br>Pain-related variables<br><u>Outcomes</u>:<br>MPI Severity<br>MPI Distress<br>MPI Activity<br>WAIS Coding [c] | Control less negatively associated with Distress for Aboriginal than others<br>Solicitousness more positively associated with Distress for SEA than others<br>Job classification more positively associated with Coding for East Asian (EA) and SEA than others<br>Severity more negatively associated with Coding for ME than others<br>Life Control more positively associated with Coding for EA and ME than others |
| Hypothesis 5 | Nativity differences in pain outcomes | MPI Severity<br>MPI Distress<br>MPI Activity<br>MMPI A | Foreign-born higher Severity and lower Activity than Canadian-born |
| Hypothesis 6 | Nativity differences in pain-related variables | MPI Control<br>MPI Support<br>MPI Solicitousness | No differences |
| Hypothesis 7 | Nativity differences in overall pain profile | MPI profile | No difference |
| Hypothesis 8 | Acculturation-related variables will predict pain outcomes | <u>Predictors</u>:<br>Years in Canada<br>Years of English<br>WRAT Reading<br><u>Outcomes</u>:<br>See Hypothesis 1 | Acculturation-related variables were not significantly correlated with outcomes, therefore multiple regression analyses were not conducted |
| Hypothesis 9 | Ethnocultural differences on performance validity measures | Percent of performance validity scores below cutoff | EA [h], SA, SEA, and ME higher percentage than Caucasian |

[a] = Multidimensional Pain Inventory. [b] = Minnesota Multiphasic Personality Inventory – 2nd Edition Welsh's Anxiety scale T-score. [c] = Wechsler Adult Intelligence Scale – 3rd Edition Digit-Symbol Coding scaled score. [d] = Minnesota Multiphasic Personality Inventory – 2nd Edition Symptom Validity Scale.

**Supplementary Analyses: Gender Differences on Performance Validity Measures**

A gender difference was found on performance validity analyses in the present study, as female clients in the Edmonton sample scored below cutoff on a higher percentage of performance validity measures than male clients. A male advantage has been identified on Digit Span (Lynn & Irwing, 2008) and Finger Tapping (Strauss et al., 2006), two of the four tests from which the performance validity measures in this study were derived, and this may have accounted for the observed gender difference on performance validity measures. As such, additional analyses were conducted exploring gender differences in percentage of scores below cutoff on each individual performance validity measure for the Edmonton sample.

For Reliable Digit Span, 51% of males and 49% of females scored below cutoff, with no gender difference detected $\chi^2$ (2) = .001, $p$ = .979. For Trails A raw score, 66% of males and 34% of females scored below cutoff, with no gender difference detected $\chi^2$ (2) = 3.57, $p$ = .059. For Finger Tapping combined raw score, 32% of males and 68% of females scored below cutoff, and a gender difference was detected $\chi^2$ (2) = 21.96, $p < .001$. For CVLT Recognition raw hits, 61% of males and 39% of females scored below cutoff, with no gender difference detected $\chi^2$ (2) = 2.74, $p$ = .098. These results suggest that gender differences only existed on one of the four performance validity measures used to calculate the percentage of scores below cutoff composite, Finger Tapping combined raw score.

To test the possibility that a gender difference on Finger Tapping combined raw score was sufficient to account for the overall gender difference observed on the percentage of performance validity scores below cutoff in the Edmonton sample, a new version of percentage of performance validity scores below cutoff was calculated omitting Finger Tapping combined raw score. Gender differences were not found on this new variable $F(1,704) = .82$, $p = .366$, which suggests that gender differences on Finger Tapping combined raw score were sufficient to create a gender imbalance with respect to percentage of performance validity scores below cutoff.

**Supplementary Analyses: Ethnocultural Differences on Self-Report Validity Scale**

Limited research has been conducted regarding ethnocultural differences on the MMPI-2 FBS (Dean et al., 2008). As such, supplemental analyses were conducted with the samples used in this study to add to this body of research.

**Novi Differences on the MMPI-2 FBS**

To determine whether there were ethnocultural differences on the MMPI-2 FBS scores, an ANOVA was conducted with MMPI-2 FBS raw score as the dependent variable and ethnocultural group and gender as between-subjects factors. Neither age ($r = -.04$, $p = .661$), years of education ($r = -.07$, $p = .443$), nor WTAR raw score ($r = -.18$, $p = .036$) correlated significantly with the MMPI-2 FBS raw score, and as such these variables were not used as covariates in this analysis.

No issues with normality or homogeneity of variance and covariance were detected in the data set. The main effects of ethnocultural group and gender on MMPI-2 FBS raw score were not significant, nor was the interaction between these variables. Refer to Table 116 in Appendix B for ANOVA values and Figure 22 for a visual representation of the data.

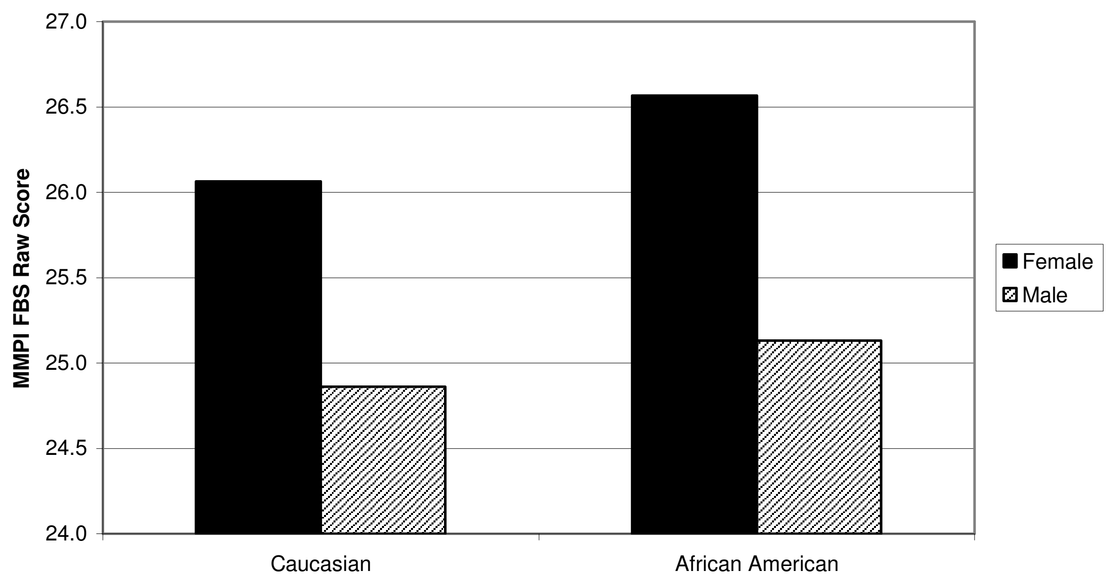


*Figure 22.* Novi Mean Minnesota Multiphasic Personality Inventory – 2nd Edition Symptom Validity Scale (FBS) Raw Score by Ethnocultural Group and Gender.

**Edmonton Differences on the MMPI-2 FBS**

Procedures used in this analysis were the same as those employed in the analysis of Novi data. Unfortunately, the sample was smaller for this analysis than other Edmonton analyses, as many clients in the Edmonton sample did not have scores recorded for the MMPI-2 FBS since they were not administered the MMPI-2 or completed it before the FBS scale was developed. Given that age was significantly correlated with the MMPI-2 FBS raw score ($r = .20$; $p < .001$) it was included in the analysis as a covariate. Years of education ($r = .04$; $p = .449$) and the WRAT Reading scaled score ($r = -.13$; $p = .027$) did not correlate significantly with the MMPI-2 FBS raw score and therefore were not used as covariates in this analysis.

No issues with normality, homogeneity of variance and covariance, or homogeneity of regression slopes were detected in the data set. Age, the covariate, was significantly associated with the MMPI-2 FBS raw score, $F(1,366) = 22.62$, $p < .001$, $r = .24$. The main effect of ethnocultural group was significant, $F(5,366) = 3.23$, $p = .007$, $r = .06$, though pairwise comparisons did not reveal any specific differences between the ethnocultural groups and the Caucasian group on the MMPI-2 FBS raw score. Neither gender nor the interaction between ethnocultural group and gender was significant. Refer to Tables 117 and 118 in Appendix B for ANCOVA and pairwise comparison values and Figure 23 for a visual representation of the data.

In the Novi sample, there were no ethnic group differences on a psychometric indicator of over-reporting, the MMPI-2 FBS raw score. In the Edmonton sample, ethnocultural group differences were found on the same measure (adjusted for age).

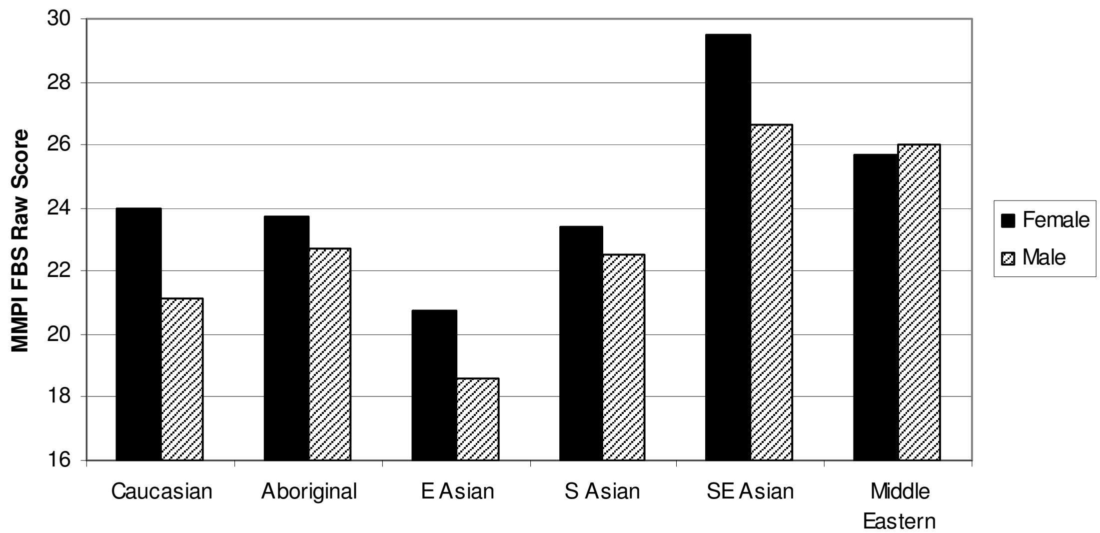


*Figure 23.* Edmonton Unadjusted Mean Minnesota Multiphasic Personality Inventory – 2nd Edition Symptom Validity Scale (FBS) Raw Score by Ethnocultural Group and Gender.

*Note.* Higher FBS scores suggest greater possibility that the client is over-reporting psychopathology.

**Supplementary Analyses: Differences on MMPI-2 Hs**

Past research has revealed ethnocultural differences in somatization (Al-Krenawi & Graham, 1999; Rogers & Allison, 2004) and these differences may have accounted for some of the ethnocultural differences in pain presentation that were observed in the Edmonton sample. Although no specific measures of somatization were available in the archival data sets used in this study, the MMPI-2 Hypochondriasis (Hs) scale was available, and this scale has been associated with somatization in past studies (Wetzel et al., 1999). As such, supplementary analyses were conducted using this scale.

To determine whether there were ethnocultural differences MMPI-2 Hs scores, an ANCOVA was conducted with the MMPI-2 Hs T-score as the dependent variable and ethnocultural group and gender as between-subjects factors. Age ($r$ = .14, $p$ <.001), and years of education ($r$ = -.12, $p$ = .011) correlated significantly with the MMPI-2 Hs T-score, and as such these variables were used as covariates in this analysis. Although the WRAT Reading scaled score correlated significantly with the MMPI-2 Hs T-score ($r$ = -.16, $p$ <.001), the use of this variable as a covariate would have resulted in data loss, especially in groups of minority ethnocultural status and therefore it was not used.

No issues with normality or homogeneity of variance and covariance were detected in the data set. Age and years of education, the covariates, were significantly associated with the MMPI-2 Hs T-score, $F$(1,735) = 22.23, $p$ < .001, $r$ = .17 and $F$(1,735) = 12.76, $p$ <.001, $r$ = .13 respectively. The main effect of ethnocultural group was significant, $F$(5,735) = 4.32, $p$ = .001, $r$ = .13, and pairwise comparisons revealed that Middle Eastern clients had higher MMPI-2 Hs T-scores than Caucasian clients (mean difference = -12.56, $p$ = .002),. Neither gender nor the interaction between ethnocultural group and gender were significant. Refer to Tables119 and 120 in Appendix B for ANCOVA and pairwise comparison values and Figure 24 for a visual representation of the data.

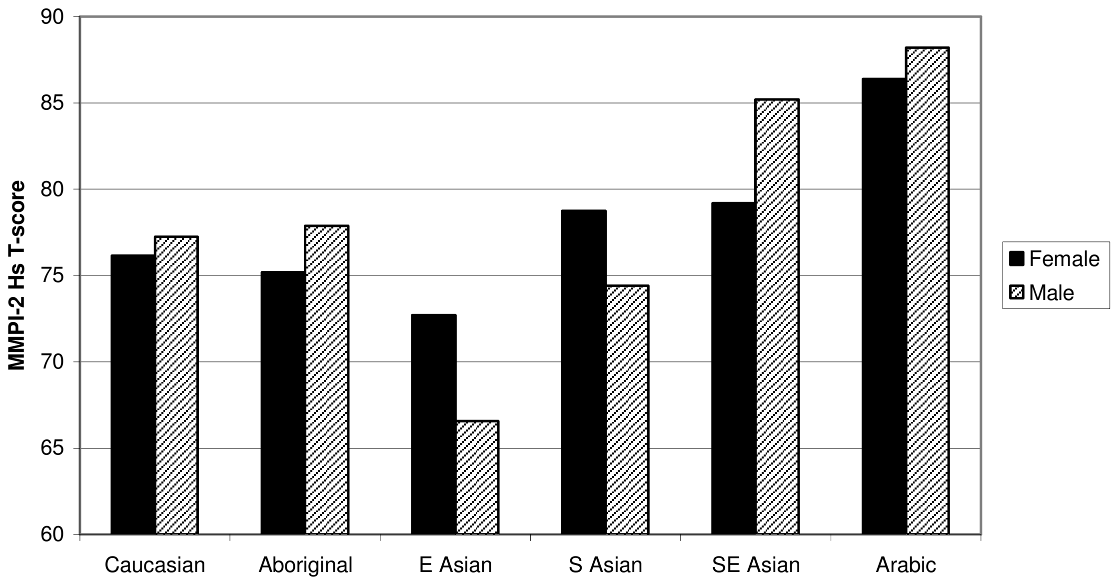


*Figure 24.* Edmonton Mean Minnesota Multiphasic Personality Inventory – 2nd Edition Hypochondriasis (Hs) Scale T-Score by Ethnocultural Group and Gender.

CHAPTER 4

# Discussion

This study investigated ethnocultural differences in chronic pain presentations in two samples of clients undergoing neuropsychological assessment following closed head injury. In one sample of Caucasian and African American clients seen for assessment in Novi, Michigan, relatively few differences in pain presentation were identified. In the second sample of Caucasian, Aboriginal, East Asian, South Asian, Southeast Asian, and Middle Eastern clients seen for assessment in Edmonton, Alberta, differences in pain presentation were observed in a number of analyses. A summary and discussion of major findings follows; a detailed listing of results by hypothesis appears in Tables 16 and 17, presented earlier.

## Major Findings

Hypothesis 1, that scores on measures of pain outcomes (severity, activity level, and two measures of affective distress) would differ across ethnocultural groups beyond the influence of sociodemographic variables (years of education, quality of education, and SES), was partially supported by the results of the study. Although no ethnocultural group differences on pain outcomes were detected in the Novi sample, differences on three of four outcome measures were found in the Edmonton sample. Southeast Asian and Middle Eastern clients reported greater pain severity than Caucasian clients, South Asian and Middle Eastern clients reported lower levels of activity than Caucasian clients, and Middle Eastern clients obtained higher scores on one index of affective distress.

Hypothesis 2, that scores on measures of pain-related variables (perceived control, perceived support, and partner solicitousness) would differ across ethnocultural groups beyond the influence of sociodemographic variables (years of education, quality of education, and SES), was also partially supported by the results of the study. In the Novi sample, male African American clients were found to report higher levels of life control than their Caucasian male counterparts, while no such difference was found in female clients. In the Edmonton sample, overall ethnocultural group differences were found on measures of life control and solicitousness. Although no specific ethnocultural group differences were found with respect to life control, South Asian clients reported higher levels of partner solicitousness in comparison to Caucasian clients.

Hypothesis 3, that overall pain profiles would differ across ethnocultural groups was partially supported by the results of the study. No ethnocultural group difference was detected in the Novi sample, but a difference in pain profiles was observed in the Edmonton sample. Middle Eastern clients appeared more likely to be classified as having a dysfunctional pain profile (characterized by high severity, high interference from pain, high affective distress, low life control, and low activity level) than clients from other ethnocultural groups.

Hypothesis 4, that the ability of pain-related variables (perceived life control, perceived support, partner solicitousness), pain outcomes (severity and affective distress), and demographic variables (years of education, quality of education) to predict pain outcomes (severity, affective distress, activity level, and processing speed) would vary across ethnocultural groups, was partially supported by the results of this study. Although the predictive value of most variables on the aforementioned outcomes did not differ across ethnocultural groups in the Novi sample, higher partner solicitousness was found to be more predictive of higher affective distress for African American clients relative to Caucasian clients. In the Edmonton sample, higher levels of life control were less predictive of lower affective distress for Aboriginal clients relative to clients of other ethnocultural backgrounds, and higher levels of solicitousness were found to be more predictive of higher levels of affective distress for Southeast Asian clients relative to clients of other ethnocultural backgrounds. Higher levels of pain severity were found to be more predictive of lower scores on a measure of processing speed for Middle Eastern clients relative to clients of other ethnocultural groups, higher life control was found to be more predictive of higher scores on a measure of processing speed for East Asian and Middle Eastern clients relative to clients of other ethnocultural groups, and higher SES (based on job classification) was found to be more predictive of higher scores on a measure of processing speed for East Asian and Southeast Asian clients relative to clients of other ethnocultural groups.

Hypothesis 5, that scores on pain outcome measures (severity, affective distress, and activity level) would differ by nativity beyond the influence of sociodemographic variables (years of education, quality of education, and SES), was partially supported by the results of this study. Foreign-born East Asian, South Asian, Southeast Asian, and Middle Eastern clients were found to report higher levels of pain severity and lower levels of activity than Canadian-born clients from the same four ethnocultural groups. Levels of affective distress were not found to differ based on nativity.

Hypothesis 6, that scores on measures of pain-related variables (perceived control, perceived support, and partner solicitousness) would differ by nativity beyond the influence of sociodemographic variables (years of education, quality of education, and SES), was not supported by the results of the study. No differences were detected on any of the measures in question when comparing the scores of East Asian, South Asian, Southeast Asian, and Middle Eastern clients based on nativity.

Hypothesis 7, that overall pain profiles would differ based on nativity, was not supported by the results of the study. No difference was detected between the overall pain profiles of minority group clients based on nativity.

Hypothesis 8, that acculturation-related variables would play a role in pain outcomes and pain-related variables, was not supported by the results of this study. None of the acculturation-related variables generated based on years spent in Canada or years of English exposure were found to correlate significantly with pain outcomes or pain-related variables, and neither was a measure of English reading ability (WRAT Reading). As such, further analyses were not undertaken.

Hypothesis 9, that scores on performance-based validity tests would differ across ethnocultural groups beyond the influence of sociodemographic variables (years of education, quality of education, and SES), was partially supported by the results of the study. Although no ethnocultural differences were detected in the Novi sample, in the Edmonton sample South Asian, Southeast Asian, and Middle Eastern clients were observed to score below cutoff on a higher percentage of performance validity tests than Caucasian clients.

Supplementary analyses were conducted to investigate ethnocultural differences on a self-report validity scale (MMPI-2 FBS raw score) and on a measure associated with somatization (MMPI-2 Hs T-score). Although no ethnocultural group differences on the MMPI-2 FBS scale were detected in the Novi sample, an overall difference in scores on this scale was observed across ethnocultural groups in the Edmonton sample. However, no specific ethnocultural groups were found to differ from Caucasian clients when contrasts were performed. With respect to the MMPI-2 Hs T-score, an overall ethnocultural group difference was detected in the Edmonton sample. Planned comparisons indicated that clients of Middle Eastern background obtained higher MMPI-2 Hs T-scores than Caucasian clients.

**Novi Ethnocultural Group Similarities and Differences in Chronic Pain Presentation**

Overall, the African American and Caucasian clients in the Novi sample had similar chronic pain presentations; no differences were detected on chronic pain outcomes. This is consistent with previous studies of these two groups which controlled for education (Cano et al., 2006) or in which African American and Caucasian clients did not differ with respect to years of education (Jordan et al., 1998). In another study in which years of education differed between African American and Caucasian groups, differences in pain severity, affective distress, and interference from pain were detected (Vallerand et al., 2005). It may be that the relative similarities between the groups in the present study with respect to years of education and job classification contributed to the similarities observed with respect to chronic pain outcomes. In any case, the results of the present study suggest that the Caucasian and African American groups experienced chronic pain in remarkably similar ways.

On the other hand, a number of past studies of African American and Caucasian American participants found that African Americans reported lower levels of control over their pain (Vallerand et al., 2005; Tan et al., 2005; Jordan et al., 1998), even when accounting for years of education (Cano et al., 2006). This finding was not replicated in the present study – in fact, African American clients were found to report higher levels of life control than Caucasian clients. An interaction between gender and ethnocultural group was observed with regard to life control, though, as African American and Caucasian American females reported similar levels of life control, while African American males reported more life control than Caucasian males. Most of the studies cited were conducted with predominately female samples (Cano et al., 2006; Jordan et al., 1998), or with more females in the African American group than the Caucasian group (Vallerand et al., 2005). With that said, African Americans were found to report lower life control even in the one study where the sample was predominately male (Tan et al., 2005), so the percentage of male and female clients in the present study does not fully explain the inconsistency regarding life control in comparison to previous studies.

The inconsistency with respect to life control may be because chronic pain was a secondary problem in the present study and the primary presenting problem in other studies. African American males primarily concerned with pain could perceive lower levels of control than those for whom pain was a secondary concern. Possible differences in the measures of control employed from study to study could also have led to variability in responses. In addition, consultation with the clinician in possession of the data suggested that the African American clients seen in Novi predominately resided in suburban areas, whereas those in other samples may have been more likely to live in inner-city areas and accordingly less likely to perceive control over their lives. That a large proportion of clients in the Novi sample were in litigation also may have been a factor, as Caucasian male clients in this study may have reported lower levels of control than those in other studies who were not engaged in litigation regarding their injuries.

**Edmonton Ethnocultural Group Differences in Chronic Pain Presentation**

In contrast with the Novi sample, a number of differences in chronic pain outcomes and pain-related variables were observed in the Edmonton sample. Southeast

Asian, South Asian, and Middle Eastern clients reported higher levels of pain severity than Caucasian clients, Middle Eastern clients reported higher levels of affective distress than Caucasian clients, and South Asian and Middle Eastern clients reported lower levels of activity than Caucasian clients. With respect to pain-related variables, South Asian and Middle Eastern clients reported higher levels of partner solicitousness than Caucasian clients and an overall difference was observed with respect to life control, with no specific group differences detected. Overall, the chronic pain presentations of South Asian and Middle Eastern clients seemed to differ the most from those of Caucasian clients. In contrast, the pain presentations of Aboriginal and East Asian clients did not differ from those of Caucasian clients on any variables.

The reasons for the differences in pain presentation across ethnocultural groups in Edmonton are not entirely clear. Differences do not appear to be due to the sociodemographic variables included in this study, namely age, years of education, and job classification (a proxy for SES), as these variables were accounted for statistically when they correlated with the pain outcome measures and pain-related variables used in the statistical analyses. Furthermore, the Aboriginal group, which differed the most from Caucasians with respect to years of education and job classification, did not differ with respect to pain presentation. This also suggests that these demographic variables do not fully explain ethnocultural differences in chronic pain. Similarly, although South Asian, Southeast Asian, and Middle Eastern clients, whose pain presentations differed in some respects from those of Caucasian clients, were more likely to have immigrated to Canada than East Asian clients, acculturation-related variables based on years of residence in Canada, years of exposure to English, and English reading ability were not found to correlate significantly with pain-related variables (refer to Table 16 on p. 173), nor did these acculturation-related variables differ across the ethnocultural groups surveyed in this study (refer to Table 15 on p. 172). As such, these aspects of acculturation do not appear to fully explain the observed ethnocultural differences in pain presentation. Based on these findings regarding sociodemographic and acculturation-related variables, it appears that some other culture-related variable or variables accounted for the differences in pain outcomes and pain-related factors observed this study. In addition, it may be that the items and scales on the MPI do not capture manifestations of chronic pain that are specific to certain groups.

