THE EFFECTS OF AGE AND FEAR OF PAIN ON ATTENTIONAL AND MEMORY BIASES

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Abstract

Fear of pain and pain associated activities have received substantial attention in the literature. Such fear can contribute to avoidance of activity and, if severe enough, can interfere with recovery by contributing to deconditioning (Lethem, Slade, Troup, & Bentley, 1983). Fear of pain can be very pervasive. This has been demonstrated in experimental investigations that relate high levels of fear of pain to attentional biases favouring pain-related stimuli. Memory biases for pain-related information (i.e., an increased likelihood of remembering such information) have also been found among pain patients (e.g., Pincus, Pearce, & Perrott, 1996). Despite the high prevalence of pain among seniors, fear of pain has only been studied among younger adults. Many seniors also have been found to display high levels of fear of falling, a construct that is distinct from fear of pain, but also associated with deconditioning (e.g., Cumming, Salkeld, Thomas, & Szonyi, 2000). The purpose of this project was to extend the results of previous research by determining the nature of attentional and memory biases among seniors with a fear of pain and fear of falling. Moreover, the relationship of the construct of fear of pain to the construct of fear of falling was investigated. Attentional biases were studied by comparing the responses of seniors to those of younger adults by using the computerized Modified Stroop task (e.g., Pincus, Fraser, & Pearce, 1998; Snider, Asmundson, & Wiese, 2000). It was expected that people with high levels of fear of pain would show attentional biases toward pain-related stimuli, regardless of age. Unlike younger persons, it was expected that seniors would display fear of falling and would manifest attentional and memory biases toward fall-related stimuli. Correlational analyses supported the hypothesis that fear of pain and fear of falling are distinct but related constructs. However, the findings did not provide strong support for the existence of pervasive attentional and memory biases in the sample. The theoretical and clinical implications of the findings are discussed, as are directions for future research.

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OVERVIEW

For some people, cognitive, behavioural, and physiological responses to a painful situation can culminate in a phobic-like response to pain – fear of pain (Asmundson, Norton, & Norton, 1999). Fear of pain (and fear of activities associated with pain) has received substantial attention in the literature. When fear of pain is associated with an injury, the fear can contribute to avoidance of activity and, if severe enough, interfere with recovery by causing avoidance of beneficial activity and deconditioning (Lethem, Slade, Troup, & Bentley, 1983). In correlational studies, chronic pain patients with high levels of fear of pain were found to have a poorer range of motion and use less effective coping strategies than individuals with low or moderate levels of fear of pain (e.g., McCracken, Gross, Sorg, & Emands, 1993).

Fear of pain and avoidance of activity are the strongest predictors of whether a person will recover from an injury or whether the condition will become chronic (Klenerman, Slade, Stanley, Pennie, Reilly, Atchison, Troup, & Rose, 1995). Furthermore, according to the fear-avoidance model of pain (e.g., Philips, 1987; Vlaeyen & Linton, 2000), fear of pain is related to avoidance and chronicity largely because it leads to increased attention to pain-related stimuli. Indeed, several investigations have identified a relation between fear of pain and attentional biases (e.g., Asmundson, Kuperos, & Norton, 1997a; Crombez, Hermans, & Adriaensen, 2000; Keogh, Ellery, Hunt, & Hannent, 2001).

Pain is very prevalent among seniors, but this population has been understudied (Hadjistavropoulos, von Baeyer, & Craig, 2001). Although researchers have increasingly been paying attention to pain in seniors, certain phenomena including fear of pain have yet to be investigated in this population. The study of the fear of pain construct among seniors could facilitate treatment and prevention of chronic pain. It could also facilitate the incorporation of developmental components into the fear-avoidance model of pain. Thus, the goal of this project is to investigate fear of pain and an associated construct fear of falling in seniors. Age differences with respect to these phenomena will be examined, including age differences in attentional biases. Moreover, the relationship between fear of pain and fear of falling will be examined.

1. REVIEW OF THE LITERATURE

1.1 Pain

Pain is a universal form of distress. It has both sensory and emotional components and is usually related to tissue damage from injury or illness. The International Association for the Study of Pain (IASP) defines pain as, "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Merskey & Bogduk, 1994, p. 211). Pain represents an adaptive survival mechanism that promotes safety and wellness (Rosenzweig, Leiman, & Breedlove, 1999). In general, it can be seen as comprising various elements including behaviour, nociception (i.e., noxious stimulation), perception, and a negative emotional response. Dennis and Melzack (1983) discuss three responses to pain that promote soundness and healing of the body. First, whenever possible, the experience of pain causes us to withdraw from the source of noxious stimulation. Second, longer lasting pain induces behaviours that assist the body in the healing process (e.g., initial bed rest when an injury occurs). Finally, pain behaviours (e.g., guarding the sore area) may indicate to other individuals that care and attention is needed, therefore assisting in the restoration of well-being.

Pain can be classified as acute and chronic. Acute pain is felt immediately after trauma to the body has occurred. It is transient in nature and often relents once the initial injury has healed (Durand & Barlow, 2000). Individuals with acute pain respond well to analgesic medication and the pain serves a protective role similar to that described by Dennis and Melzack (1983). Prevalence rates for acute pain in the general population have been estimated at approximately 5% with acute pain being defined as pain experienced two weeks prior to the interview (Crook, Rideout, & Brown, 1984). Chronic pain (defined by the IASP as lasting longer than three months) on the other hand, is persistent. After the initial injury has healed, persisting pain serves a very limited protective role. In some instances, chronic pain may be related to diseases, such as arthritis, but in other instances the source of the pain is unidentifiable. In addition, chronic pain, like acute pain, can vary in severity. Prevalence rates for chronic pain also vary from study to study. Elliott, Smith, Penny, Smith, and Chambers (1999) defined chronic pain as pain experienced continuously or intermittently for longer than three months in the six months prior to interview and found prevalence rates of as high as 46.5% in the general population. Most studies, however, report prevalence rates in the range of 15-20% using similar definitions of chronic pain as cited above (Blyth, March, Brnabic, Jorm, Williamson, & Cousins, 2001). Regardless of the source or severity of the pain, chronic pain tends to disrupt most aspects of an individual's life and results in frequent physician visits and health-care expenditures (Ruoff, 1996).

1.2 Pain and Seniors

Although chronic pain is very common among seniors, research in this area has been fairly limited. Elderly persons differ from younger persons with respect to prevalence of many illnesses that are associated with pain (e.g., osteoarthritis) as well as with respect to some psychological characteristics (Wijeratne, Shome, Hickie, & Koschera, 2001). Pain sensitivity also seems to change with age, although results from research concerning pain sensitivity have been somewhat equivocal. Although seniors demonstrate higher pain thresholds for thermal stimulation (Gibson, Katz, Corran, Farrell, & Helme, 1994) and lessened ability to discriminate between noxious stimuli (Harkins & Chapman, 1977), researchers using methods other than thermal stimulation have not replicated these findings (e.g., Harkins & Chapman, 1977; Kenshalo, 1986). Explanations of altered pain thresholds in seniors include the possibility that seniors have more stringent criteria for reporting pain (Clark & Mehl, 1971). A deterioration of the peripheral and central nervous system pathways with increasing age could also be used to explain such findings (Gibson et al., 1994). Research is necessary to recognise and understand the particularities of this population, so treatment for chronic pain can be appropriate and accessible.

Prevalence rates for chronic pain have been found to increase as people age. Although a small number of studies have reported a decrease in pain as people age, this is most probably the result of a statistical artefact based on a reluctance of elderly people, in comparison to their younger counterparts, to report painful symptoms (Gallagher, Verma,

& Mossey, 2000). The majority of studies support the conclusion that most seniors suffer from at least one recurrent pain complaint. At the time of study, for people 60-69 years of age, the prevalence rates of a recurrent pain complaint were found to be 78% and for 80-89 year-old people, the prevalence rate for persistent pain has been estimated at 64% (Gagliese & Melzack, 1997). Although prevalence rates for chronic pain are high in older persons, the estimates may still be somewhat conservative. It is often assumed that older persons can accurately report their pain. However, cognitive impairment has been associated with reductions in pain reports even when controlling for the number of health problems (Gibson et al., 1994; Hadjistavropoulos et al., 2001; Parmelee, Smith, & Katz, 1993).

The sources of chronic pain change as people age. Although complaints of migraine headache and back pain decrease in older people, other complaints become more common (Gallagher et al., 2000). Chronic pain in this population, similar to other populations, is generally a result of chronic physical conditions. Musculoskeletal diseases such as osteoporosis, osteoarthritis, and rheumatoid arthritis are the most common aetiology for pain in community-dwelling older persons. For elderly persons referred to a pain clinic, arthritis and post-herpetic neuralgia were the most common complaints (Gibson et al., 1994). In addition, cancers are predominant among older persons and cause a considerable amount of pain and suffering (Gold & Roberto, 2000).

At present, pain management for elderly people is often inaccessible and complicated by other factors. Gloth (2000) states that, for elderly persons, pain management is complicated by inadequate assessments of pain, comorbid psychological and physical conditions, few physicians being well versed in geriatric pain treatment, and a reluctance to use prescription and opiate medications. Lansbury (2000) also identified several physical and psychological barriers that render pain management a challenge for the elderly person. Financial limitations coupled with the cost of therapeutic treatments, restriction of activity, side-effects of medications, the patient's attitudes towards pain, and lack of available services all contribute to the elderly person's difficulty managing his or her pain. Social factors such as isolation and loss of family and friends may be additional barriers (Gibson et al., 1994).

The psychological impact of the combination of persistent pain and diminishing social support may be anger, frustration, irritability, and depression (Gibson et al., 1994). Depression, in particular, complicates the pain experience. High levels of depression seem to intensify the frequency and severity of pain, and depression is often comorbid with chronic pain, especially in elderly individuals (Bulmer & Heibronn, 1982; Gold & Roberto, 2000). Anger can also have detrimental consequences for the chronic pain patient, although these effects can vary depending upon the target of the anger (Okifuji, Turk, & Curran, 1999). For example, Okifuji et al. (1999) found that in chronic pain patients, self-directed anger was associated with pain and depression and overall anger was related to perceived level of disability. Anger intensity has also been associated with perceived pain interference and activity level (Kerns, Rosenberg, & Jacob, 1994). Moreover, an inhibitory style of anger management has been associated with levels of pain intensity and pain behaviours (Kerns et al., 1994). In another study, female chronic pain patients (i.e., females with fibromyalgia syndrome, rheumatoid arthritis, and chronic lower back pain) demonstrated more anger than healthy controls (Amir, Neumann, Bor, Shir, Rubinow, & Buskila, 2000). In short, anger may interfere with recovery from chronic pain and chronic pain patients seem more susceptible to feelings of anger.

Due to sleep and appetite reductions, and physical activity limitations, many chronic pain patients undergo physical deterioration (Gehring & Watson, 1999). Because of increased frailty in the elderly individual in general, the effects of physical deterioration may be especially potent. For elderly people, the increase in chronic pain conditions in combination with a unique set of social factors paint a bleak picture with respect to the prospects of a fulfilling old age. Pain is an obstacle many older people face that can stand in the way of a satisfying quality of life. The present investigation examines the role of fear of pain and fear of falling as possible sources of difficulty in adjusting to pain.

1.3 The Gate-control Theory of Pain

Melzack and Wall's (1965) gate control theory of pain has had a profound influence on our understanding of pain and its maintenance. Prior to the articulation of this theory, researchers within the mainstream in the pain literature emphasised the physiological and sensory aspects of pain while largely ignoring the cognitive and emotional components. Melzack and Wall (1965) discuss some of the theories that predated the gate control theory and illustrate the views of the time. According to the specificity theory (Müller, 1842; von Frey, cited in Boring, 1942), a noxious stimulation felt on the body tissue is projected directly to a pain center in the brain (specifically, in the thalamus). These theorists suggested that there was a one-to-one correspondence between the amount of pain felt and the amount of noxious stimulation present. The psychological component (pain perception) was viewed as merely reactive to the physiological process. Pattern theories (Sinclair, 1955; Weddell, 1955), on the other hand, were designed to overcome the idea of a direct relationship between physiological stimulation and actual perception as proposed by specificity theorists. These theorists focused on either the patterning of stimulation in non-specific receptors or the summation of stimulation in the central nervous system, but a dynamic psychological component was still disregarded. In contrast, the gate control theory of pain integrated both physiological and psychological factors to explain the subjective experience of pain.