Middle Eastern clients reported lower levels of life control than Caucasian clients, and low levels of life control have been associated with higher levels of chronic pain severity in other studies (e.g., Tan et al., 2002; Keefe et al., 1987), as well as in regression analyses in the present study. Lower control was also found to be associated with lower levels of activity in the present study. It seems possible that the low levels of life control expressed by Middle Eastern clients in this study contributed to their higher levels of pain severity and lower levels of activity. These findings are in keeping with those from previous studies. For example, individuals of Middle Eastern (Arabic) background have been shown to endorse an external locus of control with respect to mental health problems (Al-Krenawi, 1999), i.e., people with a Middle Eastern background tend to believe such problems are God’s will. The same ethnic group may take a similar point of view with respect to chronic pain. This belief could potentially result in less favourable chronic pain and treatment outcomes, as it could lead to a reduced sense of agency and control with respect to dealing with stressful situations, as well as feelings of hopelessness (Jamil et al., 2002).

Similarly, higher levels of partner solicitousness have been shown to be associated with negative chronic pain outcomes in past studies (Romano et al., 2000), and higher levels of solicitousness predicted higher affective distress in the present study. The fact that South Asian clients reported higher levels of partner solicitousness than Caucasian clients may be related to differences observed for this group on a measure of activity level relative to Caucasians. Past studies have shown that the families of South Asian individuals experiencing chronic pain are more likely to assume the duties of the individual with pain than family members of Caucasian individuals experiencing chronic pain (Rogers & Allison, 2004). This type of solicitous behaviour could engender a reduced level of activity in the pain sufferer. Although assuming the duties of someone experiencing chronic pain may be done with good intentions, it also reinforces their inactivity and perpetuates a sick role (Romano et al., 2000). This may be particularly problematic in more collectivistic ethnocultural groups, such as South Asian groups.

Interestingly, a previous study of chronic pain attitudes in South Asian (Indian) clients found that they expressed the belief that it would be in poor character to be distracted by pain or hardship, and accordingly went about their daily activities to the extent possible (Kodiath & Kodiath, 1992). Another study with South Asian (Indian) university students showed that they had higher pain tolerance than Caucasian Americans in laboratory pain induction procedures, and were also less accepting of pain expression than Caucasian Americans (Nayak et al., 2000). The fact that South Asian clients in the present study reported lower activity levels than Caucasian clients directly contradicts these previous findings. The participants in the Kodiath and Kodiath (1992) and Nayak and colleagues (2000) studies resided in India, though, whereas those in the present study were born in or immigrated to Canada. Past findings that South Asian students residing in England demonstrated lower levels of experimental pain tolerance than British students (Watson, Latif, & Rowbotham, 2005) provide tentative support for this suggestion. In addition, most of the clients in this study were involved in litigation, whereas those in other studies were not. This may have also influenced their pain presentations.

Contrary to the findings of previous studies that individuals of East Asian background perceive less control over their lives than Caucasians (Hamid, 1994; Lu et al., 2000; Liang & Bogat, 1994), such differences were not found in the present study. This may have been due in part to the fact that the participants in the present study all resided in Canada, whereas those in other studies did not, and also because some of the clients in the present study were Canadian-born. Overall, given the variety of ethnocultural groups included in the past sample and previous findings of ethnocultural differences in perceived control, it was somewhat surprising that more differences were not observed with regard to this variable.

Previous research has found that Native Americans reported higher levels of affective distress than Caucasian Americans on the MMPI-2 (Pace et al., 2006; Greene, 2000) and were more likely than Caucasian Americans to experience chronic pain conditions (Jiminez et al., 2011). Furthermore, surveys have found that Aboriginal Canadians were at a much higher risk for experiencing depression, anxiety, and suicidality than the general Canadian population (Government of Canada, 2006). These findings were produced in samples of Aboriginal Canadians who resided on reservations as well as those who did not. Research regarding chronic pain severity in Native American or Aboriginal Canadian individuals was not found in the literature review. With that said, given that Native Americans report higher levels of affective distress than Caucasian Americans (Pace et al., 2006) and Aboriginal Canadians are at a higher risk of mental health problems than other Canadians (Government of Canada, 2006), it would not be unreasonable to expect Aboriginal Canadian clients to report higher levels of affective distress than Caucasian clients. In addition, since emotional distress has been linked with less favourable chronic pain outcomes (Asmundson, 2002) it might follow that Aboriginal Canadians, who are at higher risk of mental health concerns, could have less favourable pain outcomes.

However, in spite of disadvantages with respect to level of education, quality of education, and SES, the Aboriginal clients in the present study did not demonstrate expected differences from Caucasian clients on any measures of chronic pain outcomes or pain-related variables. This may be due to cultural or demographic differences between the Native American and Aboriginal samples in previous studies where such differences were found (e.g., Government of Canada, 2006; Pace et al., 2006; Anderson & Mayes, 2010; Jiminez et al., 2011) and the Aboriginal clients in the present study (e.g., different nations or tribes may have been involved in previous versus the present research). It may also be that the chronic pain experience is similar for Aboriginal Canadians and Caucasian Canadians. In any case, more research is necessary in order to better understand the chronic pain presentation of Aboriginal Canadians and their methods of dealing with stressful situations.

As with the Novi sample, the fact that chronic pain was a secondary problem in the present study and the primary presenting problem in most other studies may have played a role in results. The fact that most clients in the Edmonton sample were in litigation may have also had an impact on results.

**The Possible Role of Trauma**

A history of childhood trauma has been found to be associated with the risk of developing chronic pain as an adult (Goldberg, 1999), and comorbid post-traumatic stress disorder (PTSD) has been shown to play a role in the maintenance of chronic pain (Sharp & Harvey, 2001). More generally speaking, experiences of stress, helplessness, and low social status early in life have been associated with health problems later in life (Alfredsson et al. 2011). Given these findings, it is reasonable to hypothesize that clients who experienced past trauma, either earlier in their lives, before moving to Canada, or during the immigration process would be more likely to experience chronic pain and have negative chronic pain outcomes. Unfortunately, no information regarding a given client's past negative life experiences, or their reasons for immigrating to Canada and the quality of their immigration experience was available. However, taking into account the longstanding and ongoing unrest in the Middle East and previous findings of high rates of trauma in individuals of Middle Eastern background (Al-Krenawi & Graham, 2000), it is safe to assume that some clients of Middle Eastern descent came to Canada as refugees or experienced war and violence before moving to Canada.

Furthermore, individuals of Middle Eastern descent are likely to experience discrimination in North America, especially since the attacks of September 11th, 2001 (Amer & Hovey, 2012), and increased discrimination against this group has been associated with higher rates of mental health concerns relative to the general population.

These factors may have contributed to the less favourable chronic pain outcomes of Middle Eastern clients in comparison to Caucasian clients. On the other hand, there is evidence to suggest that Aboriginal Canadians are more likely to experience trauma than Caucasian Canadians (Söchting, Corrado, Cohen, Ley, & Brasfield, 2007), and the pain profiles of Aboriginal clients did not differ from those of Caucasian clients. In addition, there were no measures of trauma in the present study, so any link between trauma and chronic pain outcomes in this sample is purely speculation. Research regarding the interaction of trauma and chronic pain presentation in diverse ethnocultural groups may lead to new insights in this regard.

**The Possible Role of Somatization**

Somatization, or the tendency to experience and express psychological distress in the form of physical symptoms, has been linked with less favourable chronic pain outcomes (Birket-Smith, 2001). This may have relevance for the results of the present study, as ethnocultural differences have been found with respect to somatization. Notably, individuals of Middle Eastern (Arabic; Al-Krenawi & Graham, 1999) and South Asian (Rogers & Allison, 2004) backgrounds have been identified as likely to have somatized psychological symptoms. In the present study, Middle Eastern clients were found to obtain higher scores on a self-report scale associated with somatization (MMPI-2 Hs). Several explanations have been proposed for these findings. First, it has been noted that individuals of Middle Eastern and South Asian backgrounds have a holistic view of health and do not view mental health and physical health as separate as is the case in western cultures (Salimbene, 1999; Hakim-Larson, Kamoo, McMillan, & Porcerelli, 2007). Secondly, mental health problems are highly stigmatized in both Middle Eastern and South Asian cultures, as they are seen to bring shame to the family and reduce prospects for a good marriage (Al-Krenawi & Grama, 2000; Durvasula & Mylaganam, 1994). Finally, it has been suggested that individuals of some cultural groups believe that physicians are mainly concerned with physical symptoms, and therefore they must present physical symptoms in order to receive assistance (Rait & Burns, 1997).

In any case, an elevated tendency toward somatization could effectively magnify the severity and impact of chronic pain, which could explain the findings of elevated pain severity and lower general activity for the Middle Eastern and South Asian groups. With that said, South Asian clients did not differ from Caucasian clients on the MMPI-2 Hs scale, which suggests that somatization may not fully explain their reduced level of activity relative to Caucasian clients. In addition, East Asian individuals are also thought to be more likely to somatize psychological symptoms than Caucasians (Dere et al., 2013) and they did not differ from Caucasians with respect to any chronic pain outcomes, nor on the MMPI-2 Hs scale. As such, more research is necessary before conclusions can be made with respect to the impact of somatization on ethnocultural differences in chronic pain presentation.

**Differences in Predictive Value of Pain-Related Variables**

Although the predictive value of most variables used in the dummy-coded regression analyses did not vary across ethnocultural groups, there were some notable exceptions. Consistent with expectations, the predictive value of life control was found to vary for some ethnocultural groups with respect to some chronic pain outcomes. First, the negative association between life control and affective distress was weaker for Aboriginal clients than for clients of other ethnocultural groups in the Edmonton sample. Secondly, the positive association between life control and processing speed was stronger in Middle

Eastern and Southeast Asian clients than for clients of other ethnocultural groups in the Edmonton sample. The first finding could be interpreted two ways: first, it is possible that higher levels of life control did not influence affective distress in the Aboriginal group. Alternatively, Aboriginal clients experiencing high levels of distress may have been less likely to feel out of control than clients from other ethnocultural groups. Based on the data available, it is difficult to find evidence for one interpretation over the other. Conversely, the interaction between life control and processing speed in Middle Eastern and Southeast Asian clients suggests that higher life control is more important in determining aspects of chronic pain outcomes for these clients. With that said, though, differences were not observed on all measures, nor in some groups where the influence of perceived control has been found to vary in past studies (e.g., East Asian; O'Connor & Shimizu, 2002), and thus it is difficult to draw definite conclusions.

The relationship between partner solicitousness and affective distress was found to vary for African American clients relative to Caucasian clients in the Novi sample, and for Southeast Asian clients relative to clients of all other ethnocultural groups in the Edmonton sample. In both cases, the positive association between solicitousness and affective distress was higher for the ethnocultural groups in question as compared to other groups. As with the previously mentioned findings regarding the predictive value of life control, this could be interpreted two ways: first, it is possible that partners of African American and Southeast Asian clients were more likely to behave in a solicitous manner when clients were expressing higher levels of distress. Alternatively, solicitous, overly-accommodating behaviour from a partner may engender higher levels of affective distress in clients of African American and Southeast Asian background. Unfortunately, it is not possible to determine which of these explanations is more likely based on the data available, but the results of past studies suggest that solicitousness reinforces negative chronic pain behaviour (see review by Newton-John, 2002), which is consistent with the first explanation. The reason for the difference in predictive value for African American and Southeast Asian clients in particular, though, is unknown.

The negative association between pain severity and processing speed was stronger for Middle Eastern clients relative to clients of all other ethnocultural groups in the Edmonton sample. This suggests that the impact of more severe pain has a greater effect on processing speed for clients of Middle Eastern background, but again, the reason for this is not clear.

It should be noted that the relatively low number of interactions observed between ethnocultural group and pain-related variables/pain outcomes in the Edmonton sample may have been due to the inclusion of all ethnocultural groups at once in each MRA. By performing analyses this way, the influence of a given predictor on a given ethnocultural group would have had to differ relative to all of the other groups rather than just one or two in order to constitute a significant interaction. As such, if two groups differed from the others, an interaction would be less likely to be detected, as they would still be similar to each other and not distinct from all groups. More interactions may have been observed if analyses had been conducted using only two groups per predictor and outcome variable at a time, but this would have meant for far more analyses and greatly inflated the chance of type I error. Perhaps additional, theory-driven analyses comparing the predictive value of pain-related variables on pain outcomes in two groups thought to differ with respect to methods of dealing with stressful situations would produce a greater number of interactions.

**Differences in Pain Presentation Based on Nativity**

Differences on two of three chronic pain outcomes, pain severity and activity level, were detected when comparing the chronic pain presentation of foreign-born East Asian, South Asian, Southeast Asian, and Middle Eastern clients and with Canadian-born clients of the same ethnocultural groups. On the other hand, differences were not observed with regard to affective distress, nor the pain-related variables of life control, perceived support, or partner solicitousness. As such, it is difficult to explain the differences in pain outcomes based on differing levels of pain-related variables. With that said, the immigrant and non-immigrant groups differed with regard to a number of demographic variables which may help explain the group differences observed on chronic pain outcome measures. First, foreign-born clients were older than Canadian-born clients, and older age has been associated with less favourable chronic pain outcomes (Dobscha et al., 2009). Second, foreign-born clients had lower levels of education than Canadian-born clients, and lower levels of education have also been associated with worse chronic pain outcomes (Dobscha et al., 2009). With that said, age and education were not found to correlate with pain outcomes and pain-related variables in the subset of clients used in immigration-based analyses. Although foreign-born clients obtained lower scores than Canadian-born clients on the WRAT Reading scaled score and FSIQ, it is difficult to draw inferences based on these differences. Scores on the WRAT Reading subtest and the WAIS could have been influenced by a number of variables, such as level of English familiarity, level of English education, quality of education, and the clinician's decision to administer tests to some clients with relatively low English fluency but not to others.

Finally, in comparison to the non-immigrant group, the immigrant group contained a higher percentage of clients with Middle Eastern and South Asian background, who were found to report relatively higher levels of pain severity and lower levels of activity in other analyses. Furthermore, the non-immigrant group included a higher percentage of clients with East Asian background, who were not found to obtain elevated scores on pain outcome measures relative to other groups in the present study. Comparisons of immigrant and non-immigrant clients who did not differ with respect to demographic variables and group membership may have produced more interpretable results, but the sample size in the present study did not allow for the formation of more homogeneous groups.

**Ethnocultural Differences on Symptom Validity Measures**

Differences on performance validity tests were observed across ethnocultural groups in the Edmonton sample, which is consistent with the limited past research (Salazar et al., 2007; Johnson-Greene et al., 2013). On the other hand, differences were not observed in the Novi sample. Ethnocultural group differences on a self-report validity measure were observed across ethnocultural groups in the Edmonton sample, but not in the Novi sample. This is consistent with variable findings in past studies (e.g., Pace et al., 2006; Tsushima & Tsushima, 2009; DuAlba & Scott, 1993). Although ethnocultural group differences on validity measures were found in the Edmonton sample, it is important to keep in mind that these results do not necessarily mean that certain ethnocultural groups are more likely to apply less effort or over-report distress in the context of neuropsychological assessment.

First, many neuropsychological tests are culturally biased (Boone et al., 2007), and this may include performance-based validity measures (Salazar et al., 2007; Johnson-

Greene et al., 2013). As such, non-Caucasian English-speaking clients would be more likely to score below cutoffs on such measures. This is corroborated by the fact that no difference in the percentage of effort test scores below cutoff was observed between Aboriginal and Caucasian clients, the two groups which did not include immigrants and were most likely to have English as a first language. Secondly, the MMPI-2 was administered in English, and although only clients who demonstrated an adequate understanding of English (Grade 8 equivalency; Greene, 2000) were administered this measure, there is nevertheless a possibility that clients with English as a second language may have misinterpreted items. Finally, very few clients of some ethnocultural groups were administered the MMPI-2 (e.g., $n$ = 7 for Southeast Asian), and this may have affected ANOVA results. Taken together, these qualifications mean that the analyses regarding response bias must be interpreted carefully, and cannot be easily tied to findings regarding ethnocultural differences in chronic pain presentation. The results of the present study add to a small but growing literature suggesting caution in the interpretation of validity measures when conducting neuropsychological assessment with individuals of diverse ethnocultural backgrounds.

**Gender Differences**

Gender differences were found on some measures in the present study. Specifically, female clients in the Edmonton sample reported higher levels of partner solicitousness than male clients and scored below cutoff on a higher percentage of performance validity measures. Females may experience higher levels of partner solicitousness because they tend to have higher levels of pain-related disability (Portenoy et al., 2004) which could engender a greater degree of care from their loved ones. Another possibility is that females receive more solicitous treatment because they are more likely to openly express distress than males (Brody, 2000). With respect to differences on performance validity measures, supplementary analyses suggested that the gender difference in percentage of performance validity scores below cutoff was due to known gender differences on one of the measures used to calculate this composite score, the Finger Tapping test combined raw score. As such, gender-specific cutoff points should be used when interpreting the Finger Tapping test combined raw score as a performance validity measure.

**Limitations of the Present Study**

The results of the present study must be interpreted in the context of certain limitations. The archival data used in this study were intended primarily for clinical and medico-legal use, not for research purposes. As such, not all of the desired demographic and injury-related information was available for all clients, and there were missing data from certain measures of interest for some clients. For instance, although the use of an English reading measure in a client who has very low English familiarity may not be useful for clinical purposes, this sort of data would have been helpful for conducting analyses concerning English language proficiency in the present study. Similarly, much of the demographic information used in statistical analyses was collected through self report and therefore may not have been entirely accurate. Along similar lines, a substantial proportion of clients reported that they were unsure about some aspects of their head injuries, which made it difficult to ensure that the groups did not differ in terms of head injury severity. Notwithstanding, the availability of such data did not appear to differ across groups.

Studies of chronic pain often include specific measures of coping style (e.g., Jordan et al., 1998; Jensen & Karoly, 1991; Cano et al., 2006; and Evans et al., 2009), and no such instrument was used at either of the sites from which data was collected. The use of a direct measure of coping style would have allowed for more in-depth analysis of how individuals from diverse ethnocultural groups respond to challenges in their lives, including chronic pain, and could have provided more insight into why certain groups had less favourable chronic pain outcomes than others.

Furthermore, no formal measure of acculturation was used in this study, which made it difficult to draw inferences regarding the role of acculturation in chronic pain presentation or to account for the influence of acculturation in statistical analyses. Similarly, no direct measure of SES (i.e., family income) was available, and the job classification index intended to approximate SES may not have been an entirely adequate proxy measure. A more direct measure would have allowed for better statistical controls for SES. All-in-all, the absence of variables which could explain the observed ethnocultural differences in chronic pain presentation (e.g., copying style, acculturation) is a significant limitation of this study. Furthermore, with respect to the measurement of chronic pain and pain-related variables, only one self-report instrument was used (the MPI), and as such some of the results of the present study may be accounted for by shared method variance or response tendencies.

As noted earlier in this document, the present study employed non-directional hypotheses. In addition, a large number of statistical analyses were performed. These procedures increased the risk of type 1 error and raise the possibility that some of the significant findings in this study were due to chance (Bender & Lange, 2001). Although statistical procedures were employed to minimize the possibility of type 1 error, given the number of analyses conducted this nevertheless remains a concern.

Although clients in this study were assigned to ethnocultural groups based on self-report information regarding ethnicity and heritage, this does not necessarily mean that clients in each group were equivalent with respect to all cultural factors. For instance, religious affiliation (i.e., Christian vs. Muslim) has been shown to have an important role in mental health outcomes for individuals of Middle Eastern background living in America (Amer & Hovey, 2007), and country of origin may have an influence on variables such as social class, level of education, and cultural values (Erickson & Al-Timimi, 2001). Given the wide range of heritages and first languages represented in the East Asian, South Asian, Southeast Asian, and Middle Eastern groups (Tables 24-25), religion, language, social class, and other variables may played a hidden role in the results of this study.

**Strengths of the Present Study**

Few, if any previous studies have investigated ethnocultural group differences in chronic pain presentation in the context of neuropsychological assessment for closed head injury, and this study takes steps toward filling this gap in the literature. Similarly, the present study included ethnocultural groups which have received little or no study in chronic pain research, namely clients of Canadian Aboriginal, South Asian, Southeast Asian, and Middle Eastern ethnicities. The findings of this study might help clinicians and researchers better understand the chronic pain presentations of these under-researched groups and in turn assist in the development of treatment strategies better suited to their needs. Although the archival nature of this study was earlier cited as a limitation due to inconsistency in some aspects of data collection, it would have been extremely difficult to recruit enough participants for such a study using a prospective research design, as the data used were gathered over a period of nearly 20 years.

The present study included multiple measures of chronic pain outcomes beyond only pain severity, as well as measures of variables thought to be related to chronic pain. This thorough survey of pain-related information provided a rich dataset and allowed for analysis of multiple aspects of the chronic pain experience. In addition, when relevant sociodemographic variables were taken into account in the statistical analyses, which reduced the chance that the differences in chronic pain presentation detected across some ethnocultural groups were due to variables other than ethnocultural background (i.e., years of education, educational quality, SES).

Not only were multiple pain-related and demographic variables considered in the present study, but the differential influence of these variables on pain outcomes was also explored. Few, if any other studies regarding ethnocultural differences in chronic pain presentation have used such a technique. Looking beyond differences between ethnocultural groups on chronic pain variables into how the relationships between these variables differ across ethnocultural groups allowed for a better understanding of the importance of a given variable in influencing pain outcomes in a given ethnocultural group. Although few differences were found in these analyses, those which were found suggest that it should not be assumed that pain-related and demographic variables impact all ethnocultural groups equally.

Lastly, although response bias and symptom validity are important variables to consider in neuropsychological assessment and have received a great deal of research in recent years, little research has been conducted regarding ethnocultural differences in scores on performance validity measures or measures of self-report validity. This study helped to address this gap in the literature.

## Implications for Theory and Practice

Broadly speaking, the results of the present study and previous studies suggest that ethnocultural differences in pain presentation exist, but not between all groups, and not consistently across all aspects of chronic pain. With these results in mind, it is important for clinicians to think carefully when assessing or treating individuals of diverse backgrounds with chronic pain. As with cognitive testing, judging the chronic pain presentation of clients of minority ethnocultural status based on majority group normative standards may produce inaccurate interpretations which could in turn negatively affect treatment outcomes. Careful consideration of the pain presentation of individuals of diverse ethnocultural status is especially important in that minority group clients are less likely to have access to health care services than clients of the majority group (Dressler et al., 2005; Fuentes et al., 2007; Green et al., 2004), more likely to experience difficulties communicating with health care providers (Bonham, 2001; Cooper et al., 2006), and less likely to complete chronic pain treatment (Heckman et al., 2008). Compounding matters, health care providers have been found to be insensitive to cultural differences in symptom presentation (Bonham, 2001). In combination with the finding that clients of minority ethnocultural status are more likely to discontinue treatment than majority group clients when they feel misunderstood by treatment providers (Goldberg & Remy-St. Louis, 1998) this means that careful consideration of each client's understanding of their pain is especially important (Lasch, 2000). Above all, it is important to remember that pain should be treated with the client's perspective and needs in mind (Davidhizar & Giger, 2004), regardless of the clinician's perspective.

Based on the results of the present study, clinicians should be especially cautious when interpreting the chronic pain presentation of individuals of South Asian and Middle

Eastern backgrounds, as their results were most different from those of the Caucasian majority group. Future research may help better clarify why this is the case and identify specific variables to target when engaging in chronic pain treatment with these groups. Given that the positive relationship between solicitous partner behaviour and affective distress was stronger for South Asian clients than clients from other ethnocultural groups, one tentative suggestion for chronic pain treatment would be to place greater emphasis on educating South Asian clients and their families regarding the way that solicitous behaviour can reinforce disability.

The results of this and other studies regarding ethnocultural differences in chronic pain presentation have varied based on the ethnocultural groups included, demographic variables, level of acculturation, and no doubt other variables not accounted for. This suggests that there is no typical chronic pain profile for individuals of minority ethnocultural status. Each client must be viewed as an individual, and all variables found to influence chronic pain, including ethnicity and culture, must be considered. Despite theoretical support for the biopsychosocial model of chronic pain, it has yet to be fully embraced by North American health care providers, and no standard conceptualization of pain exists across treatment sites (Frohm & Beeler, 2010). As such, culture, as well as other demographic, individual, and coping-related variables, is not always taken into account when a health care provider is treating a client with chronic pain. This can lead to stigmatization of clients with persistent chronic pain, which in turn decreases the chance of positive treatment outcomes. Although changes at the level of individual treatment providers would be helpful in improving health care services for individuals of minority ethnocultural background experiencing chronic pain and other ailments, it is only through larger scale changes in health care delivery that greater differences will be made. Psychologists have a unique position in health care, with their patient-centered approach, consideration of multiple aspects of a client's presentation, integration of research into practice, and tolerance of ambiguity, and as such they can and should be agents of system change in health care practice (Frohm & Beeler, 2010).

There are several ways that psychologists can change health care delivery that could lead to better treatment for individuals of minority ethnocultural status. First, the development of new test measures that are specific to particular cultures or less culturally biased would allow for more appropriate and interpretable assessments (Manly, 2008). In the context of pain assessment, this could be as simple as translating or adapting existing measures, or as complex as creating new measures that relate to specific aspects of pain expressed by certain cultures. Non-verbal measures of pain intensity and unpleasantness may also allow individuals who are not fluent in English to better express their pain (Hadjistravropoulos et al., 2011). On a related note, current test instruments could be made more culturally sensitive. For instance, the term "Dysfunctional" used in MPI profile classification carries negative connotations for any client experiencing difficulties with chronic pain, but it is especially inappropriate for clients who may be more likely to fit this profile due to a culturally-influenced expression of their pain. That is to say, more Middle Eastern clients may have been classified as having "Dysfunctional" pain profiles in the present study due to culturally sanctioned or appropriate ways of expressing pain and not due to "dysfunction" based on Western models of chronic pain coping.

Secondly, whenever possible it would be best if clients of minority group status could be assessed or treated by clinicians who are similar to them with respect to ethnicity, culture, language, and gender. Similarities in language would allow clients to better express themselves to a clinician, and similarities with respect to culture, ethnicity, and gender could potentially reduce a client's discomfort at discussing personal matters with someone of a different background and concerns with respect to discrimination (Sue & Sue, 2007). In cases when a perfect demographic match is not possible, referral to someone with a background more similar to the client's may be appropriate.

Thirdly, psychologists must consider not only the behaviour and characteristics of their minority group clients during assessment, but their own behaviour and potential biases. Attending to these factors could make minority group clients more comfortable with receiving mental health treatment and in turn lead to better outcomes.

Finally, related to the previous two points, psychology as a discipline would benefit from having more diverse practitioners within its ranks. Given the discomfort that some minority group clients have when dealing with health care providers of the majority group (Sue & Sue, 2007), encouraging students of diverse backgrounds to enter into psychology would make it more likely that clients could be provided with services by someone of a similar background to their own.

**Future Directions for Research**

Although a great deal of research has been conducted regarding chronic pain presentation and outcomes in certain ethnocultural groups, many questions remain to be answered and much work remains to be done. Most studies have thus far focused on pain in African American and Hispanic clients, with very little research conducted with other ethnocultural groups. Future prospective studies concerning the presentation of chronic pain and chronic pain outcomes in less-studied groups would assist clinicians in better understanding the treatment needs of individuals from these groups. If possible, the use of groups that are homogeneous with regard to first language, culture, religion, heritage, level of acculturation, and other demographic variables would allow for more specific conclusions than heterogeneous groups such as those used in this study. The collection of information regarding variables such as religion and acculturation would also allow for the investigation of their role in chronic pain presentation. Similarly, the use of measures specifically designed to assess coping style could provide insight into how this varies across ethnocultural groups and in turn influences chronic pain presentation.

In addition, many of the existing studies regarding chronic pain in individuals of minority group status have had relatively small sample sizes for the minority groups concerned. Larger sample sizes would allow for better generalizability of results and also permit the use of more sophisticated statistical modeling techniques, which would allow researchers to better understand how the relationships between pain outcomes, pain-related variables, and sociodemographic variables differs across ethnocultural groups. The use of statistical modeling techniques would allow for the creation and refinement of new, culturally-sensitive models of chronic pain.

Finally, future research into ethnocultural differences in chronic pain presentation would benefit from the use of qualitative methods in combination with quantitative methods. Although studies such as the present study can describe the manner in which ethnocultural groups differ in terms of chronic pain presentation and provide insight into the reasons their presentations may differ, the use of qualitative methods would allow for a better understanding of how chronic pain affects individuals from diverse ethnocultural groups at a deeper and more meaningful level. Examining responses to questions such as how pain has affected an individual's life, what they believe they have lost as a result of their pain, how their family relationships have changed as a result of pain, and how they cope with their pain could provide rich insight into the ways people from different ethnocultural groups view, understand, and deal with pain. This in turn could allow for the design of culturally appropriate assessment measures and lead to more effective treatment and intervention strategies.

REFERENCES

Al-Krenawi, A. (1999). Explanations of mental health symptoms by the Bedouin-Arabs of the Negev. *International Journal of Social Psychiatry, 45*(1), 56-64.

Al-Krenawi, A. & Graham, J.R. (1999) Gender and biomedical/traditional mental health utilization among the Bedouin-Arabs of the Negev. *Culture, Medicine, and Psychiatry, 23*, 219-243.

Al-Krenawi, A. & Graham, J.R. (2000). Culturally sensitive social work practice with Arab clients in mental health settings. *Health and Social Work, 25*(1), 9-22.

Alfredsson, L., Kivimaki, M., Leineweber, C., Theorell, T., Westerholm, P., & Westerlund, H. (2011) Covert coping with unfair treatment at work and risk of incident myocardial infarction and cardiac death among men: Prospective cohort study. *Journal of Epidemiology & Community Health, 65*(5), 420-425. doi: 10.1136/jech.2009.088880

Ali, J. (2002). *Mental Health of Canada's Immigrants. Health Reports*. Retrieved from http://www.statcan.gc.ca/pub/82-003-s/2002001/pdf/82-003-s2002006-eng.pdf on August 24, 2013.

Amer, M.M. & Hovey, J.D. (2007). Socio-demographic differences in acculturation and mental health for a sample of 2nd generation/early immigrant Arab Americans. *Journal of Immigrant Minority Health, 9*, 335-347. doi: 10.1007/s10903-007-9045-y

Amer, M.M. & Hovey, J.D. (2012). Anxiety and depression in a post-September 11 sample of Arabs in the USA. *Social Psychiatry and Psychiatric Epidemiology, 47*(3), 409-418. doi: 10.1007/s00127-011-0341-4

Anderson, E.R. & Mayes, L.C. (2010). Race/ethnicity and internalizing disorders in youth: A review. *Clinical Psychology Review, 30*, 338-348. doi: 10.1016/j.cpr.2009.12.008

American Psychological Association. (2003). Guidelines on multicultural education, training, research, practice, and organizational change for psychologists. *American Psychologist, 58*(5), 377-402. doi: 10.1037/0003-066X.58.5.377

American Psychological Association. (2008). *The current status of ethnic minorities in psychology*. Retrieved from: www.apa.org/divisions/div45/images/statusofethnicminoritypsychologists.pdf

Arnstein, P., Caudill, M., Mandle, C.L., Norris, A., & Beasley, R. (1999). Self efficacy as a mediator of the relationship between pain intensity, disability and depression in chronic pain patients. *Pain, 80*, 483-491. doi: 10.1016/S0304-3959(98)00220-6

Arthur, A. & Collins, S. (2005). *Culture-infused counselling: Celebrating the Canadian Mosaic.* Calgary: Counselling Concepts.

Asmundson, G.J. (2002). Anxiety and related factors in chronic pain. *Pain Research & Management: The Journal of the Canadian Pain Society, 7*(1), 7-8.

Backhaus, S.L., Fichtenberg, N.L., & Hanks, R.A. (2004). Detection of sub-optimal performance using a floor effect strategy in patients with traumatic brain injury. *The Clinical Neuropsychologist, 18*, 591-603. doi: 10.1080/13854040490888558

Baird, A.D., Ford, M., & Podell, K. (2007). Ethnic differences in functional and neuropsychological performance in older adults. *Archives of Clinical Neuropsychology,* 22(3), 309-318. doi: 10.1016/j.acn.2007.01.005

Bates, M.S. (1987). Ethnicity and pain: A biocultural model. *Social Science & Medicine, 24*(1), 47-50. doi: 10.1016/0277-9536(87)90138-9

Bates, M.S., Edwards, W.T, & Anderson, K.O. (1993). Ethnocultural influences on variation in chronic pain perception. *Pain, 52*, 101-112.

Bates, M.S. & Rankin-Hill, L. (1994). Control, culture, and chronic pain. *Social Science & Medicine, 39*(5), 629-645. doi: 10.1016/0277-9536(94)90020-5 doi: 10.1016/0304-3959(93)90120-E

Bates, M.S., Rankin-Hill, L., & Sanchez-Avendez, M. (1997). The effects of the cultural context of health care on treatment of and response to chronic pain and illness. *Social Science & Medicine, 45*(9), 1433-1447. doi: 10.1016/S0277-9536(97)00068-3

Beck, A. T., & Steer, R. A. (1993). *Beck Depression Inventory*. San Antonio, TX: The Psychological Corporation (Manual).

Bender, R. & Lange, S. (2001). Adjusting for multiple testing – when and how? *Journal of Clinical Epidemiology, 54*, 343-349.

Berry, D.T. & Schipper, L.J. (2008). Assessment of feigned cognitive impairment using standard neuropsychological tests. In R. Rogers (Ed.), *Clinical Assessment of Malingering and Deception (3rd Ed;* pp 237-25*4).* New York: Guildford Press.

Bertakis, K.D., Azari, R., Helms, L.J., Callahan, E.J., & Robbins, J.A. (2000). Gender differences in the utilization of health care. *The Journal of Family Practice, 49*(2), 147-152.

Bhattacharya, P. C. (2006). Economic development, gender inequality, and demographic outcomes: Evidence from India. *Population and Development Review, 32*(2), 263–291.

Bianchini, K.J., Etherton, J.L., Greve, K.W., Heinly, M.W., & Meyers, J.E. (2008). Classification accuracy of the MMPI-2 validity scales in the detection of pain-related malingering: A known-groups study. *Assessment, 15*(4), 435-449. doi: 10.1177/1073191108317341

Birket-Smith, M. (2001). Somatization and chronic pain. *Acta Anaesthesiologica Scandinavica, 45*(9), 1114–1120. doi: 10.1034/j.1399-6576.2001.450911.x

Bonham, V.L. (2001). Race, ethnicity, and pain treatment: Striving to understand the causes and solutions to the disparities in pain treatment. *Journal of Law, Medicine & Ethics, 29(s4)*, 52-68. doi: 10.1111/j.1748-720X.2001.tb00039.x

Boone C., Meng, C., and van der Velden, R. (2007) Individualism and Collectivism. In J. Allen, Y. Inenaga, R. van de Velden, and K. Yoshimoto (Eds.), *Competencies, Higher Education and Career in Japan and the Netherlands* (pp. 211-224). Dodrecht, The Netherlands: Springer.

Boone, K.B., Victor, T.L., Wen, J., Razani, J., & Pontón, M. (2007). The association between neuropsychological scores and ethnicity, language, and acculturation variables in a large patient population. *Archives of Clinical Neuropsychology, 22*, 355-365. doi: 10.1016/j.acn.2007.01.010

Bowen, J., McCormick, W.C., & Larson, E.B. (2001). Neuropsychological test performance in a cognitively intact sample of older Japanese American adults. *Archives of Clinical Neuropsychology, 16*(5), 447-459. doi: 10.1016/S0887-6177(00)00056-1

Bradley, L.A., Haile, J.M., & Jaworski, T.M. (1992). Assessment of psychological status using interviews and self-report instruments. In D.C. Turk & R. Melzack (Eds.), *Handbook of Pain Assessment* (pp. 193–213). New York: Guilford.

Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006). Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment. *European Journal of Pain, 10,* 287-333. doi:10.1016/j.ejpain.2005.06.009

Brody, L.R. (2000). The socialization of gender differences in emotional expression: Display rules, infant temperament, and differentiation. In A. Fischer (Ed.) *Gender and Emotion: Social Psychological Perspectives*. New York: Cambridge University Press.

Burt, D.B, Zembar, M.J., & Niederehe, G. (1995). Depression and memory impairment: A meta-analysis of the association, its pattern, and specificity. *Psychological Bulletin, 117*(2), 285-305. doi: 10.1037/0033-2909.117.2.285

Butcher, J.N., Cheung, F.M., & Lim, J. (2003) Use of the MMPI-2 with Asian populations. *Psychological Assessment, 15*(3), 248-256. doi: 10.1037/1040-3590.15.3.248

Butcher, J. N., Dahlstrom, W. G., Graham, J. R., Tellegen, A., & Kaemmer, B. (1989). *Manual for administration and scoring MMPI-*2. Minneapolis, MN: University of Minnesota Press.

Campbell, C.M., Edwards, R.R., & Fillingim, R.B. (2005). Ethnic differences in response to multiple experimental pain stimuli. *Pain, 113*, 20-26. doi: 10.1016/j.pain.2004.08.013

Campbell, P., Wynne-Jones, G., & Dunn, K.M. (2011). The influence of informal social support on risk and prognosis in spinal pain: A systematic review. *European Journal of Pain, 15*, 444.e1 - 444.e14. doi: 10.1016/j.ejpain.2010.09.011

Cano, A., Mayo, A., & Ventimiglia, M. (2006). Coping, pain severity, interference, and disability: The potential mediating and moderating roles of race and education. *The Journal of Pain, 7*(7), 459-468. doi: 10.1016/j.jpain.2006.01.445

Carroll, L.J, Cassidy, D.J., Peloso, P.M., Borg, J., von Holst, H., Holm, L., Paniak, C., & Pépin, M. (2004). Prognosis for mild traumatic injury: Results from the WHO collaborating centre task force on mild traumatic head injury. *Journal of Rehabilitation Medicine, 43*(Suppl.), 84-105. doi: 10.1080/16501960410023859

Carter, L.E., McNeil, D.W., Vowles, K.E., Sorrell, J.T., Turk, C.L., Ries, B.J., & Hopko, D.R. (2002). Effects of emotion on pain reports, tolerance, and physiology. *Pain Research & Management: The Journal of the Canadian Pain Society, 7*(1), 21-30.

Chang, M.K. & Harden, J. T. (2002). Meeting the challenge of the new millennium: Caring for culturally diverse patients. *Urologic Nursing*. 22(6), 372-377.

Chao, R.C. (2011). Managing stress and maintaining well-being: Social support, problem-focused coping, and avoidant coping. *Journal of Counseling & Development, 89,* 338-348. doi: 10.1002/j.1556-6678.2011.tb00098.x

Cheung, F. M., Song, W., & Butcher, J. N. (1991). An infrequency scale for the Chinese MMPI. *Journal of Consulting and Clinical Psychology, 3*(4), 648-653. doi: 10.1037/1040-3590.3.4.648

Cintron, A.C. & Morrison, R.S. (2006). Pain and ethnicity in the United States: A systematic review. *Journal of Palliative Medicine, 9*(6), 1454-1473. doi: 10.1089/jpm.2006.9.1454

Clark, W.C. & Clark, S.B. (1980). Pain responses in Nepalese porters. *Science, 209*(4454), 410-412. doi: 10.1126/science.7384815

Clarke, D.E., Colantonio, A., Rhodes, A.E., (2008). Pathways to suicidality across ethnic groups in Canadian adults: The possible role of social stress. *Psychological Medicine, 38*(3), 419-431. doi: 10.1017/S0033291707002103

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (Second ed.). Hillsdale, N.J.: Lawrence Erlbaum Associates, Publishers.

Cohen, J., Cohen, P., West, S.G., & Aiken, L.S. (2003). Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Cleeland, C.S., Nakamura, Y., Mendoza, T.R., Edwards, K.R., Douglas, J., & Serlin, R.C. (1996). Dimensions of the impact of cancer pain in a four country sample: New information from multidimensional scaling. *Pain, 67,* 267-273. doi: 10.1016/0304-3959(96)03131-4

Cooper, L.A., Beach, M.C., Johnson, R.L., & Inul, T.S. (2006). Delving below the surface: Understanding how race and ethnicity influence relationships in health care. *Journal of General Internal Medicine, 21*, 21-27. doi: 10.1111/j.1525-1497.2006.00305.x

Curtis, K.L., Greve, K.W., Bianchini, K.J., & Brennan, A. (2006). California Verbal Learning Test Indicators of Malingered Neurocognitive Dysfunction. *Assessment, 13(1),* 46-61. doi: 10.1177/1073191105285210

Davidhizar, R. & Giger, J.N. (2004). A review of literature on care of clients in pain who are culturally diverse. *International Nursing Review, 51*(1), 47-55. doi: 10.1111/j.1466-7657.2003.00208.x

Dean, A.C., Boone, K.B., Kim, M.S., Curiel, A.R., Martin, D.J., Victor, T.L., Zeller, M.A., & Lang, Y.K. (2008). Examination of the impact of ethnicity on the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) Fake Bad Scale. *The Clinical Neuropsychologist, 2*, 1054-1060. doi: 10.1080/13854040701750891

Deardorff, W.W., Chino, A.F., & Scott, D.W. (1993). Characteristics of chronic pain patients: Factor analysis of the MMPI-2. *Pain, 54*, 153-158. doi: 10.1016/0304-3959(93)90203-2

Deisinger, J.A., Cassisi, J.E., Lofland, K.R., Cole, P., & Bruehl, (2001). An examination of the psychometric structure of the Multidimensional Pain Inventory. *Journal of Clinical Psychology, 57*(6), 765-783.

Delis, D.C., Kramer, J.H., Kaplan, E., & Ober, B. (2000). *California Verbal Learning Test - Second Edition (CVLT-II).* San Antonio, TX: Pearson.

Dere, J., Sun, J., Zhao, Y., Persson, T.J., Zhu, X., Yao, S., Bagby, R.M., & Ryder, A.G., (2013). Beyond "somatization" and "psychologization": symptom-level variation in depressed Han Chinese and Euro-Canadian outpatients. *Frontiers in Psychology, 4*, 1-13. doi: 10.3389/fpsyg.2013.00377

Dickens, W.T. & Flynn, J.R. (2006) Black Americans reduce the racial IQ gap: Evidence from standardization samples. *Psychological Science, 17*(10), 913-920. doi: 10.1111/j.1467-9280.2006.01802.x

Dionne, C.E., Von Korff, M., Koepsell, T.D., Deyo, R.A., & Checkoway, H. (2001). Formal education and back pain: A review. *Journal of Epidemiology and Community Health, 55*(7), 455-468. doi: 10.1136/jech.55.7.455

Dobscha, S.K., Soleck, G.D., Dickinson, K.C., Burgess, D.J., Lasarev, M.R., Lee, E.S., & McFarland, B.H. (2009) Associations between race and ethnicity and treatment for chronic pain in the VA. *The Journal of Pain, 10*(10), 1078-1087. doi:10.1016/j.jpain.2009.04.018

Doth, A.H., Hansson, P.T., Jenson, M.P., & Taylor, R.S. (2010). The burden of neuropathic pain: A systematic review and meta-analysis of health utilities. *Pain, 149*, 338-344. doi: 10.1016/j.pain.2010.02.034

Dressler, W.W., Oths, K.S., & Gravlee, C.C. (2005). Race and ethnicity in public health research: Models to explain health disparity. *Annual Review of Anthropology, 34*, 231-252. doi: 10.1146/annurev.anthro.34.081804.120505

DuAlba, L., & Scott, R. L. (1993). Somatization and malingering for workers' compensation applicants: A cross-cultural MMPI study. *Journal of Clinical Psychology, 49*(6), 913-917. doi: 10.1002/1097-4679

Durvasula, R., & Mylaganam, G. (1994). Mental health of Asian Indians: Relevant issues and community implications. *Journal of Community Psychology, 22*(2), 97–107.

Edwards, C.L., Fillingim, R.B., & Keefe, F. (2001). Race, ethnicity, and pain. *Pain, 94*, 133,137. doi: 10.1016/S0304-3959(01)00408-0

Edwards, R.R. (2002). New directions in research on pain and ethnicity: A comment on Riley, Myers, Sheffield, Pappas, and Price (2002). *Pain, 100*, 211-212. doi: 10.1016/S0304-3959(02)00307-X

Edwards, R.R., Daniel, M.A, Doleys, M., Fillingim, R.B., & Lowery, D. (2001). Ethnic differences in pain tolerance: Clinical Implications in a chronic pain population. *Psychosomatic Medicine, 63*, 316-323.

Erickson, C.D. & Al-Timimi, N.R. (2001). Providing mental health services to Arab Americans: Recommendations and considerations. *Cultural Diversity and Ethnic Minority Psychology, 7*(4), 308-327. doi: 10.1037//1099-9809.7.4.308

Etherton, J.L., Bianchini, K.J., Greve, K.W., & Heinly, M.T. (2005). Sensitivity and specificity of Reliable Digit Span in malingered pain-related disability. *Assessment, 12(2),* 130-136. doi: 10.1177/1073191105274859

Etherton, J.L., Bianchini, K.J., Heinley, M.T., & Greve, K.W. (2006). Pain, malingering, and performance on the WAIS-III Processing Speed Index. *Journal of Clinical and Experimental Neuropsychology, 28*, 1218-1237. doi: 10.1080/13803390500346595

Evans, S., Lu, Q., Tsao, J.C., & Zelter, L.K. (2009) The role of coping and race in healthy children's experimental pain responses. *Journal of Pain Management, 1*(2), 151-162.

Ezenwa, M.O., Ameringer, S., Ward, S.E., & Serlin. R.C. (2006). Racial and ethnic disparities in pain management in the United States. *Journal of Nursing Scholarship, 38*(3), 225-233. doi: 10.1111/j.1547-5069.2006.00107.x

Faust, D., Ahern, D.C., Bridges, A.J., & Yonce, L.J. (2012). Assessment of malingering and falsification: Conceptual foundations and sources of error. In C.R. Reynolds and A.M. Horton, Jr. (Eds.) *Detection of Malingering During Head Injury Litigation (2nd ed.)* (pp.1-46). New York: Springer.

Field, A. (2005). *Discovering statistics using SPSS (2nd ed.).* Thousand Oaks, CA: Sage Publications.

Frohm, K.D. & Beeler, G.P. (2010). Psychologists as change agents in chronic pain management practice: Cultural competence in the health care system. *Psychological Services, 7*(3), 115-125. doi: 10.1037/a0019642

Fuentes, M., Hart-Johnson, T., & Green, C.R. (2007). The association among neighborhood socioeconomic status, race, and chronic pain in Black and White older adults. *Journal of the National Medical Association, 99*(10), 1160-1169.

Galanti, G. (2000). Filipino attitudes toward pain medication: A lesson in cross-cultural care. *The Western Journal of Medicine, 173*, 278-279.

Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56. doi: 10.1016/0049-089X(92)90017-B

Gaskin, D.J. & Richard, P. (2012). The economic costs of pain in the United States. *The Journal of Pain, 13*(8), 715-724. doi: 10.1016/j.jpain.2012.03.009

Gasquoine, P.G. (1999). Variables moderating cultural and ethnic differences in neuropsychological assessment: The case of Hispanic Americans. *The Clinical Neuropsychologist, 13*(3), 376-383. doi: 10.1076/clin.13.3.376.1735

Gasquoine, P.G. (2009). Race-norming of neuropsychological tests. *Neuropsychological Review, 19*, 250-262. doi: 10.1007/s11065-009-9090-5

Gatchel, R.J., Peng, Y.B., Peters, M.L., Fuchs, P.N., & Turk, D.C. (2007). The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychological Bulletin, 133*(4), 581-634. doi: 10.1037/0033-2909.133.4.581

Gervais, R.O., Rohling, M.L., Green, P., & Ford, W. (2004). A comparison of WMT, CARB, and TOMM failure rates in non-head injury disability claimants. Archives of Clinical Neuropsychology, 19, 475-487. doi: 10.1016/j.acn.2003.05.001

Glass, J.M., Williams, D.A., Fernandez-Sanchez, M., Kairys, A., Barjola, P., Heitzeg, M.M., Clauw, D.J., & Schmidt-Wilcke, T. (2011). Executive function in chronic pain patients and healthy controls: Different cortical activation during response inhibition in fibromyalgia. *The Journal of Pain, 12*(12), 1219-1229. doi: 10.1016/j.jpain.2011.06.007

Goldberg, M.A. & Remy-St. Louis, G. (1998). Understanding and treating pain in ethnically diverse patients. *Journal of Clinical Psychology in Medical Settings, 5*(3), 343-356. doi: 10.1023/A:1026258220848

Goldberg, R.T. (1999). Relationship between traumatic events in childhood and chronic pain. *Disability and Rehabilitation, 21*(1), 23-30. doi: 10.1080/096382899298061

Government of Canada (2006). *The Human Face of Mental Illness in Canada*. Retrieved from http://www.phac-aspc.gc.ca/publicat/human-humain06/index-eng.php on August 24, 2013.

Green, C.R., Baker. T.A., & Ndao-Brumblay, S.K. (2004). Patient attitudes regarding healthcare utilization and referral: A descriptive comparison in African- and Caucasian Americans with chronic pain. *Journal of the National Medical Association, 96*(1), 31-42.