Melzack and Wall (1965) regarded pain as a perceptual as opposed to purely sensory experience. They argued that emotions, cognition, and sensations interact within a neurophysiological system to produce pain. As such, pain is viewed as a process rather than as a signal. A pain-gate was conceptualised as a neurophysiological mechanism at the level of the substantia gelatinosa either facilitating or inhibiting the transmission of pain signals to the brain. This gate can be "opened or closed" by cortical input (Melzack & Wall, 1965). Past experience, emotion, and attention also influence the opening and closing of the gate and, thus, the experience of pain. For example, humour and relaxation have been found to raise pain threshold levels and expectations about the effects of humour and relaxation enhance the effect (Mahony, Burroughs, & Hieatt, 2001). Ethnicity-based expectations regarding pain have also been found to influence the affective type of pain experience and overall evaluations of pain (Lee & Essoka, 1998). Ethnic group identity, related attitudes, beliefs, psychological states and emotional states have been shown to affect perceptions of pain intensity (Bates, Edwards, & Anderson, 1993). Therefore, the individual can, to some extent, moderate the experience of pain (Kugelmann, 1997).

In addition to describing the role of cortical input, Melzack and Wall (1965) describe the physiological processes of the pain gate, involving afferent and efferent nerve fibre systems converging on the substantia gelatinosa of the dorsal horns of the spinal column. Research on physiological predictions involved in acute pain derived from the gate-control theory suggests that the theoretical prediction of spinal modulation of pain is accurate (e.g., Humphries, Johnson, & Long, 1996). Melzack and Wall (1965) proposed that inhibition of pain perception is enhanced by large-fibre activity and reduced by small-fibre activity. Small diameter fibres carry the nociceptive message to the brain. However, these small diameter afferent fibres can be inhibited by large diameter, non-nociceptive, ascending and descending fibres. The latter transmit other sensory information (e.g., heat, pressure). Consistent with these propositions, research has shown pain relief to be facilitated by peripheral skin stimulation (Kakigi & Watanabe, 1996).

1.3.1 *Neuromatrix Model of Pain*

The neuromatrix model of pain (Melzack, 1999; Melzack & Katz, in press) is an extension of the gate control theory of pain. Whereas the gate control theory focused on spinal modulation of pain signals, the neuromatrix model represents an attempt to clarify the role of the brain in pain perception. Investigations concerning phantom limb pain following the removal of spinal cord sections (e.g., Melzack, 1989) assert that although the spinal cord plays a role in pain modulation, the picture is more complex.

The neuromatrix, as described in Melzack and Katz (in press), can be defined as the anatomical mechanism that is comprised of a widespread neural network that connects the thalamus, the cortex, and the limbic system. The neuromatrix is determined by both genetics and sensory input. Moreover, the neuromatrix creates a pattern of impulses and communication that produces a neurosignature. The neurosignature can be considered the output of the matrix and provokes the perception of pain. The neurosignature is generated not only by the matrix, but also by sensory input and cognitive factors (e.g., psychological stress). Moreover, the cognitive variables can influence a physiological stress reaction (sensory input), which can further influence the neurosignature. Therefore, this model, like the gate control theory, maintains a multidimensional experience of pain that is produced by many different influences.

1.4 Learning Models of Pain

Pain can be conceptualised through learning models in a manner that is congruent with the gate-control theory. Learning theorists have argued that chronic pain behaviour is learned. Pain is dependent upon influences from both within and outside of the person (Robinson & Riley, 1999). This is consistent with the experiences of many people with chronic pain, for whom there is no correspondence between tissue damage and the subjective pain experience. Operant conditioning is a type of associative learning in which there is congruence between the response (the behaviour or the operant) and the reinforcer (consequent condition) (Skinner, 1953). That is, a behaviour that is performed is subject to conditions in the environment which can serve to maintain the behaviour. Pain behaviours (e.g., guarding) are construed as operants and can also be subjected to these consequent conditions (Novy, Nelson, Francis, & Turk, 1995). Although these behaviours arise through initial reactions to nociception, they are maintained through reinforcement. For example, pain behaviours may be directly reinforced (through desired attention or the reduction of pain) or indirectly reinforced (through the avoidance of undesirable activity) and, thus, maintained (Fordyce, 1991). Reinforcers that may contribute to the maintenance of pain behaviours include attention from family and friends, reduced social or work responsibility, and medication (Asmundson, Jacobson, Allerdings, & Norton, 1996; Robinson & Riley, 1999).

Classical conditioning may also contribute to the development of chronicity. According to the classical conditioning or respondent model of chronic pain, in the acute stage of an injury pain and tension can lead to avoidance of painful movement (Turk & Flor, 1984). Such avoidance may initially reduce pain in the acute stages. However, avoidance may also lead to immobility and increased pain and tension over time as tissue deteriorates. With time, avoidance may generalize to an increased number of activities/situations, exacerbating the pain-tension cycle.

Examinations of the social reinforcers that affect the pain response have provided support for the learning model of pain (e.g., Ciccone, Just, & Bandilla, 1999; Hadjistavropoulos, 1999; Robinson & Riley, 1999). Nielson and Weir (2001) reviewed the literature on biopsychosocial interventions for chronic pain patients and concluded that treatments including a behavioural and/or a cognitive-behavioural component are effective.

1.5 Biopsychosocial Perspective on Chronic Pain

Proponents of the biopsychosocial perspective on chronic pain (e.g., Asmundson & Wright, in press; Turk, 1996; Turk & Flor, 1984) assert that a patient's symptoms and their behavioural response to these symptoms are the result of interactions between early life events, psychosocial variables, and pathophysiology (Crowell & Barofsky, 1999). A clinical or social response to pain is seen as an interaction between physiological nociception, psychological, and social factors. Therefore, chronic symptoms would not lead to adverse outcomes in the absence of certain psychological and social circumstances. It is the coupling of precipitating somatic symptoms with predisposing psychosocial variables (e.g., mood/anxiety, abuse history) that would contribute to an adverse outcome (e.g., disability, depression) (Reiter, 1999). In other words, biological factors may initiate and maintain the presence of physical disturbances, while psychological factors influence the perception and appraisal of these disturbances. In addition, social factors may act to shape the behavioural response of the patient to his or her appraisal of the pain (Turk, 1996).

Evidence for the biopsycosocial approach to pain has been demonstrated by the importance of non-nociceptive factors in the pain experience. For example, patients' attitudes and beliefs regarding pain, their coping resources, and the health care system all have been found to affect their disability level and use of health care services (Jensen, Turner, & Romano, 1994). Moreover, Turk and Okifuji (1997) found that physical, cognitive, and affective factors were related to observed pain behaviours (i.e., behavioural manifestations of pain and distress) in chronic pain patients with fibromyalgia.

1.6 The Fear-Avoidance Model of Pain

Out of the biopsychosocial formulation of pain, a more specific model emerged; namely, the fear-avoidance model of pain. This model was derived from the broader anxiety and phobia literature (Rachman, 1998). The fear-avoidance model adds cognitive components to the operant and classical conditioning conceptualisations of pain. Using this model, researchers attempt to explain why fears and resulting behaviours often result in an increase in disability (Asmundson et al., 1999; Eccleston & Crombez, 1999; Lethem et al., 1983; Philips, 1987; Vlaeyen & Linton, 2000). According to the model, people who are fearful of pain can react to pain in one of two ways. The first, confrontation of the fear, leads to a reduction of fear and a normal recovery from injury. The second, avoidance of the fear, leads to an increase in fear and an avoidance of pain-provoking movements. This avoidance is not conducive to recovery from injury (Lethem et al., 1983). The model (presented in Figure 1) has guided much empirical investigation and numerous researchers have provided support for the model (see review by Vlaeyen & Linton, 2000). According to the model, high levels of fear of pain, anxiety, and resulting avoidance behaviours can negatively affect the physical, psychological, and cognitive outcomes of chronic pain patients (e.g., Asmundson & Norton, 1995; McCracken & Gross, 1993).

Lethem et al. (1983) attempted to explain why some people with chronic pain have pain experience or behaviour that is disproportionate to the organic pathology that can be demonstrated or the amount of nociceptive stimulation experienced. They pointed out that the experience of pain has several components: emotional, behavioural, as well as physiological responses to pain stimulation. Any one or all of these components may become desynchronous with the nociceptive stimulation and/or organic pathology. On the basis of this proposal, Lethem et al. (1983) argued that fear of pain and avoidance behaviours are the primary cognitive and behavioural determinants of the synchrony of the emotional component of pain. Avoidance behaviour can serve to maintain fear or pain (as avoidance of activity can lead to short-term reduction in physical discomfort).

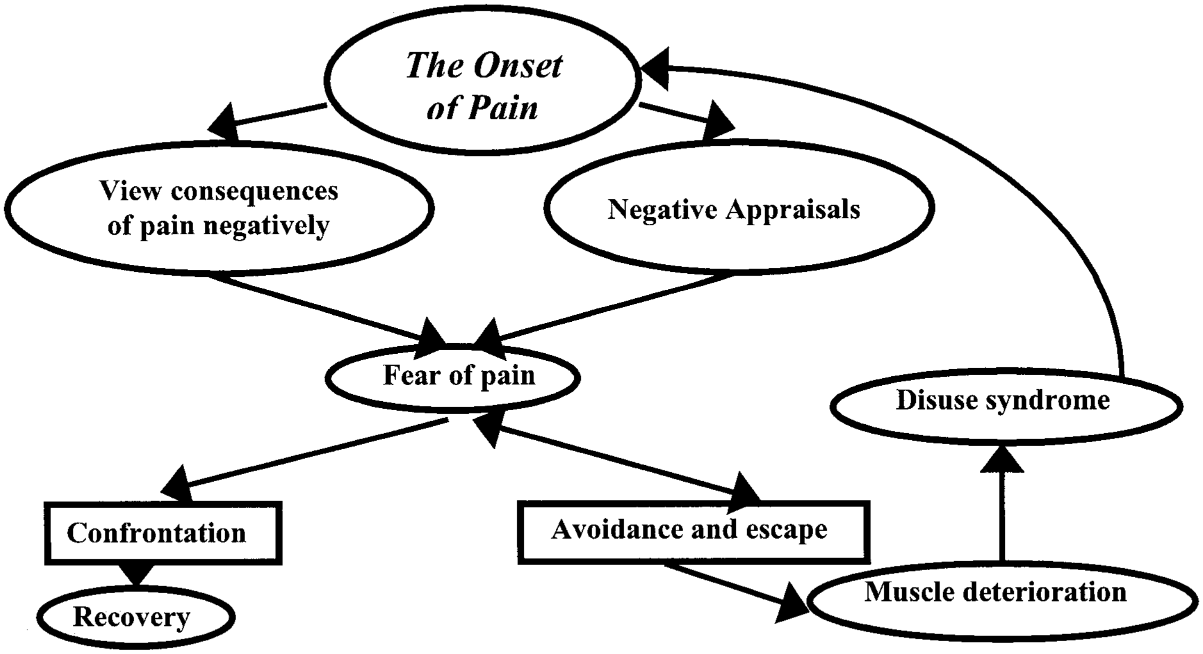

Figure 1: The Fear-Avoidance Model of Pain

(Adapted from Vlaeyen and Linton, 2000)

This can have both physical and psychological consequences. For example, loss of strength and flexibility can occur, leading to more pain. In other words, the cycle is fuelled by fear and avoidance and results in reinforcement that maintains the fear (Lethem et al., 1983).

Negative appraisals regarding pain can exacerbate an individual's fear of pain. Philips (1987) argued that such appraisals (i.e., negative beliefs and memories of past painful experiences) could motivate patients to avoid these and similar activities in the future. That is, the patient believes that by avoiding these activities, discomfort and suffering will be reduced. As a result of memory distortion, however, the patient may have an exaggerated view of the pain associated with the experience and may become increasingly motivated to continue avoidance behaviours. In other words, the patient comes to the conclusion that avoiding certain activities and situations can prevent pain. Avoidance reinforces this belief and continues to strengthen the behaviour (Philips, 1987).

Vlaeyen and Linton (2000) have incorporated negative appraisals about pain into the fear-avoidance model. Although negative appraisals are normal reactions to pain, people at risk for becoming excessively fearful of pain may display an exaggerated response (e.g., catastrophic appraisals, excessive avoidance). Persistence of these behaviours can lead to a number of difficulties including muscle deterioration, and the 'disuse' syndrome, which involves deconditioning and guarded movement. Furthermore, fear of pain may lead to a hypervigilance for pain-related information, which may contribute to an increased psychophysical reactivity to perceived threatening situations (e.g., attending to pain-related stimuli and reacting to situations involving such stimuli).

Asmundson et al. (1999) add that fear of pain can also affect a person's coping style for dealing with pain and may lead to attentional biases. Such biases, as experienced by seniors, constitute the primary focus of this investigation.

1.6.1 *Evidence for the Fear-Avoidance Model of Pain*

1.6.1.1 *Escape and Avoidance and Consequences of Prolonged Avoidance*

Asmundson, Norton, and Allerdings (1997b) investigated individual differences with respect to avoidance behaviours. Using the Multidimensional Pain Inventory (MPI; Kerns, Turk, & Rudy, 1985) and the Multiaxial Assessment of Pain (MAP; Turk & Rudy, 1987, 1988), they classified pain patients as being "globally dysfunctional" (i.e., higher than average pain severity, pain-related interference and affective distress, and lower levels of self-efficacy and activity), "interpersonally distressed" (i.e., perceived lower levels of social support as demonstrated by others responding to pain in a punitive manner with fewer distracting responses) , or "adaptive copers" (i.e., lower severity of pain, pain-related interference and affective distress, and higher levels of self-efficacy and activity). Asmundson et al. (1997b) found that the pain patients classified as "globally dysfunctional" scored higher than the other two groups on measures of pain-specific cognitive and physiological anxiety, escape and avoidance behaviours, and fearful appraisals.