Green, C.R., Baker, T.A., Smith, E.M., & Sato, Y. (2003). The effect of race in older adults presenting for chronic pain management: A comparative study of Black and White Americans. *The Journal of Pain, 4*(2), 82-90. doi:10.1054/jpai.2003.8

Green, C.R., Baker, T.A., Sato, Y., Washington, T.L., & Smith, E.M. (2003). Race and chronic pain: A comparative study of young Black and White Americans presenting for management. *The Journal of Pain, 4*(4), 176-183. doi: 10.1016/S1526-5900(02)65013-8

Green, C.R., Ndao-Brumblay, S.K., Nagrant, A.M., Baker, T.A., & Rothman, E. (2004). Race, age, and gender influences among clusters of African American and White patients with chronic pain. *The Journal of Pain, 5*(3), 171-182. doi: 10.1016/j.jpain.2004.02.227

Greene, R.L. (2000) *The MMPI-II: An Interpretive Manual* ($2^{nd}$ Ed.). Needham Heights, MA: Allyn & Bacon

Greve, K.W., Bianchini, K.J., & Brewer, S.T. (2013). The assessment of performance and self-report validity in persons claiming pain-related disability. *The Clinical Neuropsychologist, 27*(1), 108-137. doi: http://dx.doi.org/10.1080/13854046.2012.739646

Greve, K.W., Bianchini, K.J., Etherton, J.L., Meyers, J.E., Curtis, K.L., & Ord, J.S. (2010). The Reliable Digit Span Test in chronic pain: Classification accuracy in detecting malingered pain-related disability. *The Clinical Neuropsychologist*, *24*, 137-152. doi: 10.1080/13854040902927546

Hadjistavropoulos, T., Duck, S., Goubert, L, Mogil, J.S., Sullivan, M.J., Vervoort, T., Craig, K.D., Cano, A., Jackson, P.L, Rainville, P., Williams, A.C., & Fitzgerald, T.D. (2011). A biopsychosocial formulation of pain communication. *Psychological Bulletin, 137*(6), 910-939. doi: 10.1037/a0023876

Hall, G.C., Bansal, A., & Lopez, I.R. (1999) Ethnicity and psychopathology: A meta-analytic review of 31 years of comparative MMPI/MMPI-2 research. *Psychological Assessment, 11*(2), 186-197. doi: 10.1037/1040-3590.11.2.186

Hakim-Larson, J., Kamoo, R., Nasser-McMillan, S.C., & Porcerelli, J.H. (2007) Counseling Arab and Chaldean American Families. *Journal of Mental Health Counseling, 4*, 301-321.

Hamid, P.N. (1994). Self-monitoring, locus of control, and social encounters of Chinese and New Zealand students. *Journal of Cross-Cultural Psychology, 25*(3), 353-368. doi: 10.1177/0022022194253004

Hansson, E. K., Tuck, A., Lurie, S., & McKenzie, K. (2012). Rates of mental illness and suicidality in immigrant, refugee, ethnocultural, and racialized groups in Canada: A review of the literature. *Canadian Journal of Psychiatry, 57*(2), 111-121.

Hart, R.P., Martelli, M.F.,& Zasler, N.D. (2000). Chronic pain and neuropsychological functioning. *Neuropsychology Review, 10*(3), 131-149. doi: 10.1023/A:1009020914358

Hart, R.P., Wade, J.B., & Martelli, M.F. (2007). Cognitive impairment in patients with chronic pain: The significance of stress. *Current Pain and Headache Reports,7*: 116-126. doi: 10.1007/s11916-003-0021-5

Hastie, B.A., Riley, J.L., & Fillingom, R.B. (2005). Ethnic differences and responses to pain in healthy young adults. *Pain Medicine, 6*(1), 61-71. doi: 10.1111/j.1526-4637.2005.05009.x

Hathaway, S. R., & McKinley, J. C. (1943). *Manual for the Minnesota Multiphasic Personality Inventory*. New York: Psychological Corporation.

Heaton, R.K., Miller, S.W., Taylor, M.J., & Grant, I. (2004). *Revised comprehensive norms for an expanded Halstead-Reitan Battery: Demographically adjusted neuropsychological norms for African American and Caucasian adults*. Lutz, FL: PAR.

Heckman, B.D., Holroyd, K.A., O'Donnell, F.J., Tietjen, G., Utley, C., Stillman, M., & Ellis, G. (2008). Race differences in adherence to headache treatment appointments in persons with headache disorders. *Journal of the National Medical Association, 100*(2), 247-255.

IASP Subcommittee on Pain Taxonomy (1979). Pain terms: A list with definitions and notes on usage. *Pain, 6*(3), 249-252.

Iezzi, T., Duckworth, M.P., Vuong, L.N., Archibald, Y.M., & Klinck, A. (2004). Predictors of neurocognitive performance in chronic pain patients. *International Journal of Behavioural Medicine, 11*(1), 56-61. doi: 10.1207/s15327558ijbm1101_7

Islam, F. (2013). Examining the "Healthy Immigrant Effect" for mental health in Canada. *University of Toronto Medical Journal, 90*(4), 169-175.

Jackson, T., Iezzi, A., & Lafreniere, K. (1997). The impact of psychosocial features of employment status on emotional distress in chronic pain and healthy comparison samples. *Journal of Behavioral Medicine, 20*(3), 241-256. doi: 10.1023/A:1025552710949

Jamil, H., Hakim-Larson, J., Farrag, M., Kafaji, T., Duqum, I., & Jamil, L.H. (2002). A retrospective study of Arab American mental health clients: Trauma and the Iraqi refugees. *American Journal of Orthopsychiatry, 72*(3), 355-361.

Jamison, R.N., Rudy, T.E., Penzien, D.B., & Mosley, T.H. (1994) Cognitive-behavioral classifications of chronic pain: Replication and extension of empirically derived patient profiles. *Pain, 57*(3), 277-292.

Jensen, M.P. (2010). A neuropsychological model of pain: Research and clinical implications. *The Journal of Pain, 11*(1), 2-12. doi: 10.1016/j.jpain.2009.05.001

Jensen, M.P. & Karoly, P. (1991). Control beliefs, coping efforts, and adjustment to chronic pain. *Journal of Consulting and Clinical Psychology, 59*(3), 431-438. doi: 10.1037/0022-006X.59.3.431

Jensen, M.P., Turner, J.A., & Romano, J.M. (2001). Changes in beliefs, catastrophizing, and coping are associated with improvement in multidisciplinary pain treatment. *Journal of Consulting and Clinical Psychology, 69*(4), 655-662. doi: 10.1037//0022-006X.69.4.655

Jensen, M.P., Turner, J.A., Romano, J.M., & Karoly, P. (1991). Coping with chronic pain: A critical review of the literature. *Pain, 47*, 249-283. doi: 10.1016/0304-3959(91)90216-K

Jensen, M.P., Turner, J.A., Romano, J.M., & Lawler, B.K. (1994). Relationship of pain-specific beliefs to chronic pain adjustment. *Pain, 57*, 301-309. doi: 10.1016/0304-3959(94)90005-1

Jiminez, N., Garroutte, E., Kundu, A., Morales, L., & Buchwald, D. (2011). A review of the experience, epidemiology, and management of pain among American Indian, Alaska Native, and Aboriginal Canadian Peoples. *The Journal of Pain, 12*(5), 511-522. doi: 10.1016/j.jpain.2010.12.002

Johnson-Greene, D., Brooks, L., & Ference, T. (2013). Relationship between performance validity testing, disability status, and somatic complaints with fibromyalgia. *The Clinical Neuropsychologist*, *27*(1), 148-158. doi: http://dx.doi.org/10.1080/13854046.2012.733732

Jordan, M.S., Lumley, M.A., & Leisen, J.C. (1998). The relationships of cognitive coping and pain control beliefs to pain and adjustment among African-American and Caucasian women with rheumatoid arthritis. *Arthritis Care and Research, 11*(2), 80-88. doi: 10.1002/art.1790110203

Kagitçibasi , C. (1997) Individualism and Collectivism. In J.W. Berry, M.H. Segall, & C. Kagitçibasi (Eds.) *Handbook of Cross-Cultural Psychology, Volume 3: Social Behaviour and Applications* (2nd Ed.). Boston, MA: Allyn & Bacon.

Kashluba, S., Hanks, R., Casey, J.E., & Millis, S. (2008). Neuropsychologic and functional outcome after complicated mild traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 89*, 904-911. doi: 10.1016/j.apmr.2007.12.029

Keefe, F.J., Caldwell, D.S., Queen, K.T., Gil, K.M., Martinez, S., Crisson, J.E., Ogden, J.E., & Nunley, J. (1987). Pain coping strategies in osteoarthritis patients. *Journal of Consulting and Clinical Psychology, 55*(2), 208-212. doi: 10.1037/0022-006X.55.2.208

Keefe, F.J., Lumley, M.A., Buffington, A.L., Carson, J.W., Studts, J.L., Edwards, C.L., MacKlem, D.J., Aspines, A.K., Fox, L., & Steffey, D. (2002). Changing face of pain research in *Psychosomatic Medicine. Psychosomatic Medicine, 64*, 921-938. doi: 0.1097/01.PSY.0000038934.67401.BA

Kennepohl, S., Shore, D., Nabors, N., & Hanks, R. (2004). African American acculturation and neuropsychological test performance following traumatic brain injury. *Journal of the International Neuropsychological Society, 10:* 566-577. doi: 10.10170S1355617704104128

Kerns, R.D., Turk, D.C., & Rudy, T.E. (1985). The West Haven-Yale Multidimensional Pain Inventory (WHYMPI). *Pain, 23*, 345-356. doi: 10.1016/0304-3959(85)90004-1

Kim, H.S., Sherman, D.K., & Taylor, S.E. (2008). Culture and social support. *American Psychologist, 63*(6), 518-536. 10.1037/0003-066X

Kodiath, M.F. & Kodiath, A. (1992). A comparative study of patients with chronic pain in India and the United States. *Clinical Nursing Research, 1*(3), 278-291.

Kolb, B. & Whishaw, I.Q. (2009). *Fundamentals of human neuropsychology* (Sixth ed.). New York: Worth.

Kosmidis, M.H., Tsotsi, S., Karambela, O., Takou, E., & Vlahou, C.H. (2010). Cultural factors influencing performance on visuoperceptual neuropsychological tasks. *Behavioral Neurology, 23,* 245-247. doi: 10.3233/BEN20100306

Kreitler, S. & Niv, D. (2007). Cognitive impairment in chronic pain. *Pain: Clinical Updates, 15*(4): 1-4.

Kuo, B.C. & Roysircar, G. (2004). Predictors of acculturation for Chinese adolescents in Canada: Age of arrival, length of stay, social class, and English reading ability. *Journal of Multicultural Counseling and Development, 32*(3), 143-154. doi: 10.1002/j.2161-1912.2004.tb00367.x

Larrabee, G.J. (1998). Somatic malingering on the MMPI and MMPI-2 in litigating subjects. *The Clinical Neuropsychologist, 12*, 179-188. doi: 10.1076/clin.12.2.179.2008

Lasch, K.E. (2000). Culture, pain, and culturally sensitive pain care. *Pain Management Nursing, 1*(3), Suppl 1, 16-22. doi: 10.1053/jpmn.2000.9761

Latham, J. & Davis, B.D. (1994). The socioeconomic impact of chronic pain. *Disability and Rehabilitation, 16*(1). 39-44. doi: 10.3109/09638289409166435

Leadly, R.M., Armstrong, N., Lee, Y.C., Allen, A., & Kleijnen, J. (2012). Chronic diseases in the European Union: The prevalence and health cost implications of chronic pain. *Journal of Pain & Palliative Care Pharmacotherapy, 26*, 310-325. doi: 10.3109/15360288.2012.736933

Lethem, J., Slade, P. D., Troup, J. D., & Bentley, G. (1983). Outline of a Fear-Avoidance Model of exaggerated pain perception--I. *Behaviour research and Therapy 21*(4), 401–408.

Levin, R.L., Heller, W., Mohanty, A., Herrington, J.D., & Miller, G.A. (2007). Cognitive deficits in depression and functional specificity of regional brain activity. *Cognitive Therapy Research, 31*, 211-233. doi: 10.1007/s10608-007-9128-z

Liang, B. & Bogat, A. (1994). Culture, control, and coping: New perspectives on social support. *American Journal of Community Psychology, 22*(1), 123-147. doi: 10.1007/BF02506820

Lincoln, K.D., Chatters, L.M., & Taylor, R.J. (2003). Psychological distress among Black and White Americans: Differential effects of social support, negative interaction, and personal control. *Journal of Health and Social Behavior, 44*(3), 390-407. doi: 10.2307/1519786

Lipton, J.A. & Marbach, J.J. (1984). Ethnicity and the Pain Experience. *Social Science and Medicine, 19*(12), 1279-1298. doi: 10.1016/0277-9536(84)90015-7

Lönnqvist, J. (2010). Cognition and mental ill-health. *European Psychiatry, 25*, 297-299. doi: :10.1016/j.eurpsy.2010.01.006

Lu, L., Kao, S., Cooper, C.L., & Spector, P.E. (2000). Managerial stress, locus of control, and job strain in Taiwan and UK: A comparative study. *International Journal of Stress Management, 7*(3), 209-226. doi: 10.1023/A:1009518315691

Lumley, M.A., Cohen, J.L, Borszcz, G.S., Cano, A., Radcliffe, A.M., Porter, L.S., Schubiner, H., & Keefe, F.J. (2011). Pain and emotion: A biopsychosocial review of recent research. *Journal of Clinical Psychology, 67*, 942-968. doi: 10.1002/jclp.20816

Lynn, R. & Irwing, P. (2008). Sex differences in mental arithmetic, digit span, and *g* defined as working memory capacity. *Intelligence, 36*(2), 226-235. doi :10.1016/j.intell.2007.06.002

Mailis-Gagnon, A., Yegneswaran, B., Nicholson, K., Lakha, S.F., Papagapiou, M., Steiman, A.J., Ng, D., Cohodarevic, T., Umana, M., & Zurowski, M. (2007). Ethnocultural and sex characteristics of patients attending a tertiary care pain clinic in Toronto, Ontario. *Pain Research & Management: The Journal of the Canadian Pain Society,12*(1), 101-106.

Manly, J.J. (2008) Critical issues in cultural neuropsychology: Profit from diversity. *Neuropsychology Review, 19*, 179-183. doi: 10.1007/s11065-008-9068-8

Manly, J.J., Byrd, D.A., Touradji, P., & Stern, Y. (2004). Acculturation, reading level, and neuropsychological test performance among African American elders. *Applied Neuropsychology: Adult, 11*(1), 37-46. doi: 10.1207/s15324826an1101_5

McCurry, S.M., Gibbons, L.E., Uomoto, J.M., Thompson, M.L, Graves, A.B., Edland, S.D. … Iverson, G.L. (2001). Predicting complaints of impaired cognitive function in patients with chronic pain. *Journal of Pain and Symptom Management, 21*(5): 392-396. doi: 10.1016/S0885-3924(01)00267-6

McNeill, J.A., Sherwood, G.D., & Starck, P.L. (2004). The hidden error of mismanaged pain: A systems approach. *Journal of Pain and Symptom Management, 28*(1), 47-58. doi: 0.1016/j.jpainsymman.2003.11.005

McWilliams, L.A., Cox, B.J., & Enns, M.W. (2003). Mood and anxiety disorders associated with chronic pain: An examination in a nationally representative sample. *Pain, 106*, 127-133. doi: 10.1016/S0304-3959(03)00301-4

Mechlin, M.B., Maixner, W., Light, K.C., Fisher, J.M., & Girdler, S.S. (2005). African Americans show alterations in endogenous pain regulatory mechanisms and reduced pain tolerance to experimental pain procedures. *Psychosomatic Medicine, 67*, 948-956. doi: 10.1097/01.psy.0000188466.14546.68

Mee, S., Bunney, B.G., Reist, C., Potkin, S.G., & Bunney, W.E. (2006). Psychological pain: A review of the evidence. *Journal of Psychiatric Research, 40*, 680-690. doi: 10.1016/j.jpsychires.2006.03.003

Megani, S.H. & Cho, E. (2009). Self-reported pain and utilization of pain treatment between minorities and nonminorities in the United States. *Public Health Nursing, 26*(4), 307-316. doi: 10.1111/j.1525-1446.2009.00785.x

Melzack, R. (1993). Pain: Past, present, and future. *Canadian Journal of Experimental Psychology, 47*(4), 615-629. doi: 10.1037/h0078871

Melzack, R. & Wall, P.D. (1965). Pain mechanisms: A new theory. *Science, 150*(3699), 971-979.

Mendelson, G. (1986). Chronic pain and compensation: A review. *Journal of Pain and Symptom Management, 1*(3), 135-144. doi: 10.1016/S0885-3924(86)80062-8

Merideth, P., Ownsworth, T., & Strong, J. (2008) A review of the evidence linking adult attachment theory and chronic pain: Presenting a conceptual model. *Clinical Psychology Review, 28*, 407-429. doi: 10.1016/j.cpr.2007.07.009

Mesquita, B & Walker, R. (2003). Cultural differences in emotions: A context for interpreting emotional experiences. *Behaviour Research and Therapy, 41*, 777-793. doi: 10.1016/S0005-7967(02)00189-4

Meyers, J.E. & Diep, A. (2000). Assessment of malingering in chronic pain patients using neuropsychological tests. *Applied Neuropsychology, 7*(3), 133-139. doi: 10.1207/S15324826AN0703_3

Mittenberg, W., Patton, C., Canyock, E.M., & Condit, D.C. (2002). Base rates of malingering and symptom exaggeration. *Journal of Clinical and Experimental Neuropsychology, 24*(8), 1094-1102. doi: 10.1076/jcen.24.8.1094.8379

Monsivais, D. & McNeill, J. (2007). Multicultural influences on pain medication attitudes and beliefs in patients with nonmalignant chronic pain syndromes. *Pain Management Nursing, 8*(2), 64-71. doi:10.1016/j.pmn.2007.03.001

Moore, R.A. & Dworkin, S.F. (1988). Ethnographic methodologic assessment of pain perceptions by verbal description. *Pain, 34*, 195-204. doi: 10.1016/0304-3959(88)90166-2

Moulin, D.E., Clark, A.J., Speechley, M., & Morley-Forster, P.K. (2002). Chronic pain in Canada – Prevalence treatment, impact, and the role of opioid analgesia. *Pain Research & Management: The Journal of the Canadian Pain Society,7*(4), 179-184.

Nampiaparampil, D.E. (2008). Prevalence of chronic pain after traumatic brain injury: A systematic review. *Journal of the American Medical Association, 300*(6), 711-719.

Nampiaparampil, D.E., Nampiaparampil, J.X., & Harden, R.N. (2009). Pain and prejudice. *Pain Medicine, 10*(4), 716-721. doi: 1 0.1111/j.1526-4637.2009.00612.x

Nayak, S., Shiflett, S.C., Eshun, S., & Levine, F.M. (2000). Culture and gender effects in pain beliefs and the prediction of pain tolerance. *Cross-Cultural Research, 34*(2), 135-151. doi: 10.1177/106939710003400203

Neisser, U., Boodoo, G., Bouchard, T.J., Boykin, A.W., Brody, N., Ceci, S.J. . . . Urbina, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist, 51*(2), 77-101. doi: 10.1037/0003-066X.51.2.77

Nelson, N.W., Hoezle, J.B., Sweet, J.J., Arbisi, P.A., & Demakis, G.J. (2010). Updated meta-analysis of the MMPI-2 Symptom Validity Scale (FBS): Verified utility in forensic practice. *The Clinical Neuropsychologist, 24,* 701-724. doi: 10.1080/13854040903482863

Newton-John, T.R. (2002). Solicitousness and chronic pain: A critical review. *Pain Reviews, 9*, 7-27. doi: 10.1191/0968130202pr186ra

Nichols, D.S. (2001). *Essentials of MMPI-2 Assessment.* Hoboken, NJ: John Wiley & Sons, Inc.

Nguyen, M., Ugarte, C., Fuller, I., Haas, G., & Portenoy, R.K. (2005). Access to care for chronic pain: Racial and ethnic differences. *The Journal of Pain, 6*(5), 301-314. doi: 10.1016/j.jpain.2004.12.008

Noble, K.G., McCandliss, B.D., & Farah, M.J. (2007). Socioeconomic gradients predict individual differences in neurocognitive abilities. *Developmental Science, 10*(4), 464-480. doi: 1 0.1111/j.1467-7687.2007.00600.x

Noh, S., & Kaspar, V. (2003). Perceived discrimination and depression: Moderating effects of coping, acculturation, and ethnic support. *American Journal of Public Health, 93*(2), 232-239.

O'Connor, D.B. & Shimizu, M. (2002). Sense of personal control, stress, and coping style: A cross-cultural study. *Stress and Health, 18*, 173-183. doi: 10.1002/smi.939

Ocanez, K.L., McHugh, K., & Otto, M.W. (2010). A meta-analytic review of the association between anxiety sensitivity and pain. *Depression and Anxiety, 27*, 760-767. doi: 10.1002/da.20681

Ooserman J.M., de Vries, K., de Haan, E.H.F., & Scherder, E.J.A. (2009). Exploring the relationship between cognition and self-reported pain in residents of homes for the elderly. *International Psychogeriatrics, 21*(1), 157-163. doi: 10.1017/S1041610208007941

Oyserman, D., Coon, H.M., & Kemmelmeir, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analysis. *Psychological Bulletin, 128*(1), 3-72. doi: 10.1037//0033-2909.128.1.3

Pace, T.M., Robbins, R.R., Choney, S.K., Hill, J.S., Lacey, K., & Blair, G. (2006). A cultural-contextual perspective on the validity of the MMPI-2 with American Indians. *Cultural Diversity and Ethnic Minority Psychology, 12*(2), 320-333. doi: 10.1037/1099-9809.12.2.320

Payne, B. & Norfleet, M.A. (1986). Chronic pain and the family: A review. *Pain, 26*, 1-22. doi: 10.1016/0304-3959(86)90169-7

Pearson. (1997*). Wechsler Adult Intelligence Scale — Third Edition (WAIS–III).* San Antonio, TX: Author.

Pedraza, O. & Mungas, D. (2008) Measurement in cross-cultural neuropsychology. *Neuropsychology Review, 18*, 184-193. doi: 10.1007/s11065-008-9067-9

Pengel, L.H., Herbert, R.D., Maher, C.G., & Refshauge, K.M. (2003). Acute low back pain: Systematic review of its prognosis. *British Medical Journal, 327*(7410), 323-325. doi: 10.1136/bmj.327.7410.323

Portenoy, R.K., Ugarte, C., Fuller, I., & Haas, G. (2004). Population-based survey of pain in the United States: Differences among White, African American, and Hispanic subjects. *The Journal of Pain, 5*(6), 317-328. doi: 10.1016/j.jpain.2004.05.005

Rahim-Williams, F.B., Riley, J.L., Herrera, D., Campbell, C.M., Hastie, B.A., & Fillingim, R.B. (2007). Ethnic identity predicts experimental pain sensitivity in African Americans and Hispanics. *Pain, 129*, 177-184. doi: 10.1016/j.pain.2006.12.016

Rait, G., & Burns, A. (1997). Appreciating background and culture: The South Asian elderly and mental health. *International Journal of Geriatric Psychiatry, 12*(10), 973–977.

Ramage-Morin, P.L. (2008). Chronic pain in Canadian seniors. *Health Reports, 19*(1), 1-16.

Ramond, A., Bouton, C., Richard, I., Roquelaure, Y., Baufreton, C., Legrand, E., & Huez, J. (2011). Psychosocial risk factors for chronic low back pain in primary care – A systematic review. *Family Practice, 28*, 12-21. doi: 10.1093/fampra/cmq072

Reitan, R.M. & Wolfson, D. (2000). *Mild Head Injury: Intellectual, Cognitive, and Emotional Consequences.* Tucson, AZ: Neuropsychology Press.

Reitsma, .L., Tranmer, J.E., Buchanan, D.M., & Van Den Kerkhof, E.G. (2012). The epidemiology of chronic pain in Canadian men and women between 1994 and 2007: Results from the longitudinal component of the National Population Health Survey. *Pain Research & Management: The Journal of the Canadian Pain Society, 17*(3), 166-172.

Riley, J.L., Wade, J.B., Myers, C.D., Sheffield, D., Papas, R.K., & Price, D.D. (2002). Racial/ethnic differences in the experience of chronic pain. *Pain, 100,* 291-298. doi: 10.1016/S0304-3959(02)00306-8

Rogers, A. & Allison, T. (2004). What if my back breaks? Making sense of musculoskeletal pain among South Asian and African-Caribbean people in the north west of England. *Journal of Psychosomatic Research, 57*(1), 79-87.