Asmundson and Norton (1995) suggested that anxiety sensitivity might play a role in the development and maintenance of pain-related fear. Anxiety sensitivity refers to the fear of anxiety-related bodily sensations with a belief that the sensations will have harmful consequences. They demonstrated that people with anxiety sensitivity, which is associated with conditionability for fear, show a higher prevalence of negative cognitive, behavioural, and affective characteristics than chronic pain patients low in anxiety sensitivity. Asmundson and Norton (1995) classified chronic back pain patients into high, medium, and low anxiety sensitivity using the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). The dependent variables were derived from scores on the Beck Depression Inventory (BDI; Beck, 1978), the Pain Anxiety Symptoms Scale (PASS; McCracken et al., 1992), and the MPI (Kerns, Turk, & Rudy, 1985). Those high in anxiety sensitivity reported more pain-related cognitive anxiety, fear of the negative consequences of pain, negative affect, and depression, despite similar pain intensity to those with low and medium levels of anxiety sensitivity. Therefore, by rendering a person susceptible to developing a fear of pain, anxiety sensitivity contributes to the fear-avoidance cycle. Anxiety sensitivity may underlie fear of pain and indirectly contribute to attentional biases among pain-fearful individuals.

Asmundson and Taylor (1996) hypothesized that anxiety sensitivity in pain patients has an indirect effect on avoidance behaviours with fear of pain being the mediating variable. Building on their previous work, Asmundson and Taylor (1996) sought to establish the pathway through which anxiety sensitivity might influence pain-related escape and avoidance. Chronic pain patients were evaluated with respect to levels of anxiety sensitivity, fear of pain, pain-related escape and avoidance, and pain severity. Structural equation modelling was used to test a model of the relationship between the variables. In accordance with their hypothesis, the researchers concluded that anxiety sensitivity exacerbates fear of pain and indirectly encourages pain-related escape and avoidance.

According to the fear-avoidance model, avoidance is a common coping strategy among people who are highly anxious about and excessively fearful of pain. McCracken and Gross (1993) investigated the relationship between pain-related anxiety and strategies used to cope with pain. They argued that anxiety can manifest in fearful appraisals of pain and that coping strategies can predict pain intensity, depression, anxiety, and functional capacity. Because anxious individuals tend to focus on the area of pain, they cannot use their attentional resources for cognitive coping strategies. Therefore, it was predicted that patients with anxiety symptoms would not use effective cognitive coping strategies. The PASS (McCracken, Zayfert, & Gross, 1992) and the Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983) were administered to chronic pain patients. As predicted, pain-related anxiety was related to lower levels of effective cognitive coping strategy usage, higher usage of avoidant coping strategies, and to a lower perceived ability to decrease and control pain. The researchers concluded that emotional distress plays an important role in the ability to cope with pain in an effective manner. In addition, they concluded that the use of avoidant coping strategies possibly serves to maintain fear and exacerbate the problem.

According to the fear-avoidance model, prolonged avoidance has cognitive and emotional as well as physical repercussions (Eccleston & Crombez, 1999). Avoidance stems from fear of pain and anxiety, so people who avoid activities also should have higher levels of fear of pain and increased anxiety. Furthermore, avoidance of activities leads to more fear and anxiety, thus engaging the individual in a vicious cycle. It has been suggested that a very pain-fearful and avoidant person will not fare as well as a less fearful and avoidant person with respect to areas such as cognition, behaviour, and emotion. Indeed, Eccleston and Crombez (1999) found that pain-fearful people bring pain into the focus of their attention. Their high somatic awareness interacts with high pain intensity to produce a bias for processing pain-related information at the expense of other tasks. In pain-fearful people, pain is more likely to disrupt the attention needed to perform other tasks.

1.6.1.2 *Physical Repercussions and Disability*

Excessive pain-related avoidance and escape behaviours can lead to physical deterioration (McCracken et al., 1993). McCracken et al. (1993) investigated variables associated with range of motion in chronic back pain patients. Patients were divided into low anxiety and high anxiety groups using the PASS (McCracken et al., 1992) total score. They were required to undergo a range of motion task in conjunction with a routine physical examination. Although both groups reported the same amount of pain during the task, persons with high PASS scores reported more anxiety. These people tended to overpredict the amount of pain they expected to experience and, subsequently, displayed a lower range of motion. In other words, high pain-related anxiety led to both negative appraisals of pain (overprediction) and physical repercussions (a lesser range of motion). Restrictions in range of motion could be detrimental with respect to recovery from musculoskeletal problems.

Waddell, Newton, Henderson, Somerville, and Main (1993) demonstrated that the consequences of fear of pain and avoidance relate to higher levels of disability in work and daily living. These researchers developed the Fear-Avoidance Beliefs Questionnaire (FABQ), which focuses primarily on work and work-related disability. Using the FABQ, they found that severity of pain only accounts for 14% of the variance in daily activities.

Only a further 5% of the variance was accounted for by biomedical measures. There was, however, a strong relationship between fear-avoidance beliefs about work and work loss and disability in daily life (26% of the variance). Fear-avoidance beliefs about physical activity also accounted for 9% of the variance in disability. In a related study, Fritz, George, and Delitto (2001) assessed low back pain patients using the FABQ at the acute stage of their injuries (less than 3 weeks duration). They found that initial scores on the FABQ were significant predictors of level of disability and work status after four weeks of physical therapy. These findings could be especially relevant to seniors who may experience increased frailty as a result of advancing age, but research on fear of pain in this population has yet to be undertaken.

The concepts of the 'disuse' syndrome and deconditioning can be described within the framework of the fear-avoidance model of pain. As previously discussed, the avoidance of activities can lead to disuse and deconditioning, both of which play an instrumental role in disability. Based on a review of the extant literature, Verbunt, Seelen, Vlaeyen, van de Heijden, Heuts, Pons, and Knottnerus (2003) proposed a modification of this theory. They argued that disuse (i.e., the decrease of physical activities of daily living) and deconditioning (i.e., an extremely low level of physical fitness) were not the only central factors in the development of chronicity. Low back pain patients were found to have a lower level of physical fitness than controls only when occupational status (i.e., working or not working) was considered (Verbunt et al., 2003). Although inactivity is still considered important in the perpetuation of pain conditions, it appears that the combination of physical activity, deconditioning, and psychosocial variables is critical in the development of chronicity (Verbunt et al., 2003). Therefore, when disuse and deconditioning are considered in the fear-avoidance model, the interpretation of the purely physical nature of these constructs should be adjusted to reflect the psycholosocial variables that result in disuse and deconditioning.