Rohling, M.L., Binder, L.M, & Langhinrichsen-Rohling, J. (1995). Money matters: A meta-analytic review of the association between financial compensation and the experience and treatment of chronic pain. *Health Psychology, 14*(6), 537-547. doi: 10.1037/0278-6133.14.6.537

Rohling, M.L., Green, P., Allen, L.M., & Iverson, G.L. (2002). Depressive symptoms and neurocognitive test scores in patients passing symptom validity tests. *Archives of Clinical Neuropsychology, 17,* 205-222. doi: 10.1093/arclin/17.3.205

Romano, J.M., Jensen, M.P., Turner, J.A., Good, A.B., & Hops, H. (2000). Chronic pain patient-partner interactions: Further support for a behavioral model of chronic pain. *Behaviour Therapy, 31*, 415-440. doi: 10.1016/S0005-7894(00)80023-4

Rosselli, M. & Ardila, A. (2003). The impact of culture and education on non-verbal neuropsychological measurements: A critical review. *Brain and Cognition, 52*, 326-333. doi: 10.1016/S0278-2626(03)00170-2

Roth, P.L., Bevier, C.A., Bobko, P., Switzer, F.S., & Tyler P. (2001). Ethnic group differences in cognitive ability in employment and educational settings: A meta-analysis. *Personnel Psychology, 54*, 297-330. doi: 10.1111/j.1744-6570.2001.tb00094.x

Rudy, T.E., Turk, D.C., Zaki, H.S., & Curtin, H.D. (1989). An empirical taxometric alternative to traditional classification of temporomandibular disorders. *Pain, 36*(3), 311-320. doi: 10.1016/0304-3959(89)90090-0

Ruff, R.M., Iverson, G.L., Barth, J.T., Bush, S.S., Broshek, D.K., & NAN Policy an Planning Committee. (2009). Recommendations for diagnosing a mild traumatic brain injury: A National Academy of Neuropsychology education paper. *Archives of Clinical Neuropsychology, 24*(1), 3-10. 10.1093/arclin/acp006

Sanders, S.H., Brena, S.F., Spier, C.J., Beltrutti, D., McConnell, H., & Quintero, O. (1992). Chronic low back pain patients around the world: Cross-cultural similarities and differences. *Clinical Journal of Pain, 8*(4), 317-323.

Salazar, X., Lu. P.H., Wen, J., & Boone, K.B. (2007). The use of effort tests in ethnic minorities and in non-English-speaking and English as a second language populations. In K.B. Boone (Ed.), *Assessment of feigned cognitive impairment: A neuropsychological perspective* (pp. 405-427). New York: Guildford Press.

Salimbene, S. (1999). Cultural competence: A priority for performance improvement action. *Journal of Nursing Care Quality, 13*(3), 23–35.

Sam, D.L. & Berry, J.W. (2006) Introduction. In D.L. Sam and J.W. Berry (Eds.), *The Cambridge Handbook of Acculturation Psychology* (pp. 1-10). Cambridge, UK: Cambridge University Press.

Sattler, J.M. & Ryan, J.R. (2008). WAIS-III subtests and interpreting the WAIS-III In J.M. Sattler (Ed.) *Assessment of Children: Cognitive Foundations*. San Diego, CA: Jerome M. Sattler Publisher, Inc.

Sharp, T.J. & Harvey, A.G. (2001). Chronic pain and posttraumatic stress disorder: Mutual maintenance? *Clinical Psychology Review, 21*(6), 857-877.

Shavers, V.L., Bakos, A., & Sheppard, V.B. (2010). Race, ethnicity, and pain among the U.S. adult population. *Journal of Health Care for the Poor and Underserved, 21*, 177-220. doi: 10.1353/hpu.0.0255

Sheu, H. & Sedlacek, W.E. (2004). An exploratory study of help-seeking attitudes and coping strategies among college students by race and gender. *Measurement and Evaluation in Counseling and Development, 37*, 130-143.

Shuttleworth-Edwards, A.B., Kemp, R.D., Rust, A.L., Muirhead, J.G., Hartman, N.P., & Radloff, S.E. (2004). Cross-cultural effects on IQ test performance: A review and preliminary normative indications on WAIS-III test performance. *Journal of Clinical and Experimental Neuropsychology, 26*(7), 903-920. doi: 10.1080/13803390490510824

Slesinger, D., Archer, R.P., & Duane, W. (2002). MMPI-2 characteristics in a chronic pain population. *Assessment, 9*(4), 406-414. doi: 10.1177/1073191102238153

Söchting, I., Corrado, R., Cohen, I.M., Ley, R.G., & Brasfield, C. (2007). Traumatic pasts in Canadian Aboriginal people: Further support for a complex trauma conceptualization? *BC Medical Journal, 49*(6), 320-326.

Solberg Nes, L., Roach, A.R., & Segerstrom, S.C. (2009). Executive functions, self-regulation, and chronic pain: A review. *Annals of Behavioral Medicine, 37,* 173-183. doi: 10.1007/s12160-009-9096-5

Statistics Canada. (2010). *Projections of the diversity of the Canadian population.* (Catalogue number 91-551-X). Retrieved August 30, 2011 from Statistics Canada: http://www.statcan.gc.ca/pub/91-551-x/91-551-x2010001-eng.pdf

Statistics Canada. (2012). *Canada's Population Clock.* Retrieved March 12, 2012 from Statistics Canada: http://www.statcan.gc.ca/ig-gi/pop-ca-eng.htm

Staton, L.J., Panda, M., Chen, I., Genao, I., Kurz, Pasanen, M., et al. (2007). When race matters: Disagreement between patients and their physicians in primary care. *Journal of the National Medical Association, 99*(5), 532-538.

Stevens, M.J., Kwan, K., & Graybill, D. (1993). Comparison of MMPI-2 scores of foreign Chinese and Caucasian-American students. *Journal of Clinical Psychology, 49*(1), 23-27. doi: 10.1002/1097-4679(199301)49:1

Strassberg, D.S., Tilley, D., Bristone, S., & Oei, T. (1992). The MMPI and chronic pain: a cross-cultural view. *Psychological Assessment, 4*(4), 493-497. doi: 10.1037/1040-3590.4.4.493

Strategier, L.D., Chwalisz, K., Altamaier, E.M., Russell, D.W., & Lehmann, T.R. (1997). Multidimensional assessment of chronic low back pain: Predicting treatment outcomes. *Journal of Clinical Psychology in Medical Settings, 4*(1), 91-110.

Strauss, E., Sherman, M.S., & Spreen, O. (2006). *A Compendium of Neuropsychological Tests: Administration, Norms, and Commentary (3rd Ed.).* New York: Oxford University Press.

Strong, J., Ashton, R., & Stewart, A. (1994). Chronic low back pain: Toward an integrated psychosocial assessment model. *Journal of Consulting and Clinical Psychology, 62*(5), 1058-1063.

Sullivan, M.J., Hall, E., Bartolacci, R. Sullivan, M.E., & Adams, H. (2002). Perceived cognitive deficits, emotional distress and disability following whiplash injury. *Pain Research & Management: The Journal of the Canadian Pain Society, 7*(3), 120-126.

Sue, S., Keefe, K., Enomoto, K., Durvasula, R. S., & Chao, R. (1996). Asian American and White college students' performance on the MMPI-2. In J. N. Butcher (Ed.), *International adaptations of the MMPI-2: Research and clinical applications* (pp. 206-218). Minneapolis: University of Minnesota Press.

Sue, D. W. & Sue, D. (2007). *Counseling the culturally diverse: Theory and practice* (Fifth ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Tan. G., Jensen, M.P. Robinson-Whelen, S., Thornby, J.I., & Mongal, T. (2002). Measuring control appraisals in chronic pain. *The Journal of Pain, 3*(5), 385-393. doi: 10.1054/jpai.2002.126609

Tan, G., Jensen, M.P., Thornby, J., & Anderson, K.O. (2005). Ethnicity, control appraisal, coping, and adjustment to chronic pain among Black and White Americans. *Pain Medicine, 6*(1), 18-28. doi: 10.1111/j.1526-4637.2005.05008.x

Tan. G., Jensen, M.P., Thornby, J., & Sloan, P.A. (2008). Negative emotions, pain, and functioning. *Psychological Services, 5*(1), 26-35. doi: 10.1037/1541-1559.5.1.26

Tang, N. & Crane, C. (2006). Suicidality in chronic pain: A review of the prevalence, risk factors, and psychological links. *Psychological Medicine, 36*, 575-586. doi:10.1017/S0033291705006859

Taylor, S.E., Sherman, D.K., Kim H.S., Jarcho, J. Takagi, K., & Dunagan, M.S. (2004). Culture and social support: Who seeks it and why? *Journal of Personality and Social Psychology, 87*(3), 354-362. doi: 10.1037/0022-3514.87.3.354

Teasdale, G. and B. Jennett (1974). Assessment of coma and impaired consciousness. A practical scale. *Lancet 2*(7872), 81-4.

The Psychological Corporation (2001). *Wechsler Test of Adult Reading.* San Antonio, TX: Harcourt Assessment.

Triandis, H.C., McCusker, C., Betancourt, H., Iwao, S., Leung, K., Salazar, J.M. et al. (1993). An etic-emic analysis of individualism and collectivism. *Journal of Cross-Cultural Psychology, 24*(3), 366-383. doi: 10.1177/0022022193243006

Truchon, M. & Fillion, L. (2000). Biopsychosocial determinants of chronic disability and low-back pain: A review. *Journal of Occupational Rehabilitation, 10*(2), 117-142. doi: 10.1023/A:1009452019715

Tsai, D.C. & Pike, P.L. (2000). Effects of acculturation on the MMPI-2 scores of Asian American students. *Journal of Personality Assessment, 74*(2), 216-230.

Tsushima, W.T. & Tsushima, V.G. (2009). Comparison of MMPI-2 validity scales among compensation-seeking Caucasian and Asian American medical patients. *Assessment, 16*(2), 150-164. doi: 10.1177/1073191108327695

Turk, D.C. (2002). A diathesis-stress model of chronic pain and disability following traumatic injury. *Pain Research and Management, 7*(1), 9-19.

Turk, D.C. & Rudy, T.E. (1988). Toward an empirically derived taxonomy of chronic pain patients: Integration of psychological assessment data. *Journal of Consulting and Clinical Psychology, 56*(2), 233-238.

Tyrer, S. & Lievesley, A. (2003). Pain following traumatic brain injury: Assessment and management. *Neuropsychological Rehabilitation, 13*(1/2), 189-210. doi: 10.1080/09602010244000381

United Nations. (2013). *United Nations Statistics Division – Standard Country and Area Codes Classification (M49).* Retrieved May 20, 2013 from United Nations: http://unstats.un.org/unsd/methods/m49/m49regin.htm

United States Census Bureau. (2011). *Population Estimates- National Totals: Vintage 2011*. Retrieved March 12, 2012 from United States Census Bureau: http://www.census.gov/popest/data/national/totals/2011/index.html

UPMC Pain Medicine Program. (2005) *MPI norms*. Retrieved from: http://www.pain.pitt.edu/mpi/MPI_Norms.pdf."

Vallerand, A.H., Hasenau, S., Templin, T., & Collins-Bohler, D. (2005). Disparities between Black and White patients with cancer pain: The effects of perception of control over pain. *Pain Medicine, 6*(3), 242-250. doi: 10.1111/j.1526-4637.2005.05038.x

Van Den Kerkhof, E.G., Hopman, W.M., Towheed, T.E. Anastassiades, T.P., & Goldstein, D.H. (2003). The impact of sampling and measurement on the prevalence of self-reported pain in Canada. *Pain Research & Management: The Journal of the Canadian Pain Society,8*(3), 157-163.

Van Dyke, S.A., Millis, S.R., Axelrod, B.N., & Hanks, R.A. (2013). Assessing effort: Differentiating performance and symptom validity. *The Clinical Neuropsychologist, 27*(8), 1234-1246. doi:  10.1080/13854046.2013.835447

Walker, A.J., Batchelor, J., & Shores, A. (2009). Effects of education and cultural background on performance on WAIS-III, WAIS-R, and WMS-R measures: Systematic review. *Australian Psychologist, 44*(4), 216-223. doi: 0.1080/00050060902833469

Watson, P.J., Latif, R. K., & Rowbotham, D.J. (2005). Ethnic differences in thermal pain responses: A comparison of South Asian and White British healthy males. *Pain, 118,* 194-200.

Wechsler, D., (1981). *Manual for the Wechsler Adult Intelligence Scale – Revised.* New York: The Psychological Corporation.

Wechsler, D. (1997). *WAIS-III Technical Manual.* San Antonio, TX: PsychCorp.

Weiner, D.K., Rudy, T.E., Morrow, L., Slaboda, J., & Lieber, S. (2006). The relationship between pain, neuropsychological performance, and physical function in community-dwelling older adults with chronic lower back pain. *Pain Medicine, 7*(1), 60-70. doi: 10.1111/j.1526-4637.2006.00091.x

Wetzel, R.D., Brim, J., Guze, S.B., Cloninger, C.R., Martin, R.L., & Clayton, P.J. (1999). MMPI screening scales for somatization disorder. *Psychology Reports, 85*(1), 341-348.

Wilkinson, G.S. (1993). *Wide Range Achievement Test 3.* Wilmington, DE: Wide Range.

Wittink, H., Turk, D.C., Carr, D.B., Sukiennik, A., & Rogers, W. (2004). Comparison of the redundancy, reliability, and responsiveness to change among SF-36, Oswestry Disability Index, and Multidimensional Pain Inventory. *Clinical Journal of Pain, 20*(3), 133-142.

Zborowski, M. (1969). *People in Pain.* Ann Arbor, MI: Proquest Information &Learning.

# APPENDIX A: ORDER OF TEST ADMINISTRATION

**Edmonton (test list as of September 2013)**

Interview
Lateral Dominance Test
Orientation
Aphasia Screening Test
Prospective Memory Test
Paced Auditory Naming Test
Story Memory
Figure Memory
Selective Reminding Test
Wechsler Adult Intelligence Scale – IV
Wisconsin Card Sorting Test
Woodcock-Johnson III Picture Vocabulary
Woodcock-Johnson III Reading Fluency
Stroop Test
Spatial Span
Victoria Symptom Validity Test
California Verbal Learning Test – II
Grip Strength
Grooved Pegboard
Finger Tapping Test
Reaction Time
Paced Auditory Serial Addition Test
Test of Memory Malingering
Wide Range Achievement Test – 4
Thurstone Word Fluency Test
Trails A and B
Sensory Perceptual Examination
Multidimensional Pain Inventory
Minnesota Multiphasic Personality Inventory – 2

**Novi (test list as of September, 2013)**

BDAE: Complex Ideation
Token Test (optional)
Trail Making Test
TOMM (optional)
RBANS (optional)
CVLT-II
Visual Reproduction
Finger Tapping Test
Finger Localization Test
Grooved Pegboard Test
WTAR
Sentence Repetition
Word-Generation: FAS / Animals
Boston Naming Test
WAIS-III
Digit Vigilance Test (optional)
Stroop Neuropsychological Screening Test (optional)
RBANS Coding (optional)
WRAT-4 (optional)
RMT-words (optional)
Rey Complex Figure (optional)
Wisconsin Card Sorting Test (optional)

APPENDIX B: SUPPLEMENTARY STATISTICAL TABLES

**Novi Demographics**

Table 19

*Novi Sample Referral Sources*

| | Caucasian American ($n$ =79) | | African American ($n$ =74) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| Legal | 6 | 8 | 2 | 3 |
| Medical | 48 | 61 | 45 | 61 |
| Insurance | 23 | 29 | 23 | 31 |
| Worker's compensation | 2 | 3 | 4 | 5 |

Table 20

*Novi Sample Litigation Status*

| | Caucasian American ($n$ =79) | | African American ($n$ =74) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| No litigation | 18 | 23 | 14 | 19 |
| Settled litigation | 3 | 4 | 2 | 3 |
| Worker's compensation | 9 | 11 | 14 | 19 |
| Litigation ongoing | 49 | 62 | 44 | 60 |

Table 21

*Novi Sample IASP [a] Pain Sites*

| | Caucasian American ($n$ =79) | | African American ($n$ =74) | |
|---|---|---|---|---|
| | $n$ | % | $n$ | % |
| Head, face, or jaw | 17 | 22 | 14 | 19 |
| Cervical region | 11 | 14 | 4 | 5 |
| Shoulders and upper limbs | 1 | 1 | 1 | 1 |
| Upper back | 1 | 1 | 1 | 1 |
| Lower back | 9 | 11 | 7 | 10 |
| Lower limbs | 2 | 3 | 3 | 4 |
| Pelvic region | 1 | 1 | 1 | 1 |
| Multiple sites | 37 | 47 | 43 | 58 |

[a] International Association for the Study of Pain.

Table 22

*Novi Sample Mechanism of Injury*

| e | Caucasian American ($n$ =79) | | African American ($n$ =74) | |
|---|---|---|---|---|
| | $n$ | % | $n$ | % |
| Motor vehicle accident | 72 | 91 | 60 | 81 |
| Fall | 3 | 4 | 8 | 11 |
| Blow to the head | 4 | 5 | 6 | 8 |

Table 23

*Novi Sample Duration of Loss of Consciousness*

| | Caucasian American ($n$ =77) | | African American ($n$ =69) | |
|---|---|---|---|---|
| | $n$ | % | $n$ | % |
| None | 43 | 56 | 35 | 51 |
| Less than 1 minute | 30 | 39 | 29 | 42 |
| 1 to 2 minutes | 1 | 1 | 0 | 0 |
| 3 to 5 minutes | 1 | 1 | 0 | 0 |
| 6 to 10 minutes | 0 | 0 | 0 | 0 |
| 11 to 15 minutes | 0 | 0 | 3 | 4 |
| 16 to 20 minutes | 2 | 3 | 2 | 3 |
| 21 to 30 minutes | 0 | 0 | 0 | 0 |

*Note.* The instances of missing data or client uncertainty with respect to duration of loss of consciousness did not vary across the Caucasian and African American groups $\chi^2$ (1) = 1.56, $p$ = .211.

Table 24

*Novi Sample Duration of Post-Traumatic Amnesia (PTA)*

| | Caucasian American ($n$ =78) | | African American ($n$ =72) | |
|---|---|---|---|---|
| | $n$ | % | $n$ | % |
| None | 47 | 60 | 40 | 56 |
| Less than 1 minute | 27 | 35 | 25 | 35 |
| 1 to 5 minutes | 2 | 3 | 0 | 0 |
| 6 to 30 minutes | 2 | 3 | 7 | 10 |

*Note.* No Novi clients reported PTA of longer than 30 minutes in duration. The instances of missing data or client uncertainty with respect to duration of PTA did not vary across the Caucasian and African American groups $\chi^2$ (1) = 5.42, $p$ = .367.

**Edmonton Demographics**

Table 25

*Edmonton Sample Pairwise Comparisons for Years of Education (Caucasian as Reference Group; N = 936)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal [a] vs. Caucasian [b] | 2.24 | .35 | <.001 | 1.22 | 3.26 |
| E Asian [c] vs. Caucasian | -1.54 | .42 | .004 | -2.76 | -.31 |
| S Asian [d] vs. Caucasian | -.47 | .34 | .944 | -1.48 | .54 |
| SE Asian [e] vs. Caucasian | .83 | .44 | .604 | -.46 | 2.11 |
| Middle Eastern [f] vs. Caucasian | -.18 | .37 | 1.000 | -1.26 | .90 |

[a] *n* = 681. [b] *n* = 61. [c] *n* = 41. [d] *n* = 62. [e] *n* = 37. [f] *n* = 54.

Table 26

*Edmonton Sample Pairwise Comparisons for Job Classification [a] (Caucasian as Reference Group; N = 925)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal [b] vs. Caucasian [c] | 11.07 | 2.71 | .001 | 3.12 | 19.01 |
| E Asian [d] vs. Caucasian | -5.10 | 3.19 | .828 | -14.47 | 4.28 |
| S Asian [e] vs. Caucasian | 2.80 | 2.60 | .993 | -4.84 | 10.45 |
| SE Asian [f] vs. Caucasian | 7.20 | 3.36 | .389 | -2.66 | 17.05 |
| Middle Eastern [g] vs. Caucasian | 2.80 | 2.80 | .997 | -5.41 | 11.02 |

[a] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56." Copyright 1992 by Elsevier.
[b] *n* = 677. [c] *n* = 57. [d] *n* = 40. [e] *n* = 62. [f] *n* = 36. [g] *n* = 53

Table 27

*Edmonton Sample Pairwise Comparisons for Wide Range Achievement Test – 3rd Edition Reading Scaled Score (Caucasian as Reference Group; N = 755)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal [a] vs. Caucasian [b] | 7.16 | 1.61 | <.001 | 2.45 | 11.88 |
| E Asian [c] vs. Caucasian | 3.94 | 2.28 | .732 | -2.75 | 10.64 |
| S Asian [d] vs. Caucasian | 8.93 | 1.84 | <.001 | 3.53 | 14.33 |
| SE Asian [e] vs. Caucasian | 4.11 | 2.65 | .856 | -3.67 | 11.89 |
| Middle Eastern [f] vs. Caucasian | 11.93 | 1.76 | <.001 | 6.76 | 17.09 |

[a] *n* = 569. [b] *n* = 55. [c] *n* = 26. [d] *n* = 41. [e] *n* = 19. [f] *n* = 45.

Table 28

*Edmonton Sample Pairwise Comparisons for Full Scale IQ [a] (Caucasian as Reference Group; N = 862)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal [b] vs. Caucasian [c] | 8.74 | 1.61 | <.001 | 4.00 | 13.47 |
| E Asian [d] vs. Caucasian | .32 | 2.27 | 1.000 | -6.35 | 7.00 |
| S Asian [e] vs. Caucasian | 11.66 | 1.83 | <.001 | 6.28 | 17.05 |
| SE Asian [f] vs. Caucasian | 11.25 | 2.61 | <.001 | 3.59 | 18.92 |
| Middle Eastern [g] vs. Caucasian | 15.46 | 1.73 | <.001 | 10.39 | 20.54 |

[a] Based on Wechsler Adult Achievement Test – Revised or 3rd Edition.
[b] *n* = 661. [c] *n* = 58. [d] *n* = 28. [e] *n* = 44. [f] *n* = 21. [g] *n* = 50.

Table 29

*Edmonton Sample Referral Sources*

| | Caucasian (*n* = 681) | | Aboriginal (*n* = 61) | | E Asian (*n* = 41) | | S Asian (*n* = 62) | | SE Asian (*n* = 37) | | Middle East (*n* = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Legal | 643 | 94 | 59 | 97 | 41 | 100 | 62 | 100 | 35 | 95 | 100 | 100 |
| Medical | 9 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Insurance | 13 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 |
| Worker's compensation | 16 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 |

Table 30

*Edmonton Sample IASP [a] Pain Sites*

| | Caucasian (*n* = 681) | | Aboriginal (*n* = 61) | | E Asian (*n* = 41) | | S Asian (*n* = 62) | | SE Asian (*n* = 37) | | Middle East (*n* = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Head, face, or jaw | 143 | 21 | 9 | 15 | 8 | 20 | 14 | 23 | 6 | 16 | 8 | 15 |
| Cervical region | 55 | 8 | 4 | 7 | 4 | 10 | 5 | 8 | 7 | 19 | 10 | 19 |
| Shoulders and upper Limbs | 33 | 5 | 3 | 5 | 1 | 2 | 3 | 5 | 4 | 11 | 1 | 2 |
| Upper back | 8 | 1 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| Abdomen | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lower back | 74 | 11 | 10 | 16 | 7 | 17 | 13 | 21 | 3 | 8 | 8 | 15 |
| Lower limbs | 35 | 5 | 2 | 3 | 1 | 2 | 3 | 5 | 0 | 0 | 4 | 7 |
| Multiple sites | 329 | 48 | 33 | 54 | 19 | 46 | 23 | 37 | 17 | 46 | 23 | 43 |

[a] International Association for the Study of Pain.

Table 31

*Edmonton Sample Mechanisms of Injury*

| | Caucasian (*n* = 681) | | Aboriginal (*n* = 61) | | E Asian (*n* = 41) | | S Asian (*n* = 62) | | SE Asian (*n* = 37) | | Middle East (*n* = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Motor vehicle accident | 640 | 94 | 60 | 98 | 40 | 98 | 58 | 94 | 35 | 95 | 54 | 100 |
| Fall | 19 | 3 | 0 | 0 | 1 | 2 | 4 | 7 | 0 | 0 | 0 | 0 |
| Blow to the head | 22 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 |

Table 32

*Edmonton Sample Neuroimaging Information*

| | Caucasian (*n* = 681) | | Aboriginal (*n* = 61) | | E Asian (*n* = 41) | | S Asian (*n* = 62) | | SE Asian (*n* = 37) | | Middle East (*n* = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Negative neuroimaging | 324 | 48 | 35 | 57 | 14 | 34 | 33 | 53 | 15 | 41 | 24 | 44 |
| No neuroimaging undertaken | 274 | 40 | 17 | 28 | 21 | 51 | 18 | 29 | 10 | 27 | 22 | 41 |
| No data regarding imaging | 83 | 12 | 9 | 15 | 6 | 15 | 11 | 18 | 12 | 32 | 8 | 15 |

Table 33

*Edmonton Sample Duration of Loss of Consciousness*

| | Caucasian ($n$ = 504) | | Aboriginal ($n$ = 40) | | E Asian ($n$ = 36) | | S Asian ($n$ = 51) | | SE Asian ($n$ = 28) | | Middle East ($n$ = 36) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| None | 269 | 53 | 17 | 43 | 20 | 56 | 17 | 33 | 12 | 43 | 14 | 39 |
| Less than 1 minute | 78 | 16 | 13 | 33 | 12 | 33 | 19 | 37 | 6 | 21 | 9 | 25 |
| 1 to 2 minutes | 16 | 3 | 0 | 0 | 1 | 3 | 4 | 8 | 1 | 4 | 3 | 8 |
| 3 to 5 minutes | 65 | 13 | 7 | 18 | 3 | 8 | 5 | 10 | 6 | 21 | 6 | 17 |
| 6 to 10 minutes | 26 | 5 | 2 | 5 | 0 | 0 | 4 | 8 | 1 | 4 | 1 | 3 |
| 11 to 15 minutes | 26 | 5 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 7 | 1 | 3 |
| 16 to 20 minutes | 9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 to 30 minutes | 15 | 3 | 1 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 6 |

*Note.* The instances of missing data or client uncertainty with respect to duration of loss of consciousness did not vary across the ethnocultural groups $\chi^2$ (10) = 15.02, $p$ = .131.

Table 34

*Edmonton Sample Duration of Post-Traumatic Amnesia (PTA)*

| | Caucasian ($n$ = 565) | | Aboriginal ($n$ = 46) | | E Asian ($n$ = 36) | | S Asian ($n$ = 51) | | SE Asian ($n$ = 33) | | Middle East ($n$ = 37) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| None | 267 | 47 | 16 | 35 | 23 | 64 | 18 | 35 | 12 | 36 | 13 | 35 |
| Less than 1 minute | 94 | 17 | 11 | 24 | 9 | 25 | 9 | 18 | 7 | 21 | 10 | 27 |
| 1 to 5 minutes | 68 | 12 | 10 | 22 | 1 | 3 | 8 | 16 | 5 | 15 | 8 | 22 |
| 6 to 30 minutes | 65 | 12 | 3 | 7 | 1 | 3 | 8 | 16 | 2 | 6 | 3 | 8 |
| 31 to 59 minutes | 50 | 9 | 6 | 13 | 0 | 0 | 5 | 10 | 5 | 15 | 3 | 8 |
| 1 hour to 4 hours 59 minutes | 19 | 3 | 0 | 0 | 1 | 3 | 3 | 6 | 2 | 6 | 0 | 0 |
| 5 hours to 11 hours 59 mins | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 hours 59 mins to 24 hours | 2 | .4 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |

*Note.* The instances of missing data or client uncertainty with respect to duration of PTA did not vary across the ethnocultural groups $\chi^2$ (10) = 16.12, $p$ = .096.

Table 35

*Edmonton Sample Self-reported Heritage of East Asian, South Asian, Southeast Asian, and Middle Eastern Clients*

| | *n* | *Percentage* |
|---|---|---|
| East Asian | | |
| China | 28 | 68 |
| Hong Kong | 9 | 22 |
| Japan | 1 | 2 |
| Korea | 3 | 7 |
| South Asian | | |
| India | 57 | 92 |
| Pakistan | 5 | 8 |
| Southeast Asian | | |
| Brunei | 1 | 3 |
| Cambodia | 2 | 5 |
| Malaysia | 1 | 3 |
| Philippines | 8 | 22 |
| Vietnam | 25 | 68 |
| Middle Eastern | | |
| Iran | 11 | 20 |
| Iraq | 12 | 22 |
| Israel | 4 | 7 |
| Jordan | 2 | 4 |
| Lebanon | 21 | 39 |
| Palestine | 1 | 2 |
| Syria | 1 | 2 |
| Turkey | 2 | 4 |

Table 36

*Edmonton Sample First Language of Aboriginal, East Asian, South Asian, Southeast Asian, and Middle Eastern Clients*

| | *n* | *Percentage* | | *n* | *Percentage* |
|---|---|---|---|---|---|
| Aboriginal | | | Southeast Asian | | |
| Chipewyan | 1 | 2 | Bisaya | 1 | 3 |
| Cree | 13 | 21 | Cambodian | 2 | 5 |
| English | 45 | 74 | English | 2 | 5 |
| Sioux | 2 | 3 | Malaysian | 1 | 3 |
| East Asian | | | Tagalog | 7 | 19 |
| Cantonese | 14 | 34 | Vietnamese | 24 | 65 |
| Chinese (dialect unspecified) | 7 | 17 | Middle Eastern | | |
| English | 10 | 24 | Arabic | 32 | 59 |
| Japanese | 1 | 2 | Assyrian | 1 | 2 |
| Korean | 3 | 7 | Chaldean | 1 | 2 |
| Mandarin | 5 | 12 | English | 6 | 11 |
| Shanghaianese | 1 | 2 | Farsi | 1 | 2 |
| South Asian | | | Hebrew | 2 | 4 |
| English | 9 | 15 | Kurdish | 1 | 2 |
| Gujarati | 6 | 10 | Lebanese | 3 | 6 |
| Hindi | 10 | 16 | Persian | 5 | 9 |
| Malayam | 1 | 2 | Turkish | 2 | 4 |
| Punjabi | 25 | 40 | | | |
| Pushto | 1 | 2 | | | |
| Tamil | 1 | 2 | | | |
| Telegu | 4 | 7 | | | |
| Urdu | 5 | 8 | | | |

Table 37

*Edmonton Sample Nativity Information for East Asian, South Asian, Southeast Asian, and Middle Eastern Clients*

| | East Asian ($n$ = 41) | | South Asian ($n$ = 62) | | Southeast Asian ($n$ = 37) | | Middle Eastern ($n$ = 54) | |
|---|---|---|---|---|---|---|---|---|
| | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| Foreign-born | 27 | 66 | 57 | 92 | 33 | 89 | 44 | 82 |
| Canadian-born | 14 | 34 | 5 | 8 | 4 | 11 | 10 | 19 |

Table 38

*Edmonton Sample Interpretation Information for East Asian, South Asian, Southeast Asian, and Middle Eastern Clients*

| | East Asian ($n$ = 41) | | South Asian ($n$ = 62) | | Southeast Asian ($n$ = 37) | | Middle Eastern ($n$ = 54) | |
|---|---|---|---|---|---|---|---|---|
| | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| Assessment interpreted | 10 | 24 | 12 | 19 | 15 | 41 | 5 | 9 |
| Assessment not interpreted | 31 | 76 | 50 | 81 | 22 | 60 | 49 | 91 |

Table 39

*Edmonton Sample Ethnocultural Group Membership by Nativity*

| | Canadian-born ($n$ = 32) | | Foreign-born ($n$ = 155) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| East Asian | 14 | 42 | 27 | 17 |
| South Asian | 5 | 15 | 57 | 35 |
| Southeast Asian | 10 | 30 | 44 | 27 |
| Middle Eastern | 4 | 12 | 33 | 20 |

Table 40

*Edmonton Nativity-Based Analysis Sub-Sample Referral Sources*

| | Canadian-Born ($n$ =33) | | Foreign-Born ($n$ =159) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| Legal | 33 | 100 | 159 | 99 |
| Insurance | 0 | 0 | 1 | .5 |
| Worker's Compensation | 0 | 0 | 1 | .5 |

*Note.* Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

Table 41

*Edmonton Nativity-Based Sub-Sample IASP [a] Pain Sites*

| | Canadian-Born (*n* =33) | | Foreign-Born (*n* =161) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| Head, face, or jaw | 8 | 24 | 28 | 17 |
| Cervical region | 8 | 24 | 18 | 11 |
| Shoulders and upper limbs | 1 | 3 | 8 | 5 |
| Upper back | 0 | 0 | 2 | 1 |
| Lower back | 4 | 4 | 27 | 17 |
| Lower limbs | 1 | 1 | 7 | 4 |
| Multiple sites | 11 | 33 | 71 | 44 |

*Note.* Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.
[a] International Association for the Study of Pain.

Table 42

*Edmonton Nativity-Based Sub-Sample Sample Mechanism of Injury*

| | Canadian-Born (*n* =33) | | Foreign-Born (*n* =161) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| Motor vehicle accident | 32 | 97 | 155 | 96 |
| Fall | 1 | 3 | 4 | 3 |
| Blow to the head | 0 | 0 | 2 | 1 |

*Note.* Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

Table 43

*Edmonton Nativity-Based Sub-Sample Duration of Loss of Consciousness*

| | Canadian-Born ($n$ =26) | | Foreign-Born ($n$ =125) | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| None | 8 | 31 | 55 | 44 |
| Less than 1 minute | 12 | 46 | 34 | 27 |
| 1 to 2 minutes | 2 | 8 | 7 | 6 |
| 3 to 5 minutes | 3 | 12 | 17 | 14 |
| 6 to 10 minutes | 1 | 4 | 5 | 4 |
| 11 to 15 minutes | 0 | 0 | 4 | 3 |
| 21 to 30 minutes | 0 | 0 | 3 | 2 |

*Note.* Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.
The instances of missing data or client uncertainty with respect to duration of loss of consciousness did not vary across the Canadian-born and foreign-born groups $\chi^2$ (2) = .076, $p$ = .963.

Table 44

*Edmonton Nativity-Based Sub-Sample Duration of Post-Traumatic Amnesia*

| | Canadian-Born ($n$ = 29) | | Foreign-Born ($n$ = 129) | |
|---|---|---|---|---|
| | $n$ | % | $n$ | % |
| None | 9 | 31 | 57 | 45 |
| Less than 1 minute | 12 | 41 | 23 | 18 |
| 1 to 5 minutes | 3 | 10 | 19 | 15 |
| 6 to 30 minutes | 2 | 7 | 12 | 9 |
| 31 to 59 minutes | 1 | 3 | 12 | 9 |
| 1 hour to 4 hours 59 minutes | 2 | 7 | 4 | 3 |
| 11 hours 59 mins to 24 hours | 0 | 0 | 1 | 1 |

*Note.* Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.
The instances of missing data or client uncertainty with respect to duration of post-traumatic amnesia did not vary across the Canadian-born and foreign-born groups $\chi^2$ (2) = 1.62, $p$ = .446.

**Hypothesis 1: Novi**

Table 45

*Novi ANOVA Results for Multidimensional Pain Inventory Severity Raw Score by Ethnocultural Group and Gender (N = 153)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | .49 | 1 | 149 | .484 | .06 |
| Gender | 2.47 | 1 | 149 | .227 | .10 |
| Ethnocultural grp. X gender | 1.79 | 1 | 149 | .283 | .11 |

*Note.* African American $n$ = 74, Caucasian $n$ = 79.

Table 46

*Novi ANOVA Results for Multidimensional Pain Inventory Affective Distress Raw Score by Ethnocultural Group and Gender (N = 153)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | 3.39 | 1 | 149 | .068 | .15 |
| Gender | 1.19 | 1 | 149 | .278 | .09 |
| Ethnocultural grp. X gender | .66 | 1 | 149 | .420 | .06 |

*Note.* African American $n$ = 74, Caucasian $n$ = 79.

Table 47

*Novi ANOVA Results for Multidimensional Pain Inventory General Activity Raw Score by Ethnocultural Group and Gender (N = 153)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | .23 | 1 | 149 | .631 | .05 |
| Gender | .69 | 1 | 149 | .409 | .07 |
| Ethnocultural grp. X gender | 6.11 | 1 | 149 | .015 | .20 |

*Note.* African American $n$ = 74, Caucasian $n$ = 79.

Table 48

*Novi ANOVA Results for Minnesota Multiphasic Personality Inventory Welsh's Anxiety Scale T-score by Ethnocultural Group and Gender (N = 140)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | .50 | 1 | 136 | .479 | .06 |

*Note.* African American *n* = 66, Caucasian *n* = 74.

## Hypothesis 1: Edmonton

Table 49

*Edmonton ANCOVA for Multidimensional Pain Inventory Severity Raw Score by Ethnocultural Group and Gender with Age (N = 936)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Age (covariate) | 26.05 | 1 | 923 | <.001 | .16 |
| Ethnocultural group | 8.28 | 5 | 923 | <.001 | .21 |
| Gender | 6.36 | 1 | 923 | .012 | .08 |
| Ethnocultural grp. X gender | 1.02 | 5 | 923 | .402 | .08 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 50

*Edmonton Pairwise Comparisons for Multidimensional Pain Inventory Severity Raw Score (Caucasian as Reference Group; N = 936)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal vs. Caucasian | -.05 | .16 | .1.000 | -.53 | .42 |
| E Asian vs. Caucasian | -.001 | .20 | 1.000 | -.59 | .59 |
| S Asian vs. Caucasian | -.52 | .16 | .017 | -.99 | -.05 |
| SE Asian vs. Caucasian | -.74 | .20 | .004 | -1.34 | -.15 |
| Middle Eastern vs. Caucasian | -.94 | .20 | <.001 | -1.53 | -.34 |

*Note.* Based on estimated marginal means taking into account age as a covariate.
Caucasian $n$ = 681, Aboriginal $n$ = 61, East Asian $n$ = 41, South Asian $n$ = 62, Southeast Asian $n$ = 37, Middle Eastern $n$ = 54.

Table 51

*Edmonton ANOVA for Multidimensional Pain Inventory Affective Distress Scale Raw Score by Ethnocultural Group and Gender (N = 936)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | 2.75 | 5 | 924 | .02 | .12 |
| Gender | .70 | 1 | 924 | .40 | .03 |
| Ethnocultural grp. X gender | .39 | 5 | 924 | .85 | .05 |

*Note.* Caucasian $n = 681$, Aboriginal $n = 61$, East Asian $n = 41$, South Asian $n = 62$, Southeast Asian $n = 37$, Middle Eastern $n = 54$.

Table 52

*Edmonton ANOVA for Multidimensional Pain Inventory General Activity Raw Score by Ethnocultural Group and Gender (N = 936)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | 11.03 | 5 | 924 | <.001 | .26 |
| Gender | 1.22 | 1 | 924 | .231 | .03 |
| Ethnocultural grp. X gender | .93 | 5 | 924 | .361 | .08 |

*Note.* Caucasian $n = 681$, Aboriginal $n = 61$, East Asian $n = 41$, South Asian $n = 62$, Southeast Asian $n = 37$, Middle Eastern $n = 54$.

Table 53

*Edmonton Pairwise Comparisons for Multidimensional Pain Inventory General Activity Raw Score (Caucasian as Reference Group; N = 936)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal vs. Caucasian | -.09 | .12 | 1.000 | -.46 | .27 |
| E Asian vs. Caucasian | .17 | .15 | .993 | -.29 | .62 |
| S Asian vs. Caucasian | .72 | .12 | <.001 | .36 | 1.08 |
| SE Asian vs. Caucasian | .35 | .16 | .330 | -.11 | .80 |
| Middle Eastern vs. Caucasian | .83 | .16 | <.001 | .38 | 1.29 |

*Note.* Caucasian $n$ = 681, Aboriginal $n$ = 61, East Asian $n$ = 41, South Asian $n$ = 62, Southeast Asian $n$ = 37, Middle Eastern $n$ = 54.

Table 54

*Edmonton ANCOVA for Minnesota Multiphasic Personality Inventory Welsh's Anxiety Scale T-score by Ethnocultural Group and Gender with Age and Years of Education (N = 743)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Age (covariate) | 10.69 | 1 | 742 | .001 | .12 |
| Years of education (covariate) | 23.66 | 1 | 742 | <.001 | .18 |
| Ethnocultural group | 3.24 | 5 | 742 | .007 | .15 |

*Note.* Caucasian $n$ = 599, Aboriginal $n$ = 42, East Asian $n$ = 20, South Asian $n$ = 37, Southeast Asian $n$ = 15, Middle Eastern $n$ = 30.

Table 55

*Edmonton Pairwise Comparisons for Minnesota Multiphasic Personality Inventory Welsh's Anxiety Scale T-score (Caucasian as Reference Group; N = 743)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal vs. Caucasian | -2.84 | 1.92 | .895 | -8.48 | 2.80 |
| E Asian vs. Caucasian | -3.43 | 2.75 | .972 | -11.50 | 4.64 |
| S Asian vs. Caucasian | -1.99 | 2.02 | .997 | -7.93 | 3.96 |
| SE Asian vs. Caucasian | -.34 | 3.10 | 1.000 | -9.44 | 8.75 |
| Middle Eastern vs. Caucasian | -8.02 | 2.23 | .005 | -14.57 | -1.48 |

*Note.* Based on estimated marginal means taking into account age and years of education as covariates.
Caucasian $n$ = 599, Aboriginal $n$ = 42, East Asian $n$ = 20, South Asian $n$ = 37, Southeast Asian $n$ = 15, Middle Eastern $n$ = 30.

## Hypothesis 2: Novi

Table 56

*Novi ANOVA Results for Multidimensional Pain Inventory Life Control Raw Score by Ethnocultural Group and Gender (N = 153)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | 5.76 | 1 | 149 | .018 | .19 |
| Gender | .22 | 1 | 149 | .638 | .03 |
| Ethnocultural grp. X gender | 6.94 | 1 | 149 | .009 | .21 |

*Note.* African American $n$ = 74, Caucasian $n$ = 79.

Table 57

*Novi ANOVA Results for Multidimensional Pain Inventory Support Raw Score by Ethnocultural Group and Gender (N = 133)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | .10 | 1 | 129 | .758 | .03 |
| Gender | .03 | 1 | 129 | .861 | .02 |
| Ethnocultural grp. X gender | .46 | 1 | 129 | .499 | .06 |

*Note.* African American $n$ = 63, Caucasian $n$ = 70.

Table 58

*Novi ANOVA Results for Multidimensional Pain Inventory Solicitousness Raw Score by Ethnocultural Group and Gender (N = 124)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | .27 | 1 | 120 | .605 | .05 |
| Gender | 3.83 | 1 | 120 | .053 | .18 |
| Ethnocultural grp. X gender | 1.75 | 1 | 120 | .189 | .12 |

*Note.* African American $n$ = 57, Caucasian $n$ = 67.

**Hypothesis 2: Edmonton**

Table 59

*Edmonton ANOVA for Multidimensional Pain Inventory Life Control Raw Score by Ethnocultural Group and Gender (N = 936)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | 4.12 | 5 | 924 | .001 | .15 |
| Gender | .22 | 1 | 924 | .491 | .03 |
| Ethnocultural grp. X gender | .27 | 5 | 924 | .948 | .03 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 60

*Edmonton Pairwise Comparisons for Multidimensional Pain Inventory Life Control Raw Score (Caucasian as Reference Group; N = 936)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal vs. Caucasian | .33 | .17 | .533 | -.16 | .83 |
| E Asian vs. Caucasian | .32 | .21 | .873 | -.30 | .93 |
| S Asian vs. Caucasian | .28 | .17 | .770 | -.21 | .77 |
| SE Asian vs. Caucasian | .57 | .21 | .105 | -.05 | 1.19 |
| Middle Eastern vs. Caucasian | .63 | .21 | .043 | .01 | 1.25 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 61

*Edmonton ANCOVA for Multidimensional Pain Inventory Support Raw Score by Ethnocultural Group and Gender with Age (N = 873)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Age (covariate) | 14.91 | 1 | 860 | <.001 | .13 |
| Ethnocultural group | 1.85 | 5 | 860 | .101 | .10 |
| Gender | .73 | 1 | 860 | .395 | .03 |
| Ethnocultural grp. X gender | .60 | 5 | 860 | .701 | .06 |

*Note.* Caucasian *n* = 635, Aboriginal *n* = 55, East Asian *n* = 37, South Asian *n* = 60, Southeast Asian *n* = 35, Middle Eastern *n* = 51.

Table 62

*Edmonton ANOVA Results for Multidimensional Pain Inventory Solicitousness Raw Score by Ethnocultural Group and Gender (N = 883)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | 18.84 | 5 | 871 | <.001 | .22 |
| Gender | 15.01 | 1 | 871 | <.001 | .09 |
| Ethnocultural grp. X gender | .96 | 5 | 871 | .798 | .06 |

*Note.* Caucasian *n* = 638, Aboriginal *n* = 59, East Asian *n* = 39, South Asian *n* = 61, Southeast Asian *n* = 33, Middle Eastern *n* = 53.

Table 63

*Edmonton Pairwise Comparisons for Multidimensional Pain Inventory Solicitousness Raw Score (Caucasian as Reference Group; N = 883)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal vs. Caucasian | -.38 | .20 | .540 | -.96 | .19 |
| E Asian vs. Caucasian | -.45 | .24 | .620 | -1.16 | .26 |
| S Asian vs. Caucasian | -1.08 | .19 | <.001 | -1.65 | -.52 |
| SE Asian vs. Caucasian | -.61 | .26 | .231 | -1.36 | .14 |
| Middle Eastern vs. Caucasian | -.79 | .25 | .023 | -1.52 | -.06 |

*Note.* Caucasian *n* = 638, Aboriginal *n* = 59, East Asian *n* = 39, South Asian *n* = 61, Southeast Asian *n* = 33, Middle Eastern *n* = 53.

**Hypothesis 4: Novi**

Table 64

*Novi Correlations between Multidimensional Pain Inventory (MPI) Severity and Predictors for Caucasian and African American Clients*

| | Caucasian ($n$ = 79) | | African American ($n$ = 74) | |
|---|---|---|---|---|
| | $n$ | $r$ | $n$ | $r$ |
| Age | 79 | .04 | 74 | .16 |
| Years of education | 79 | -.24 | 74 | -.23 |
| WTAR [a] raw score | 79 | -.23 | 74 | -.12 |
| Job classification [b] | 79 | -.21 | 74 | -.10 |
| MPI Affective Distress | 79 | .40* | 74 | .58* |
| MPI General Activity | 79 | -.38* | 74 | -.52* |
| MPI Life Control | 79 | -.19 | 74 | -.46* |
| MPI Support | 70 | -.03 | 63 | .11 |
| MPI Solicitousness | 67 | .16 | 57 | .38* |

[a] Wechsler Test of Adult Reading
[b] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56."
* correlation significant at $p < .003$ (Dunn-Šidák correction)

Table 65

*Novi Regression for Multidimensional Pain Inventory (MPI) Severity Predicted Raw Score by MPI Affective Distress Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Affective Distress Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.17 | .12 | | | |
| MPI Affective Distress | .41 | .10 | .42 | 4.08 | <.001 |
| Caucasian vs. AA | .38 | .18 | .15 | 2.11 | .036 |
| Interaction | .13 | .14 | .10 | .96 | .337 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

Table 66

*Novi Regression for Multidimensional Pain Inventory (MPI) Severity Predicted Raw Score by MPI General Activity Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Affective Distress Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.06 | .13 | | | |
| MPI General Activity | -.55 | .15 | -.41 | -.38 | <.001 |
| Caucasian vs. AA | .12 | .18 | .05 | .64 | .526 |
| Interaction | -.11 | .20 | -.06 | -.06 | .571 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

Table 67

*Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by MPI Life Control Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Life Control Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.14 | .13 | | | |
| MPI Life Control | -.18 | .10 | -.20 | -1.78 | .078 |
| Caucasian vs. AA | .33 | .19 | .13 | 1.71 | .089 |
| Interaction | -.23 | .14 | -.18 | -1.62 | .107 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

Table 68

*Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by MPI Solicitousness Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Solicitousness Interaction (N = 124)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.10 | .15 | | | |
| MPI Solicitousness | .14 | .11 | .17 | 1.31 | .193 |
| Caucasian vs. AA | .22 | .23 | .08 | .97 | .336 |
| Interaction | .14 | .14 | .13 | 1.00 | .321 |

*Note.* African American *n* = 57, Caucasian *n* = 67.

Table 69

*Novi Correlations Between Multidimensional Pain Inventory (MPI) Affective Distress Raw Score and Predictors for Caucasian and African American Clients*

*Novi Correlations Between Multidimensional Pain Inventory (MPI) Affective Distress Raw Score and Predictors for Caucasian and African American Clients*

| | Caucasian ($n$ = 79) | | African American ($n$ = 74) | |
|---|---|---|---|---|
| | *n* | *r* | *n* | *r* |
| Age | 79 | .51 | 74 | .04 |
| Years of education | 79 | -.02 | 74 | -.12 |
| WTAR [a] raw score | 79 | -.09 | 74 | .05 |
| Job classification [b] | 79 | .44 | 74 | .68 |
| MPI Severity | 79 | .40* | 74 | .58* |
| MPI General Activity | 79 | -.35* | 74 | -.31 |
| MPI Life Control | 79 | -.51* | 74 | -.59* |
| MPI Support | 70 | -.27 | 63 | -.07 |
| MPI Solicitousness | 67 | -.04 | 57 | .39* |

[a] Wechsler Test of Adult Reading
[b] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56."
** correlation significant at $p < .003$ (Dunn-Šidák correction)*

Table 70

*Novi Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by MPI Severity Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Severity Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .21 | .13 | | | |
| MPI Severity | .40 | .10 | .38 | 3.93 | <.001 |
| Caucasian vs. AA | -.46 | .18 | -.18 | -2.52 | .013 |
| Interaction | .23 | .15 | .15 | 1.56 | .121 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

Table 71

*Novi Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by General Activity Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Life Control Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .21 | .14 | | | |
| MPI General Activity | -.50 | .16 | -.36 | -3.13 | .002 |
| Caucasian vs. AA | -.42 | .20 | -.17 | -2.12 | .036 |
| Interaction | .08 | .22 | .04 | .38 | .701 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

Table 72

*Novi Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by MPI Life Control Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Life Control Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .08 | .12 | | | |
| MPI Life Control | -.48 | .09 | -.51 | -5.19 | <.001 |
| Caucasian vs. AA | -.14 | .18 | -.05 | -.79 | .431 |
| Interaction | -.08 | .13 | -.06 | -.63 | .529 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

Table 73

*Novi Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by MPI Solicitousness Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Solicitousness Interaction (N = 124)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .23 | .16 | | | |
| MPI Solicitousness | -.03 | .11 | -.04 | -.31 | .757 |
| Caucasian vs. AA | -.48 | .23 | -.18 | -2.09 | .039 |
| Interaction | .35 | .15 | .31 | 2.43 | .016 |

*Note.* African American *n* = 57, Caucasian *n* = 67.