1.7 Seniors and Fear of Falling

Although fear of pain has not been studied in elderly people, a related construct, fear of falling, has. Elderly people, because of instability and increased frailty, are at a higher risk than the general population for experiencing a fall (Baumann, 1999). Many of the risk factors for falling occur at higher rates within the elderly population and include orthopedic diagnosis, walking aids, cardiovascular diagnosis, and confusion (Soja, Kippenbrock, Thomas, Hendrich, & Nyhuis, 1992). For an elderly individual, falling can have greater physical and psychological consequences than for a younger person. A fall is more likely to lead to increased use of medical services and a loss of independence (Howland, Walker, Peterson, Levin, Fried, Pordon, & Bak, 1993) and seniors commonly report fearing falling (Yardley & Smith, 2002). It is not surprising, then, that a subgroup of elderly people have high levels of fear of falling and that this fear may be independent of having experienced a previous fall (Howland, Lachman, Peterson, Cote, Kasten, & Jette, 1998). One recent study found that 55% of a sample of community dwelling elderly persons had a significant fear of falling (Howland et al, 1998).

Elderly persons who have high levels of fear of falling may also be pain-fearful. Fear of pain and fear of falling may be distinct but related constructs. If fear of pain relates to a fear of falling, both fear of pain and fear of falling may be of special interest in this population because they may contribute to an overall vulnerability for maintenance of chronic pain conditions. However, fear of pain has not been studied in seniors. This study may facilitate an understanding of fear of pain and its relationship to fear of falling in order to shed light on vulnerabilities in elderly persons with respect to chronic pain.

1.7.1 *Correlates of Fear of Falling*

Many factors, both physical and psychological, contribute to an individual developing a fear of falling (Gray-Miceli, 1997). Vellas, Wayne, Romero, Baumgartner, and Garry (1997) found that approximately one-third of elderly people who experience a fall go on to develop a fear of falling. However, a fall is not a necessary or sufficient condition for developing a fear of falling (Lawrence et al., 1998). It is possible for an individual who has never experienced a fall to have a fear of falling. It is largely the coupling of physical and psychological factors that determines whether a person will develop a fear of falling. For example, Lawrence et al. (1998) found that people who were fearful of falling also had low levels of perceived ability to manage a fall. Furthermore, among older adults who had experienced a fall, seniors highly fearful of falling were found to have higher levels of general anxiety than seniors with lower levels of fear (Drozick & Edelstein, 2001). Conversely, Burker, Wong, Sloane, Mattingly, Preisser, and Mitchell (1995) found that physical factors were strongly related to fear of falling. These researchers found that both dizziness and lowered stability, when standing with the feet together, were related to having a fear of falling.

Fear of falling has been associated with physical disturbances. People with fear of falling can manifest gait disturbances, balance disturbances, and decreased mobility (Vellas et al., 1997). Franzoni, Rozzini, Boffelli, Frisoni, and Trabucchi (1994) studied the association between fear of falling and functional status among 54 nursing home residents. They found that people who feared falling had both impaired postural and gait performance when compared to elderly persons not afraid of falling. Furthermore, those who had high levels of fear of falling actually fell more during a 24-month follow-up. Generally, fear of falling was associated with functional status decline across time. Maki, Holliday, and Topper (1991) also found that people who feared falling differed from their non-fearful counterparts. On two separate tests of balance (i.e., blindfolded spontaneous sway tests and eyes-open, one-leg stance tests), people fearful of falling performed significantly worse than people not fearful of falling. However, it is unclear whether the performance of the people afraid of falling on the balance tests represents a true physical deterioration, or merely a reflection of increased anxiety during the test.

Several studies have been conducted to determine the effect fear of falling has on the life of an elderly person (e.g., Cumming, Salkeld, Thomas, & Szonyi, 2000; Howland et al., 1993). In general, fear of falling impairs an elderly person's ability to perform activities of daily living (through restriction of activities), gait, self-rated health, and social interactions (Howland et al., 1993). In addition, high levels of fear of falling have been found in female seniors who do not participate in physical activity (Bruce, Devine, & Prince, 2002), although it is difficult to determine whether this curtailment of activity is a cause or result of fear of falling. Furthermore, fear of falling can lead to physical dysfunction such as balance problems (Lawrence, Tennstedt, Kasten, Shih, Howland, & Jette, 1998). In general, high levels of fear of falling can significantly impair an elderly person's ability to enjoy life and have meaningful interactions with others.

Psychological and social correlates are also associated with high levels of fear of falling. People may restrict their activities and social interactions to avoid a feared fall. They also may become anxious, depressed, and have lower self-confidence. Tinnetti, Richman, and Powell (1990) studied psychological characteristics of people with high levels of fear of falling. They found that people who were afraid of falling tend to have a lower self-efficacy with respect to avoiding falls during non-harmful daily activities. Furthermore, variables that predicted a high score on the Falls Efficacy Scale (FES; Tinetti et al., 1990) were depression, anxiety, and usual walking pace (physical ability). Fessel and Nevitt (1997) investigated correlates of fear of falling and correlates of limiting activities due to fear of falling among persons with rheumatoid arthritis. Five hundred and seventy participants over 50 years of age were questioned regarding whether they feared falling and what impact this had on their activity curtailment. They found that correlates of fear of falling included being female, having depressive symptoms, having poor physical functioning, minor fall-related injuries, and a greater number of painful joints. Furthermore, correlates of activity restriction (e.g., stair climbing, walking) due to a fear of falling included poor self-rated health, poor physical functioning, and a large number of painful joints. Even moderate fear of falling has been associated with decreased satisfaction with life, increased frailty and depressed mood (Arfken, Lach, Birge, & Miller, 1993).

1.8 Attentional Biases for Pain-related Stimuli

Another possible factor contributing to disability among chronic pain patients is attentional biases for pain-related stimuli. People who are more cognisant of pain-related cues and stimuli may be at risk for somatic hypervigilance that, as described by Eccleston and Crombez (1999), can disrupt attention needed to perform other tasks. Such individuals can become excessively preoccupied with pain. Such attentional biases may fuel fear and promote avoidance of activity, which, in turn, leads to physical deterioration.