Table 74

*Novi Correlations between Multidimensional Pain Inventory General Activity Raw Score and Predictors for Caucasian and African American Clients*

| | Caucasian ($n$ = 79) | | African American ($n$ = 74) | |
|---|---|---|---|---|
| | *n* | *r* | *n* | *r* |
| Age | 79 | .19 | 74 | .08 |
| Years of education | 79 | -.01 | 74 | .08 |
| WTAR [a] raw score | 79 | .22 | 74 | .05 |
| Job classification [b] | 79 | -.02 | 74 | -.05 |
| MPI Severity | 79 | -.38* | 74 | -.53* |
| MPI Affective Distress | 79 | -.35* | 74 | -.31 |
| MPI Life Control | 79 | .44* | 74 | .41* |
| MPI Support | 70 | -.01 | 63 | .02 |
| MPI Solicitousness | 67 | -.14 | 57 | -.12 |

[a] Wechsler Test of Adult Reading
[b] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56."
* correlation significant at $p < .003$ (Dunn-Šidák correction)

Table 75

*Novi Regression for Multidimensional Pain Inventory (MPI) General Activity Raw Score Predicted by MPI Severity Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Severity Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .05 | .09 | | | |
| MPI Severity | -.26 | .07 | -.36 | -3.57 | <.001 |
| Caucasian vs. AA | -.08 | .13 | -.05 | -.63 | .529 |
| Interaction | -.15 | .11 | -.14 | -1.43 | .156 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

Table 76

*Novi Regression for Multidimensional Pain Inventory (MPI) General Activity Raw Score Predicted by MPI Affective Distress Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Distress Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .12 | .10 | | | |
| MPI Affective Distress | -.24 | .08 | -.34 | -3.04 | .003 |
| Caucasian vs. AA | -.24 | .14 | -.13 | -1.66 | .099 |
| Interaction | .02 | .11 | .02 | .17 | .866 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

Table 77

*Novi Regression for Multidimensional Pain Inventory (MPI) General Activity Raw Score Predicted by MPI Life Control Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Life Control Interaction (N = 153)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .13 | .10 | | | |
| MPI Life Control | .29 | .07 | .42 | 3.97 | <.001 |
| Caucasian vs. AA | -.27 | .14 | -.15 | -1.98 | .050 |
| Interaction | .004 | .10 | .004 | .04 | .970 |

*Note.* African American $n$ = 74, Caucasian $n$ = 79.

Table 78

*Novi Correlations Between Wechsler Adult Intelligence Scale – 3rd Edition Digit-Symbol Coding Subtest Scaled Score and Predictors for Caucasian and African American Clients*

| | Caucasian ($n$ = 79) | | African American ($n$ = 74) | |
|---|---|---|---|---|
| | *n* | *r* | *n* | *r* |
| Age | 79 | -.22 | 74 | .26 |
| Years of education | 79 | .02 | 74 | .27 |
| WTAR [a] raw score | 79 | .18 | 74 | .28 |
| Job classification [b] | 79 | .16 | 74 | .32 |
| MPI [c] Severity | 79 | -.37* | 74 | -.19 |
| MPI Affective Distress | 79 | -.08 | 74 | -.04 |
| MPI General Activity | 79 | .22 | 74 | .24 |
| MPI Life Control | 79 | -.07 | 74 | .14 |
| MPI Support | 70 | -.06 | 63 | -.07 |
| MPI Solicitousness | 67 | -.06 | 57 | -.13 |

[a] Wechsler Test of Adult Reading
[b] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56."
[c] Multidimensional Pain Inventory
* correlation significant at $p < .003$ (Dunn-Šidák correction)

Table 79

*Novi Regression for Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score Predicted by Multidimensional Pain Inventory (MPI) Severity Raw Score, Caucasian vs. African American (AA) Dummy Code, and Dummy Code by Severity Interaction (N = 134)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .66 | .32 | | | |
| MPI Severity | -.89 | .25 | -.38 | -3.56 | .001 |
| Caucasian vs. AA | -.150 | .47 | -.26 | -3.21 | .002 |
| Interaction | .54 | .38 | .15 | 1.43 | .155 |

*Note.* African American *n* = 62, Caucasian *n* = 72.

**Hypothesis 4: Edmonton**

Table 80

*Edmonton Correlations between Multidimensional Pain Inventory (MPI) Severity Raw Score and Predictors by Ethnocultural Group*

| | Caucasian ($n$ = 681) | | Aboriginal ($n$ = 61) | | East Asian ($n$ = 41) | | South Asian ($n$ = 62) | | SE [a] Asian ($n$ = 37) | | Middle East ($n$ = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* |
| Age | 681 | .13* | 61 | .37 | 41 | .37 | 62 | .13 | 37 | .10 | 54 | -.001 |
| Years of education | 681 | -.17* | 61 | -.13 | 41 | -.20 | 62 | -.05 | 37 | -.07 | 54 | -.20 |
| WRAT Read. SS [b] | 569 | -.25* | 55 | -.05 | 26 | -.56 | 41 | -.30 | 19 | -.17 | 45 | -.35 |
| Job classification [c] | 677 | .01 | 57 | .23 | 40 | -.20 | 62 | -.05 | 36 | .05 | 53 | .04 |
| MPI Affective Distress | 681 | .30* | 61 | .25 | 41 | .52* | 62 | .44* | 37 | .43 | 54 | .39 |
| MPI General Activity | 681 | -.23* | 61 | -.05 | 41 | -.37 | 62 | -.30 | 37 | -.39 | 54 | -.33 |
| MPI Life Control | 681 | -.29* | 61 | -.12 | 41 | -.29 | 62 | -.54* | 37 | -.45 | 54 | -.35 |
| MPI Support | 635 | .30* | 55 | .23 | 37 | .27 | 60 | .19 | 35 | .06 | 51 | .34 |
| MPI Solicitousness | 638 | .22* | 59 | .19 | 39 | .25 | 61 | .18 | 33 | -.09 | 53 | .44* |

[a] Southeast [b] Wide Range Achievement Test – 3rd Edition Reading subtest scaled score.
[c] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56."
* correlation significant at $p < .001$ (Dunn-Šidák correction)

Table 81

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by Age, Ethnocultural Dummy Codes, and Dummy Code by Age Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.12 | .05 | | | |
| Age | .01 | .004 | .13 | 3.46 | .001 |
| Aboriginal vs. Others | .10 | .17 | .02 | .58 | .564 |
| E Asian vs. Others | -.04 | .20 | -.01 | -.20 | .844 |
| S Asian vs. Others | .52 | .16 | .10 | 3.17 | .002 |
| SE Asian vs. Others | .73 | .21 | .11 | 3.53 | <.001 |
| Middle Eastern vs. Others | .92 | .17 | .17 | 5.30 | <.001 |
| Aboriginal X age | .02 | .01 | .06 | 1.67 | .096 |
| E Asian X age | .03 | .02 | .06 | 1.68 | .094 |
| S Asian X age | -.001 | .01 | -.002 | -.05 | .963 |
| SE Asian X age | -.004 | .02 | -.01 | -.19 | .848 |
| Middle Eastern X age | -.01 | .02 | -.03 | -.87 | .383 |

*Note.* Caucasian $n$ = 681, Aboriginal $n$ = 61, East Asian $n$ = 41, South Asian $n$ = 62, Southeast Asian $n$ = 37, Middle Eastern $n$ = 54.

Table 82

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by Years of Education, Ethnocultural Dummy Codes, and Dummy Code by Years of Education Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.11 | .05 | | | |
| Years of education | -.09 | .02 | -.20 | -4.66 | <.001 |
| Aboriginal vs. Others | -.22 | .23 | -.04 | -.95 | .342 |
| E Asian vs. Others | .20 | .21 | .03 | .95 | .344 |
| S Asian vs. Others | .54 | .16 | .12 | 3.29 | .001 |
| SE Asian vs. Others | .71 | .21 | .11 | 3.37 | .001 |
| Middle Eastern vs. Others | .92 | .17 | .17 | 5.34 | <.001 |
| Aboriginal X education | .02 | .08 | .01 | .21 | .837 |
| E Asian X education | .02 | .05 | .01 | .34 | .738 |
| S Asian X education | .07 | .05 | .05 | 1.45 | .146 |
| SE Asian X education | .07 | .07 | .03 | .97 | .330 |
| Middle Eastern X education | .04 | .06 | .02 | .65 | .516 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 83

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by Wide Range Achievement Test (WRAT) Reading Subtest Scaled Score, Ethnocultural Dummy Codes, and Dummy Code by WRAT Reading Interactions (N = 755)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.03 | .05 | | | |
| WRAT Reading SS | -.03 | .01 | -.28 | -6.18 | <.001 |
| Aboriginal vs. Others | -.13 | .18 | -.03 | -.74 | .457 |
| E Asian vs. Others | -.37 | .24 | -.05 | -.15 | .125 |
| S Asian vs. Others | .17 | .21 | .03 | .79 | .432 |
| SE Asian vs. Others | .73 | .28 | .09 | 2.61 | .009 |
| Middle Eastern vs. Others | .67 | .23 | .13 | 2.98 | .003 |
| Aboriginal X WRAT Read | .02 | .01 | .07 | 1.74 | .082 |
| E Asian X WRAT Read | -.03 | .02 | -.06 | -1.71 | .087 |
| S Asian X WRAT Read | .002 | .01 | .01 | .14 | .890 |
| SE Asian X WRAT Read | .01 | .03 | .02 | .56 | .577 |
| Middle East X WRAT Read | .01 | .01 | .02 | .48 | .631 |

*Note.* Caucasian *n* = 569, Aboriginal *n* = 55, East Asian *n* = 26, South Asian *n* = 41, Southeast Asian *n* = 19, Middle Eastern *n* = 45.

Table 84

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by MPI Affective Distress Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Affective Distress Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.10 | .05 | | | |
| MPI Affective Distress | .33 | .04 | .30 | 8.36 | <.001 |
| Aboriginal vs. Others | -.05 | .16 | -.01 | -.31 | .759 |
| E Asian vs. Others | -.06 | .19 | -.01 | -.29 | .770 |
| S Asian vs. Others | .44 | .16 | .09 | 2.83 | .005 |
| SE Asian vs. Others | .66 | .20 | .10 | 3.30 | .001 |
| Middle Eastern vs. Others | .74 | .18 | .14 | 4.08 | <.001 |
| Aboriginal X Distress | -.05 | .15 | -.01 | -.35 | .728 |
| E Asian X Distress | .29 | .16 | .06 | 1.79 | .074 |
| S Asian X Distress | .12 | .14 | .03 | .89 | .375 |
| SE Asian X Distress | .10 | .19 | .02 | .54 | .592 |
| Middle Eastern X Distress | .03 | .18 | .01 | .18 | .860 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 85

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by MPI General Activity Raw Score, Ethnocultural Dummy Codes, and Dummy Code by General Activity Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.08 | .05 | | | |
| MPI General Activity | -.32 | .05 | -.24 | -6.19 | <.001 |
| Aboriginal vs. Others | -.07 | .16 | -.01 | -.43 | .666 |
| E Asian vs. Others | .01 | .19 | .00 | .04 | .968 |
| S Asian vs. Others | .29 | .18 | .06 | 1.56 | .120 |
| SE Asian vs. Others | .61 | .21 | .10 | 2.96 | .003 |
| Middle Eastern vs. Others | .63 | .21 | .12 | 3.14 | .002 |
| Aboriginal X Activity | .25 | .17 | .05 | 1.47 | .143 |
| E Asian X Activity | -.18 | .19 | -.03 | -.94 | .348 |
| S Asian X Activity | -.03 | .16 | -.01 | -.19 | .853 |
| SE Asian X Activity | -.07 | .19 | -.01 | -.36 | .718 |
| Middle Eastern X Activity | .02 | .18 | .004 | .11 | .914 |

*Note.* Caucasian $n$ = 681, Aboriginal $n$ = 61, East Asian $n$ = 41, South Asian $n$ = 62, Southeast Asian $n$ = 37, Middle Eastern $n$ = 54.

Table 86

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by MPI Life Control Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Life Control Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.09 | .05 | | | |
| MPI Life Control | -.29 | .04 | -.29 | -7.96 | <.001 |
| Aboriginal vs. Others | -.10 | .16 | -.02 | -.64 | .525 |
| E Asian vs. Others | -.01 | .19 | -.002 | -.07 | .948 |
| S Asian vs. Others | .42 | .16 | .08 | 2.67 | .008 |
| SE Asian vs. Others | .55 | .21 | .09 | 2.65 | .008 |
| Middle Eastern vs. Others | .76 | .18 | .14 | 4.24 | <.001 |
| Aboriginal X Life Control | .17 | .13 | .04 | 1.32 | .187 |
| E Asian X Life Control | -.09 | .17 | -.02 | -.51 | .611 |
| S Asian X Life Control | -.19 | .12 | -.05 | -1.58 | .116 |
| SE Asian X Life Control | -.05 | .14 | -.01 | -.35 | .729 |
| Middle East X Life Control | .04 | .14 | .01 | .30 | .761 |

*Note. Caucasian n = 681, Aboriginal n = 61, East Asian n = 41, South Asian n = 62, Southeast Asian n = 37, Middle Eastern n = 54.*

Table 87

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by MPI Support Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Support Interactions (N = 873)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.11 | .05 | | | |
| MPI Support | .26 | .03 | .30 | 7.99 | <.001 |
| Aboriginal vs. Others | -.02 | .17 | -.01 | -.15 | .884 |
| E Asian vs. Others | .14 | .20 | .02 | .73 | .466 |
| S Asian vs. Others | .53 | .16 | .11 | 3.23 | .001 |
| SE Asian vs. Others | .63 | .20 | .10 | 3.12 | .002 |
| Middle Eastern vs. Others | .76 | .18 | .14 | 4.27 | <.001 |
| Aboriginal X Support | -.07 | .12 | -.02 | -.61 | .540 |
| E Asian X Support | -.02 | .13 | -.01 | -.17 | .866 |
| S Asian X Support | -.13 | .10 | -.04 | -1.26 | .207 |
| SE Asian X Support | -.22 | .15 | -.05 | -1.46 | .146 |
| Middle Eastern X Support | -.02 | .15 | -.004 | -.10 | .917 |

*Note.* Caucasian *n* = 635, Aboriginal *n* = 55, East Asian *n* = 37, South Asian *n* = 60, Southeast Asian *n* = 35, Middle Eastern *n* = 51.

Table 88

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Severity Raw Score Predicted by MPI Solicitousness Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Solicitousness Interactions (N = 883)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.09 | .05 | | | |
| MPI Solicitousness | .20 | .03 | .23 | 5.99 | <.001 |
| Aboriginal vs. Others | -.08 | .17 | -.02 | -.50 | .614 |
| E Asian vs. Others | .01 | .20 | .002 | .05 | .958 |
| S Asian vs. Others | .39 | .18 | .08 | 2.10 | .036 |
| SE Asian vs. Others | .64 | .23 | .10 | 2.84 | .005 |
| Middle Eastern vs. Others | .74 | .18 | .14 | 4.09 | <.001 |
| Aboriginal X Solicitousness | -.02 | .12 | -.01 | -.18 | .860 |
| E Asian X Solicitousness | .05 | .14 | .01 | .35 | .725 |
| S Asian X Solicitousness | -.06 | .11 | -.02 | -.57 | .568 |
| SE Asian X Solicitousness | -.27 | .17 | -.05 | -1.57 | .118 |
| Mid East X Solicitousness | .09 | .13 | .02 | .67 | .503 |

*Note*. Caucasian *n* = 638, Aboriginal *n* = 59, East Asian *n* = 39, South Asian *n* = 61, Southeast Asian *n* = 33 Middle Eastern *n* = 53.

Table 89

*Edmonton Correlations between Multidimensional Pain Inventory (MPI) Affective Distress and Predictors by Ethnocultural Group*

| | Caucasian ($n$ = 681) | | Aboriginal ($n$ = 61) | | East Asian ($n$ = 41) | | South Asian ($n$ = 62) | | SE [a] Asian ($n$ = 37) | | Middle East ($n$ = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $n$ | $r$ | $n$ | $r$ | $n$ | $r$ | $n$ | $r$ | $n$ | $r$ | $n$ | $r$ |
| Age | 681 | .01 | 61 | .11 | 41 | .19 | 62 | -.08 | 37 | .21 | 54 | -.12 |
| Years of education | 681 | -.02 | 61 | .31 | 41 | .06 | 62 | -.02 | 37 | -.06 | 54 | -.19 |
| WRAT Read. SS [b] | 569 | -.07 | 55 | .11 | 26 | -.30 | 41 | -.07 | 19 | -.38 | 45 | -.20 |
| Job classification [c] | 677 | .03 | 57 | .19 | 40 | .07 | 62 | .08 | 36 | .07 | 53 | .01 |
| MPI Severity | 681 | .30* | 61 | .25 | 41 | .52* | 62 | .44* | 37 | .43 | 54 | .39 |
| MPI General Activity | 681 | -.15* | 61 | .07 | 41 | -.13 | 62 | -.16 | 37 | -.27 | 54 | -.17 |
| MPI Life Control | 681 | -.51* | 61 | -.20 | 41 | -.52* | 62 | -.61* | 37 | -.48 | 54 | -.61* |
| MPI Support | 635 | .13 | 55 | -.07 | 37 | .05 | 60 | .10 | 35 | .35* | 51 | .23 |
| MPI Solicitousness | 638 | .10 | 59 | .20 | 39 | .08 | 61 | .06 | 33 | .46* | 53 | .30 |

[a] Southeast [b] Wide Range Achievement Test – 3rd Edition Reading subtest scaled score.
[c] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56."
* correlation significant at $p < .001$ (Dunn-Šidák correction)

Table 90

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by MPI Severity Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Severity Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.03 | .04 | | | |
| MPI Severity | .26 | .03 | .30 | 8.28 | <.001 |
| Aboriginal vs. Others | -.01 | .14 | -.003 | -.10 | .922 |
| E Asian vs. Others | .24 | .17 | .04 | 1.42 | .156 |
| S Asian vs. Others | .01 | .15 | .002 | .07 | .944 |
| SE Asian vs. Others | -.10 | .20 | -.02 | -.47 | .638 |
| Middle Eastern vs. Others | .13 | .20 | .03 | .64 | .522 |
| Aboriginal X Severity | -.05 | .12 | -.01 | -.41 | .682 |
| E Asian X Severity | .16 | .12 | .04 | 1.35 | .176 |
| S Asian X Severity | .16 | .12 | .05 | 1.36 | .173 |
| SE Asian X Severity | .17 | .16 | .04 | 1.02 | .307 |
| Middle Eastern X Severity | .15 | .17 | .04 | .86 | .390 |

*Note.* Caucasian $n$ = 681, Aboriginal $n$ = 61, East Asian $n$ = 41, South Asian $n$ = 62, Southeast Asian $n$ = 37, Middle Eastern $n$ = 54.

Table 91

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by MPI General Activity Raw Score, Ethnocultural Dummy Codes, and Dummy Code by General Activity Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.04 | .04 | | | |
| MPI General Activity | -.18 | .05 | -.16 | -3.95 | <.001 |
| Aboriginal vs. Others | -.06 | .15 | -.01 | -.39 | .698 |
| E Asian vs. Others | .22 | .18 | .04 | 1.27 | .206 |
| S Asian vs. Others | .09 | .17 | .02 | .52 | .603 |
| SE Asian vs. Others | .12 | .19 | .02 | .63 | .532 |
| Middle Eastern vs. Others | .35 | .19 | .07 | 1.82 | .069 |
| Aboriginal X Activity | .27 | .16 | .06 | 1.69 | .091 |
| E Asian X Activity | .04 | .17 | .01 | .23 | .821 |
| S Asian X Activity | .004 | .15 | .001 | .03 | .977 |
| SE Asian X Activity | -.09 | .18 | -.02 | -.54 | .591 |
| Middle Eastern X Activity | .03 | .17 | .01 | .17 | .869 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 92

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by MPI Life Control Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Life Control Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.01 | .04 | | | |
| MPI Life Control | -.45 | .03 | -.52 | -15.60 | <.001 |
| Aboriginal vs. Others | -.10 | .13 | -.02 | -.74 | .457 |
| E Asian vs. Others | .11 | .16 | .02 | .68 | .498 |
| S Asian vs. Others | .08 | .13 | .02 | .65 | .518 |
| SE Asian vs. Others | -.01 | .17 | -.001 | -.03 | .973 |
| Middle Eastern vs. Others | .21 | .15 | .04 | 1.44 | .149 |
| Aboriginal X Life Control | .29 | .10 | .08 | 2.76 | .006 |
| E Asian X Life Control | -.10 | .14 | -.02 | -.72 | .475 |
| S Asian X Life Control | -.06 | .10 | -.02 | -.60 | .547 |
| SE Asian X Life Control | .10 | .11 | .03 | .84 | .402 |
| Mid Eastern X Life Control | .004 | .11 | .001 | .04 | .971 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 93

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by MPI Support Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Support Interactions (N = 873)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.05 | .04 | | | |
| MPI Support | .10 | .03 | .13 | 3.19 | .001 |
| Aboriginal vs. Others | -.01 | .15 | -.002 | -.06 | .956 |
| E Asian vs. Others | .37 | .18 | .07 | 2.04 | .041 |
| S Asian vs. Others | .18 | .15 | .04 | 1.21 | .228 |
| SE Asian vs. Others | .11 | .19 | .02 | .57 | .572 |
| Middle Eastern vs. Others | .35 | .16 | .08 | 2.16 | .031 |
| Aboriginal X Support | -.15 | .11 | -.05 | -1.38 | .167 |
| E Asian X Support | -.06 | .12 | -.02 | -.47 | .641 |
| S Asian X Support | -.02 | .09 | -.01 | -.25 | .806 |
| SE Asian X Support | .17 | .14 | .04 | 1.22 | .224 |
| Middle Eastern X Support | .08 | .13 | .02 | .62 | .534 |

*Note.* Caucasian *n* = 635, Aboriginal *n* = 55, East Asian *n* = 37, South Asian *n* = 60, Southeast Asian *n* = 35, Middle Eastern *n* = 51.

Table 94

*Edmonton Regression for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score Predicted by MPI Solicitousness Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Solicitousness Interactions (N = 883)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | -.05 | .04 | | | |
| MPI Solicitousness | .08 | .03 | .10 | 2.59 | .010 |
| Aboriginal vs. Others | -.05 | .15 | -.01 | -.36 | .719 |
| E Asian vs. Others | .28 | .18 | .05 | 1.54 | .124 |
| S Asian vs. Others | .15 | .16 | .04 | .94 | .348 |
| SE Asian vs. Others | -.06 | .20 | -.01 | -.30 | .767 |
| Middle Eastern vs. Others | .35 | .16 | .08 | 2.16 | .031 |
| Aboriginal X Solicitousness | .08 | .11 | .03 | .73 | .467 |
| E Asian X Solicitousness | -.02 | .13 | -.004 | -.12 | .901 |
| S Asian X Solicitousness | -.04 | .09 | -.02 | -.37 | .712 |
| SE Asian X Solicitousness | .31 | .15 | .07 | 2.02 | .044 |
| Mid East X Solicitousness | .13 | .12 | .04 | 1.09 | .278 |

*Note.* Caucasian *n* = 638, Aboriginal *n* = 59, East Asian *n* = 39, South Asian *n* = 61, Southeast Asian *n* = 33 Middle Eastern *n* = 53.