1.8.1 *Measuring Attentional Biases*

The Stroop task (Stroop, 1935), involves the presentation of words printed in a variety of ink colours. Each participant is asked to report the colour of the ink and to ignore the meaning of the word. The basic premise behind the Stroop task is that people cannot help but process the meaning of the word. That is, reading the word is unintentional. The meaning of the word is accessed in memory and, depending on the salience of the word, reaction times to say the colour of the ink will be affected (Ashcraft, 1998). This can be compared to a situation where the colour of the ink and the word are the same (e.g., the word RED printed in red ink). The reaction time needed to state the ink colour for in such a situation is much faster than when the word is not a colour (e.g., the word CHAIR printed in red ink) or than when the word is a colour different from the ink colour (e.g., the word BLUE printed in red ink) (Ashcraft, 1998).

A Stroop-like task (a variation often called the Emotional or Modified Stroop task) is the most commonly used task to measure attentional biases in the study of pain and anxiety disorders (MacLeod, 1991a; Williams, Mathews, & MacLeod, 1996). In the Modified Stroop Task, emotionally salient words are used instead of opposing colour-based words (e.g., the word HEART-ATTACK shown to people who are worried about their cardiovascular health). The task can be traced, in part, to a study conducted by Klein (1964). Klein was interested in determining how the meaning of a word can influence colour naming. He found that the more salient the non-colour-based word was to the participant, the more interference it caused. This paradigm was carried further into the clinical literature with the premise that attentional biases would be "syndrome-specific". For example, for an anxious individual, words that are related to anxiety may be more salient and create more interference on a Stroop task than words that are not anxiety related. The Modified Stroop Task has been used extensively to examine individual differences in areas such as anxiety, depression, and fear of pain. To illustrate, Lundh, Wikstrom, Westerlund, and Ost (1999) found that participants with panic disorder showed increased interference for panic-related words on the Modified Stroop task. Interference on the Modified Stroop task has also been found in people with Obsessive Compulsive Disorder and frequent checking behaviours (Novara, & Sanavio, 2001). Modified Stroop attentional biases for illness-related words have also been found among people with hypochondriacal tendencies (Lecci, & Cohen, 2002). Therefore, a major advantage of the Modified Stroop task is that it allows the researcher to make comparisons across different clinical groups (Williams et al., 1996).

Non-computerised versions of the Modified Stroop task have been criticised because of the possible impact of factors such as experimenter and timing bias. These factors have the potential to interfere with the actual response latency measurements (Snider et al., 2000). In response to these criticisms, most researchers now use a computerized version of the Modified Stroop task, which eliminates both experimenter and timing bias.

MacLeod (1991b) questions whether the Modified Stroop task allows a pure measurement of attentional bias or whether this approach is clouded by other biases of information processing. For example, the bias could pertain to semantic rumination over the meaning of the word rather than attentional processes. The bias could even be due to differences in the time necessary to articulate the varying verbal responses (Asmundson et al., 1997). These criticisms are addressed in the present study by the use of a control word (for each potentially emotionally salient word) that is equivalent in both word-length and frequency of usage in the English language. As both semantic rumination and articulation time would similarly affect both the emotionally salient word and the control word, any difference in response latency would be due to attentional biases. The computerized Modified Stroop task offers a promising measure of attentional biases for this investigation, which is aimed at the study of age differences in attentional biases related to fear of pain and fear of falling.

1.8.2 *Research into Attentional Biases for Pain-Related Information*

Several studies have focused on the identification of attentional biases among pain patients. Despite some mixed results, evidence has been accumulating that this attentional bias is mediated by fear. People with high levels of fear of pain show an attentional bias for pain-related stimuli, although those with low levels of such fear do not (Keogh et al., 2001). Furthermore, this attentional bias has been found in both clinical and non-clinical populations with high levels of fear of pain (Crombez et al., 2000; Keogh et al., 2001; Snider et al., 2000). Study in this area is important because fear of pain and related attentional biases may have implications for the identification of people at risk for developing a chronic pain conditions and for the development of suitable interventions.

Pearce and Morley (1989) reported that chronic pain patients show a bias towards words related to sensory and affective qualities of pain although information concerning fear of pain was not reported. Chronic pain patients and matched control participants completed a Modified Stroop task to determine whether there were differential effects between the groups. Target words were derived from the McGill Pain Questionnaire (MPQ; Reading, 1983) and included sensory pain words and affective/evaluative pain words. Negative emotional words were also included. In addition, control words for each of the categories were presented. The results revealed that chronic pain patients are more susceptible to interference on the Stroop task when the stimuli are pain-related. This implies that for pain patients, pain-related words are personally salient and that such patients attend more to such words than to either negative emotional words or neutral words.

Pincus, Fraser, and Pearce (1998) suggested that Pearce and Morley (1989) failed to adequately control for levels of depression and anxiety and, thus, these variables could have accounted for identified attentional biases. In a study designed to reproduce and extend the findings of Pearce and Morley (1989), Pincus et al. (1998) controlled for depression and anxiety levels by using a measure of anxiety and depression designed for patients with physical disorders (Hospital Anxiety and Depression Scale; Zigmond & Snaith, 1983). They found that chronic pain patients did not show attentional biases for either sensory or affective pain words. The researchers concluded that emotional variables, such as anxiety and depression, contributed more to attentional interference on the Modified Stroop task than simply pain per se.

Nevertheless, researchers (Crombez et al., 2000; Snider et al., 2000) have since been able to replicate, either wholly or partially, the findings of Pearce and Morley (1989) even after controlling for depression and anxiety. Using a computerised, Modified Stroop task, Snider et al. (2000) assessed whether chronic pain patients compared to a control group matched for age, sex, and education, exhibited a colour-naming bias for pain-related stimuli when assessed at both the strategic and automatic levels. Although both strategic and automatic processing are dependent upon attention, strategic processing is open to conscious awareness whereas automatic processing refers to processing that can occur outside of conscious awareness or at the preconscious level (Wells & Matthews, 1994). Automatic processing is of particular interest because if pain patients are processing pain-related information outside of conscious awareness, this could have significant implications for treatment strategies. Snider et al. (2000) assessed strategic processing using unmasked conditions in which the word appeared on the screen until the participant named the word colour. Automatic processing was assessed using masked conditions, in which the word appeared on the screen for 14.3 milliseconds and was then replaced with a mask (random letters), which remained on the screen until the participant named the colour. The use of the mask reduces the level of conscious awareness. Depression and anxiety were measured using the BDI (Beck, 1978) and the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). Results initially failed to show a group difference for either strategic processing or automatic processing of affective or sensory pain stimuli. However, upon using scores on the BDI (Beck, 1978) as a covariate, chronic pain patients, but not healthy controls, showed increased colour naming latencies for both affective and sensory pain words as opposed to neutral or other threat words in the strategic condition but not in the automatic condition. These findings are consistent with those of Pearce and Morley (1989).