Table 95

*Edmonton Correlations between Multidimensional Pain Inventory (MPI) General Activity Raw Score and Predictors by Ethnocultural Group*

| | Caucasian (*n* = 681) | | Aboriginal (*n* = 61) | | East Asian (*n* = 41) | | South Asian (*n* = 62) | | SE [a] Asian (*n* = 37) | | Middle East (*n* = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* |
| Age | 681 | -.12 | 61 | -.16 | 41 | -.32 | 62 | -.04 | 37 | .18 | 54 | -.20 |
| Years of education | 681 | .10 | 61 | .25 | 41 | -.11 | 62 | .18 | 37 | .09 | 54 | .04 |
| WRAT Read. SS [b] | 569 | .08 | 55 | .17 | 26 | .33 | 41 | .22 | 19 | -.06 | 45 | .33 |
| Job classification [c] | 677 | -.07 | 57 | -.12 | 40 | -.02 | 62 | .16 | 36 | -.17 | 53 | -.16 |
| MPI Severity | 681 | -.23* | 61 | -.05 | 41 | -.37 | 62 | -.30 | 37 | -.39 | 54 | -.33 |
| MPI Affective Distress | 681 | -.15* | 61 | .07 | 41 | -.13 | 62 | -.16 | 37 | -.28 | 54 | -.17 |
| MPI Life Control | 681 | .26* | 61 | .29 | 41 | .24 | 62 | .30 | 37 | .50* | 54 | .378 |
| MPI Support | 635 | .01 | 55 | .05 | 37 | .14 | 60 | .11 | 35 | -.15 | 51 | .03 |
| MPI Solicitousness | 638 | .07 | 59 | -.15 | 39 | .05 | 61 | .23 | 33 | -.11 | 53 | -.03 |

[a] Southeast [b] Wide Range Achievement Test – 3rd Edition Reading subtest scaled score.
[c] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56."
* correlation significant at $p < .001$ (Dunn-Šidák correction)

Table 96

*Edmonton Regression for Multidimensional Pain Inventory (MPI) General Activity Raw Score Predicted by MPI Severity Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Severity Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .09 | .03 | | | |
| MPI Severity | -.16 | .03 | -.21 | -5.89 | <.001 |
| Aboriginal vs. Others | .13 | .12 | .03 | 1.07 | .286 |
| E Asian vs. Others | -.19 | .14 | -.04 | -1.33 | .184 |
| S Asian vs. Others | -.60 | .13 | -.16 | -4.75 | <.001 |
| SE Asian vs. Others | -.09 | .17 | -.02 | -.50 | .619 |
| Middle Eastern vs. Others | -.53 | .17 | -.13 | -3.09 | .002 |
| Aboriginal X Severity | .12 | .10 | .04 | 1.25 | .212 |
| E Asian X Severity | -.11 | .10 | -.03 | -1.08 | .279 |
| S Asian X Severity | -.09 | .10 | -.03 | -.90 | .367 |
| SE Asian X Severity | -.22 | .14 | -.06 | -1.59 | .113 |
| Middle Eastern X Severity | -.20 | .15 | -.06 | -1.39 | .164 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 97

*Edmonton Regression for Multidimensional Pain Inventory (MPI) General Activity Raw Score Predicted by MPI Distress Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Distress Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .10 | .04 | | | |
| MPI Distress | -.12 | .03 | -.14 | -3.79 | <.001 |
| Aboriginal vs. Others | .13 | .12 | .03 | 1.05 | .294 |
| E Asian vs. Others | -.17 | .15 | -.04 | -1.15 | .250 |
| S Asian vs. Others | -.69 | .12 | -.18 | -5.65 | <.001 |
| SE Asian vs. Others | -.30 | .16 | -.06 | -1.91 | .057 |
| Middle Eastern vs. Others | -.76 | .14 | -.19 | -5.33 | <.001 |
| Aboriginal X Distress | .18 | .12 | .05 | 1.59 | .113 |
| E Asian X Distress | <.001 | .13 | <.001 | .002 | .999 |
| S Asian X Distress | -.02 | .11 | -.01 | -.21 | .837 |
| SE Asian X Distress | -.16 | .15 | -.04 | -1.10 | .270 |
| Middle Eastern X Distress | -.05 | .14 | -.01 | -.38 | .707 |

*Note.* Caucasian *n* = 681, Aboriginal *n* = 61, East Asian *n* = 41, South Asian *n* = 62, Southeast Asian *n* = 37, Middle Eastern *n* = 54.

Table 98

*Edmonton Regression for Multidimensional Pain Inventory (MPI) General Activity Raw Score Predicted by MPI Life Control Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Life Control Interactions (N = 936)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .09 | .03 | | | |
| MPI Life Control | .19 | .03 | .24 | 6.78 | <.001 |
| Aboriginal vs. Others | .18 | .12 | .05 | 1.52 | .129 |
| E Asian vs. Others | -.14 | .15 | -.03 | -.96 | .337 |
| S Asian vs. Others | -.66 | .12 | -.17 | -5.60 | <.001 |
| SE Asian vs. Others | -.15 | .16 | -.03 | -.94 | .349 |
| Middle Eastern vs. Others | -.67 | .14 | -.16 | -4.94 | <.001 |
| Aboriginal X Life Control | .03 | .10 | .01 | .34 | .731 |
| E Asian X Life Control | .05 | .13 | .01 | .38 | .707 |
| S Asian X Life Control | .04 | .09 | .01 | .43 | .664 |
| SE Asian X Life Control | .19 | .11 | .06 | 1.82 | .069 |
| Middle East X Life Control | .11 | .10 | .04 | 1.03 | .303 |

*Note*. Caucasian $n = 681$, Aboriginal $n = 61$, East Asian $n = 41$, South Asian $n = 62$, Southeast Asian $n = 37$, Middle Eastern $n = 54$.

Table 99

*Edmonton Correlations between Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score and Predictors by Ethnocultural Group*

| | Caucasian (*n* = 681) | | Aboriginal (*n* = 61) | | East Asian (*n* = 41) | | South Asian (*n* = 62) | | SE [a] Asian (*n* = 37) | | Middle East (*n* = 54) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* | *n* | *r* |
| Age | 657 | -.08 | 58 | -.07 | 33 | .12 | 53 | -.23 | 34 | -.34 | 52 | -.28 |
| Years of education | 657 | .22* | 58 | .20 | 33 | .37 | 53 | .25 | 34 | -.50 | 52 | .23 |
| WRAT Read. SS [b] | 556 | .25* | 54 | .11 | 21 | .57 | 40 | .34 | 19 | .61 | 45 | .28 |
| Job classification [c] | 653 | .13* | 54 | .09 | 33 | .40 | 53 | .29 | 33 | .44 | 51 | .33 |
| MPI [d] Severity | 657 | -.08* | 58 | .06 | 33 | -.42* | 53 | -.18 | 34 | -.25 | 52 | -.44* |
| MPI Affective Distress | 657 | -.08* | 58 | -.03 | 33 | -.16 | 53 | -.27* | 34 | -.14 | 52 | -.22 |
| MPI General Activity | 657 | .10 | 58 | .27 | 33 | .30 | 53 | .17 | 34 | .09 | 52 | .40 |
| MPI Life Control | 657 | .10 | 58 | .01 | 33 | .30 | 53 | .24 | 34 | -.03 | 52 | .39* |
| MPI Support | 611 | -.11 | 52 | -.17 | 29 | -.03 | 52 | .08 | 32 | -.06 | 49 | .04 |
| MPI Solicitousness | 614 | -.06 | 56 | -.08 | 31 | -.21 | 53 | -.06 | 30 | .01 | 51 | -.12 |

[a] Southeast [b] Wide Range Achievement Test – 3rd Edition Reading subtest scaled score.
[c] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56."
[d] Multidimensional Pain Inventory.
* correlation significant at $p < .001$ (Dunn-Šidák correction)

Table 100

*Edmonton Regression for Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score Predicted by Years of Education, Ethnocultural Dummy Codes, and Dummy Code by Years of Education Interactions (N = 816)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .26 | .10 | | | |
| Years of Education | .25 | .04 | .24 | 5.81 | <.001 |
| Aboriginal vs. Others | -.92 | .51 | -.08 | -1.81 | .071 |
| E Asian vs. Others | 1.09 | .57 | .07 | 1.92 | .055 |
| S Asian vs. Others | -2.05 | .43 | -.17 | -4.81 | <.001 |
| SE Asian vs. Others | -1.48 | .51 | -.10 | -2.90 | .004 |
| Middle Eastern vs. Others | -1.75 | .43 | -.14 | -4.07 | <.001 |
| Aboriginal X education | -.09 | .17 | -.03 | -.51 | .608 |
| E Asian X education | -.02 | .14 | -.01 | -.14 | .890 |
| S Asian X education | -.06 | .14 | -.02 | -.41 | .682 |
| SE Asian X education | .16 | .18 | .03 | .86 | .392 |
| Middle Eastern X education | .21 | .16 | .04 | 1.29 | .196 |

*Note.* Caucasian *n* = 631, Aboriginal *n* = 53, East Asian *n* = 30, South Asian *n* = 40, Southeast Asian *n* = 26, Middle Eastern *n* = 36.

Table 101

*Edmonton Regression for Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score Predicted by Wide Range Achievement Test (WRAT) Reading Subtest Scaled Score, Ethnocultural Dummy Codes, and Dummy Code by WRAT Reading Interactions (N = 703)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .11 | .11 | | | |
| WRAT Reading SS | .06 | .01 | .25 | 5.53 | <.001 |
| Aboriginal vs. Others | -1.03 | .41 | -.10 | -2.50 | .013 |
| E Asian vs. Others | 1.84 | .57 | .12 | 3.22 | .001 |
| S Asian vs. Others | -.96 | .48 | -.08 | -1.98 | .048 |
| SE Asian vs. Others | -.56 | .62 | -.03 | -.90 | .371 |
| Middle Eastern vs. Others | -.87 | .55 | -.07 | -1.59 | .111 |
| Aboriginal X WRAT Read | -.04 | .03 | -.05 | -1.27 | .205 |
| E Asian X WRAT Read | .04 | .04 | .04 | 1.14 | .255 |
| S Asian X WRAT Read | -.001 | .03 | -.002 | -.04 | .965 |
| SE Asian X WRAT Read | .13 | .07 | .07 | 1.88 | .061 |
| Middle East X WRAT Read | -.01 | .04 | -.02 | -.37 | .709 |

*Note.* Caucasian *n* = 540, Aboriginal *n* = 50, East Asian *n* = 23, South Asian *n* = 35, Southeast Asian *n* = 15, Middle Eastern *n* = 40.

Table 102

*Edmonton Regression for Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score Predicted by Job Classification [a], Ethnocultural Dummy Codes, and Dummy Code by Job Classification Interactions (N = 877)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .20 | .11 | | | |
| Job Classification | .02 | .01 | .12 | 3.34 | .001 |
| Aboriginal vs. Others | -1.18 | .45 | -.10 | -2.17 | .009 |
| E Asian vs. Others | .55 | .51 | .04 | 1.08 | .283 |
| S Asian vs. Others | -1.99 | .39 | -.17 | -5.18 | <.001 |
| SE Asian vs. Others | -1.59 | .53 | -.12 | -3.03 | .003 |
| Middle Eastern vs. Others | -2.12 | .39 | -.17 | -5.38 | <.001 |
| Aboriginal X Job Class | -.004 | .02 | -.01 | -.15 | .885 |
| E Asian X Job Class | .07 | .03 | .07 | 2.16 | .031 |
| S Asian X Job Class | .03 | .03 | .04 | 1.14 | .255 |
| SE Asian X Job Class | .08 | .04 | .07 | 2.11 | .035 |
| Middle Eastern X Job Class | .05 | .03 | .05 | 1.64 | .102 |

[a] Job classification based on "Ganzeboom, H.B., de Graaf, P.M., Treiman, D.J., de Leeuw, J.D. (1992). A standard international socio-economic index of occupational status. *Social Science Research, 21*, 1-56." Caucasian *n = 656,* Aboriginal *n = 55,* East Asian *n = 36,* South Asian *n = 56,* Southeast Asian *n = 30,* Middle Eastern *n = 46.*

Table 103

*Edmonton Regression for Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score Predicted by Multidimensional Pain Inventory (MPI) Severity Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Severity Interactions (N = 816)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .26 | .11 | | | |
| MPI Severity | -.12 | .09 | -.06 | -1.42 | .156 |
| Aboriginal vs. Others | -1.24 | .38 | -.11 | -3.31 | .001 |
| E Asian vs. Others | 1.35 | .52 | .09 | 2.59 | .010 |
| S Asian vs. Others | -1.71 | .42 | -.14 | -4.02 | <.001 |
| SE Asian vs. Others | -1.26 | .60 | -.08 | -2.10 | .036 |
| Middle Eastern vs. Others | -.68 | .57 | -.05 | -1.20 | .232 |
| Aboriginal X Severity | .31 | .31 | .04 | 1.02 | .310 |
| E Asian X Severity | -.60 | .34 | -.06 | -1.74 | .083 |
| S Asian X Severity | -.27 | .38 | -.03 | -.70 | .483 |
| SE Asian X Severity | -.34 | .49 | -.03 | -.69 | .490 |
| Middle Eastern X Severity | -1.17 | .50 | -.10 | -2.34 | .020 |

*Note.* Caucasian *n* = 631, Aboriginal *n* = 53, East Asian *n* = 30, South Asian *n* = 40, Southeast Asian *n* = 26, Middle Eastern *n* = 36.

Table 104

*Edmonton Regression for Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score Predicted by Multidimensional Pain Inventory (MPI) Distress Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Distress Interactions (N = 816)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .26 | .11 | | | |
| MPI Distress | -.16 | .10 | -.07 | -1.68 | .093 |
| Aboriginal vs. Others | -1.27 | .37 | -.12 | -3.41 | .001 |
| E Asian vs. Others | 1.64 | .52 | .11 | 3.12 | .002 |
| S Asian vs. Others | -1.82 | .41 | -.15 | -4.44 | <.001 |
| SE Asian vs. Others | -1.52 | .52 | -.10 | -2.90 | .004 |
| Middle Eastern vs. Others | -1.36 | .47 | -.12 | -2.88 | .004 |
| Aboriginal X Distress | .07 | .34 | .01 | .22 | .828 |
| E Asian X Distress | -.27 | .44 | -.02 | -.60 | .546 |
| S Asian X Distress | -.49 | .39 | -.04 | -1.25 | .211 |
| SE Asian X Distress | -.29 | .47 | -.02 | -.61 | .540 |
| Middle Eastern X Distress | -.60 | .52 | -.04 | -1.16 | .245 |

*Note.* Caucasian *n* = 631, Aboriginal *n* = 53, East Asian *n* = 30, South Asian *n* = 40, Southeast Asian *n* = 26, Middle Eastern *n* = 36.

Table 105

*Edmonton Regression for Wechsler Adult Intelligence Scale Digit-Symbol Coding Subtest Scaled Score Predicted by Multidimensional Pain Inventory (MPI) Life Control Raw Score, Ethnocultural Dummy Codes, and Dummy Code by Life Control Interactions (N = 816)*

| | *B* | *SE B* | *β* | *t* | *p-value* |
|---|---|---|---|---|---|
| Constant | .25 | .11 | | | |
| MPI Life Control | .19 | .09 | .09 | 2.26 | .024 |
| Aboriginal vs. Others | -1.28 | .38 | -.12 | -3.38 | .001 |
| E Asian vs. Others | 1.91 | .53 | .13 | 3.61 | <.001 |
| S Asian vs. Others | -1.86 | .41 | -.16 | -4.53 | <.001 |
| SE Asian vs. Others | -1.67 | .54 | -.11 | -3.12 | .002 |
| Middle Eastern vs. Others | -1.20 | .46 | -.09 | -2.59 | .010 |
| Aboriginal X Life Control | -.25 | .30 | -.03 | -.85 | .398 |
| E Asian X Life Control | 1.08 | .49 | .08 | 2.22 | .027 |
| S Asian X Life Control | .10 | .36 | .01 | .27 | .789 |
| SE Asian X Life Control | -.56 | .40 | -.05 | -1.39 | .165 |
| Middle East X Life Control | .79 | .37 | .08 | 2.12 | .034 |

*Note.* Caucasian *n* = 631, Aboriginal *n* = 53, East Asian *n* = 30, South Asian *n* = 40, Southeast Asian *n* = 26, Middle Eastern *n* = 36.

**Hypothesis 5**

Table 106

*Edmonton ANOVA Results for Multidimensional Pain Inventory (MPI) Severity Raw Score by Nativity and Gender (N = 194)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Nativity | 25.43 | 1 | 190 | <.001 | .34 |
| Gender | 1.68 | 1 | 190 | .197 | .10 |
| Nativity X gender | .94 | 1 | 190 | .380 | .06 |

*Note. Foreign-born* = 161, Canadian-born *n* = 33.
Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

Table 107

*Edmonton ANOVA Results for Multidimensional Pain Inventory (MPI) Affective Distress Raw Score by Nativity and Gender (N = 194)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Nativity | .30 | 1 | 190 | .584 | .05 |
| Gender | .57 | 1 | 190 | .452 | .06 |
| Nativity X gender | .178 | 1 | 190 | .672 | .03 |

*Note. Foreign-born* = 161, Canadian-born *n* = 33.
Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

Table 108

*Edmonton ANOVA Results for Multidimensional Pain Inventory (MPI) General Activity Raw Score by Nativity and Gender (N = 194)*

| Effect | *F* | *df* model | *df* error | *p*-value | *R* |
|---|---|---|---|---|---|
| Nativity | 25.77 | 1 | 190 | <.001 | .35 |
| Gender | .42 | 1 | 190 | .517 | .05 |
| Nativity X gender | 1.15 | 1 | 190 | .285 | .08 |

*Note. Foreign-born* = 161, Canadian-born *n* = 33.
Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

*Table 109*

*Edmonton ANOVA Results for Minnesota Multiphasic Personality Inventory Welsh's Anxiety T-score by Nativity (N = 102)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Nativity | 2.30 | 1 | 100 | .132 | .15 |

*Note. Foreign-born* = 76, Canadian-born *n* = 26.
Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

## Hypothesis 6

Table 110

*Edmonton ANOVA Results for Multidimensional Pain Inventory (MPI) Life Control Raw Score by Nativity and Gender (N = 194)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Nativity | .41 | 1 | 190 | .525 | .05 |
| Gender | .003 | 1 | 190 | .958 | .004 |
| Nativity X gender | .003 | 1 | 190 | .955 | .004 |

*Note. Foreign-born* = 161, Canadian-born *n* = 33.
Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

Table 111

*Edmonton ANOVA Results for Multidimensional Pain Inventory (MPI) Support Raw Score by Nativity and Gender (N = 183)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Nativity | 1.40 | 1 | 179 | .239 | .09 |
| Gender | .54 | 1 | 179 | .462 | .06 |
| Nativity X gender | .10 | 1 | 179 | .747 | .03 |

*Note. Foreign-born* = 153, Canadian-born *n* = 30.
Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

Table 112

*Edmonton ANOVA Results for Multidimensional Pain Inventory (MPI) Solicitousness Raw Score by Nativity and Gender (N = 186)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Nativity | 3.670 | 1 | 181 | .056 | .14 |
| Gender | 2.05 | 1 | 181 | .154 | .12 |
| Nativity X gender | <.001 | 1 | 181 | .997 | <.001 |

*Note. Foreign-born* = 154, Canadian-born *n* = 32.
Subsample composed of East Asian, South Asian, Southeast Asian, and Arabic clients.

**Hypothesis 9: Novi**

Table 113

*Novi ANCOVA Results for Percent of Effort Test Scores Below Cutoff by Ethnocultural Group and Gender with Wechsler Test of Adult Reading Raw Score (N = 153)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| WTAR (covariate) | 7.60 | 1 | 148 | .007 | .22 |
| Ethnocultural group | 2.43 | 1 | 148 | .121 | .13 |
| Gender | 6.34 | 1 | 148 | .013 | .20 |
| Ethnocultural grp. X gender | 2.44 | 1 | 148 | .121 | .13 |

*Note.* African American *n* = 74, Caucasian *n* = 79.

**Hypothesis 9: Edmonton**

Table 114

*Edmonton ANCOVA Results for Percent of Effort Test Scores Below Cutoff by Ethnocultural Group and Gender with Age and Years of Education (N = 916)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Age (covariate) | 16.56 | 1 | 902 | <.001 | .13 |
| Years of education (covariate) | 40.21 | 1 | 902 | <.001 | .21 |
| Ethnocultural group | 20.18 | 5 | 902 | <.001 | .32 |
| Gender | 18.09 | 1 | 902 | <.001 | .14 |
| Ethnocultural grp. X gender | 3.31 | 5 | 902 | .006 | .13 |

*Note.* Caucasian *n* = 673, Aboriginal *n* = 60, East Asian *n* = 36, South Asian *n* = 57, Southeast Asian *n* = 36, Middle Eastern *n* = 54.

Table 115

*Edmonton Pairwise Comparisons for Percent of Effort Test Scores Below Cutoff (Caucasian Reference Group; N = 916)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal vs. Caucasian | .45 | 3.51 | 1.000 | -9.84 | 10.75 |
| E Asian vs. Caucasian | -14.78 | 4.44 | .014 | -27.82 | -1.75 |
| S Asian vs. Caucasian | -18.26 | 3.49 | <.001 | -28.50 | -8.01 |
| SE Asian vs. Caucasian | -27.30 | 4.32 | <.001 | -39.97 | -14.62 |
| Middle Eastern vs. Caucasian | -25.44 | 4.24 | <.001 | -37.88 | -13.01 |

*Note.* Based on estimated marginal means taking into account age and years of education as covariates. Caucasian *n* = 673, Aboriginal *n* = 60, East Asian *n* = 36, South Asian *n* = 57, Southeast Asian *n* = 36, Middle Eastern *n* = 54.

## Hypothesis 10: Novi

Table 116

*Novi ANCOVA Results for Minnesota Multiphasic Personality Inventory – 2nd Edition Symptom Validity Scale (FBS) Raw Score by Ethnocultural Group and Gender (N = 143)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Ethnocultural group | .16 | 1 | 139 | .687 | .03 |
| Gender | 1.90 | 1 | 139 | .170 | .12 |
| Ethnocultural grp. X gender | .02 | 1 | 139 | .902 | .01 |

*Note.* African American *n* = 67, Caucasian *n* = 76.

**Supplementary Analyses: Edmonton Differences on MMPI-2 FBS**

Table 117

*Edmonton ANCOVA Results for Minnesota Multiphasic Personality Inventory – 2nd Edition Symptom Validity Scale (FBS) Raw Score by Ethnocultural Group and Gender with Age (N = 379)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Age (covariate) | 22.62 | 1 | 366 | <.001 | .24 |
| Ethnocultural group | 3.23 | 5 | 366 | .007 | .20 |
| Gender | 1.49 | 1 | 366 | .223 | .06 |
| Ethnocultural grp. X gender | .35 | 5 | 366 | .882 | .07 |

*Note.* Caucasian *n* = 302, Aboriginal *n* = 25, East Asian *n* = 14, South Asian *n* = 16, Southeast Asian *n* = 7, Middle Eastern *n* = 15.

Table 118

*Edmonton Pairwise Comparisons for Minnesota Multiphasic Personality Inventory – 2nd Edition Symptom Validity Scale (FBS) Raw Score (Caucasian Reference Group; N = 379)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal vs. Caucasian | -1.18 | 1.23 | .998 | -4.81 | 2.44 |
| E Asian vs. Caucasian | 3.00 | 1.65 | .658 | -1.85 | 7.85 |
| S Asian vs. Caucasian | -.32 | 1.49 | 1.000 | -4.74 | 4.06 |
| SE Asian vs. Caucasian | -6.13 | 2.23 | .091 | -12.71 | .45 |
| Middle Eastern vs. Caucasian | -3.97 | 1.90 | .432 | -9.57 | 1.62 |

*Note.* Based on estimated marginal means taking age into account as a covariate.
Caucasian *n* = 302, Aboriginal *n* = 25, East Asian *n* = 14, South Asian *n* = 16, Southeast Asian *n* = 7, Middle Eastern *n* = 15.

**Supplementary Analyses: Edmonton Differences on MMPI-2 Hypochondriasis**

Table 119

*Edmonton ANCOVA Results for Minnesota Multiphasic Personality Inventory – 2nd Edition Hypochondriasis (Hs) Scale Raw Score by Ethnocultural Group and Gender with Age and Years of Education (N = 749)*

| Effect | *F* | *df* model | *df* error | *p*-value | *r* |
|---|---|---|---|---|---|
| Age (covariate) | 22.23 | 1 | 735 | <.001 | .17 |
| Years of education (covariate) | 12.76 | 1 | 735 | <.001 | .13 |
| Ethnocultural group | 4.32 | 5 | 735 | .001 | .17 |
| Gender | 2.71 | 1 | 735 | .899 | <.01 |
| Ethnocultural grp. X gender | .74 | 5 | 735 | .596 | .07 |

*Note.* Caucasian $n$ = 605, Aboriginal $n$ = 42, East Asian $n$ = 20, South Asian $n$ = 37, Southeast Asian $n$ = 15, Middle Eastern $n$ = 30.

Table 120

*Edmonton Pairwise Comparisons for Minnesota Multiphasic Personality Inventory – 2nd Edition Hypochondriasis (Hs) Scale Raw Score by Ethnocultural Group and Gender with Age and Years of Education (Caucasian as Reference Group; N = 749)*

| | *Mean Difference* | *SE* | *Sig.* | *95% C-I* | |
|---|---|---|---|---|---|
| | | | | *Lower Bound* | *Upper Bound* |
| Aboriginal vs. Caucasian | .33 | 2.16 | 1.00 | -6.00 | 6.66 |
| E Asian vs. Caucasian | 4.84 | 3.14 | .86 | -4.40 | 14.07 |
| S Asian vs. Caucasian | -.79 | 2.22 | 1.00 | -7.31 | 5.74 |
| SE Asian vs. Caucasian | -6.85 | 3.59 | .58 | -17.38 | 3.69 |
| Middle Eastern vs. Caucasian | -12.56 | 3.23 | .002 | -22.04 | -3.077 |

*Note.* Based on estimated marginal means taking age and years of education into account as covariates.
Caucasian $n$ = 605, Aboriginal $n$ = 42, East Asian $n$ = 20, South Asian $n$ = 37, Southeast Asian $n$ = 15, Middle Eastern $n$ = 30.

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| | |
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