Crombez et al. (2000) attempted to determine whether chronic pain patients showed attentional biases for pain-related words, using a computerised version of the

Modified Stroop task. A possible problem that Crombez et al. (2000) identified with previous studies was that the target words were not representative of the core concerns of the population under study. Because pain sensations differ with respect to the pain problem (e.g., back pain sensations differ from headache pain sensations), general pain stimuli may not have been relevant. To compensate for this, they ensured that the target stimuli were applicable to their population; back pain patients. The authors predicted that back pain patients would demonstrate an attentional bias for back pathology-related stimuli (e.g., LUMBAGO). Various psychological measures (e.g., the Tampa Scale of Kinesiophobia; TSK; Kori, Miller, & Todd, 1990) were employed to determine whether factors such as fear of pain were predictive of attentional interference. Although anxiety was measured using the state and trait version of the State-Trait Anxiety Inventory (STAI; Speilberger, Gorsuch & Lushene, 1970) depression was not assessed. This may pose a potential problem for their investigation, as depression has been found to contribute to attentional biases (e.g., Snider et al., 2000). Results partially replicated those of Pearce and Morley (1989). Chronic pain patients were slower to name sensory words, but not affective words, compared to their matched controls.

Although results have been somewhat mixed regarding the effect of pain status on attentional biases, there is evidence that psychological and emotional variables may mediate or contribute to the interference. For example, Asmundson et al. (1997a) found that emotional factors (i.e., scores on the ASI; Peterson & Reiss, 1992) were related to the attentional bias towards pain-related words. Depression and anxiety were both considered in their investigation by use of scores on the BDI (Beck, 1978) and the STAI (Speilberger et al., 1970). Asmundson et al. (1997a) used an alternative measure of attentional biases: the dot-probe paradigm for the presentation of the target and control stimuli. The dot-probe task incorporates a neutral motor response to a neutral stimulus. By using the dot-probe task, inferences about attention shifts can be made (Macleod, Mathews, & Tata, 1986). In a dot-probe task, a pair of words is presented on a computer screen. These words, which may be either control or target, are presented with one word appearing at the top of the screen and the other appearing at the bottom of the screen. Participants are required to read aloud the top word of the pair. Following the presentation of the word pair, a dot-probe may appear on the screen. The dot-probe appears in the same spatial location as either word in the preceding pair. Participants are asked to respond with a key-press as soon as they detect the dot-probe. An attentional bias can be inferred if the response of the participant is faster when the probe appears in the same spatial location as the target word. Asmundson et al. (1997a) found that pain status alone did not account for attentional interference. When the researchers divided the pain patients into groups based on their scores on the ASI (Peterson & Reiss, 1992), which has been shown to be associated with fear of pain (Asmundson & Taylor, 1996), they found that those low in anxiety sensitivity tended to shift their attention away from pain-related stimuli. Those with high anxiety sensitivity did not show such a shift. Asmundson et al. (1997a) concluded that fear of pain mediates the attentional bias towards pain-related stimuli.

Roelofs, Peters, and Vlaeyen (2002) investigated the role of experimentally induced pain and fear of pain in attentional biases for pain-related information. Two studies were conducted. The first study manipulated pain levels and fear of pain and the combination of the two, whereas the second study only manipulated pain levels. The

Modified Stroop method was employed for both. Pain was induced by a muscle-ischemic procedure (i.e., reducing blood flow to the muscles of the arm) and fear was induced by the possibility of participants receiving an electric shock during the Stroop task. It was found that in the study in which pain and fear were manipulated, participants in the pain/no fear condition showed attentional biases for pain-related information. An effect for the fear-induced condition or the pain and fear combined condition was not found. However, in the second study of pain that involved pain induction and not fear induction, the findings of the first study were not replicated suggesting that the attentional bias effect may not be pervasive. Although these findings partially replicate those of earlier studies (e.g., Pearce & Morley, 1989; Snider et al., 2000), the manipulation of experimentally induced pain may not be analogous to the chronic pain state. Moreover, the fear manipulation may not be analogous to the more trait-like variable of fear of pain considered in other studies (e.g., Keogh et al., 2001; Asmundson et al., 1997).

Keogh et al. (2001) investigated the role of fear of pain in attentional biases towards pain-related stimuli using healthy, pain-free people. Employing a dot-probe paradigm, the researchers examined whether those high in fear of pain would more closely attend to stimuli related to pain as compared to people low in fear of pain, after controlling for depression, anxiety, and anxiety sensitivity using scores on the Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995) and the ASI (Peterson & Reiss, 1992). The results did, indeed, support this hypothesis. A more recent study by Keogh, Thompson, and Hannent (2003) partially replicated these findings, although the attentional bias for pain-related words among pain-fearful people was not found (possibly due to a slightly different method using the dot-probe task). The researchers found that those with low levels of fear of pain tended to orientate away from pain-related words whereas those with high levels of fear of pain did not. This is not only consistent with Keogh et al. (2001), but also with the findings of Asmundson et al. (1997a). Building on research suggesting that those who are pain-fearful have more negative pain experiences (Keogh & Birkby, 1999), Keogh et al. (2001) argued that it may be because of biased attentional processes that pain-fearful people have more negative pain experiences. Fear of pain may function as a vulnerability factor in the development of chronic pain conditions, in that fear of pain causes individuals to focus attention on pain-related sensations, which, in turn, serves to increase or maintain the pain through avoidance and escape behaviours.

Although it is evident that fear of pain mediates attentional bias for pain-related stimuli in both healthy people and pain patients, the effect that age has on this bias not been studied. In the present study, by using both elderly and younger participants, we will attempt to determine whether attentional bias to pain-related stimuli among people with a fear of pain is robust with respect to age. Because pain is prevalent among elderly people and because it has been suggested that pain-fearful people have more negative pain experiences, attentional biases for pain-related stimuli would warrant study among seniors. Furthermore, only one study has been conducted using a non-clinical population (Keogh et al., 2001), so replication of these results is necessary.

1.9 Memory Biases

Memory biases have been found to be syndrome-specific, in that people tend to remember information that is congruent with their current state. Memory biases using free-recall tasks among chronic pain patients have been well established, although these effects are not as clear using recognition memory tasks (Edwards, Pearce, Collett, & Pugh, 1992; Pincus, Pearce, McClelland, & Turner-Stokes, 1993). The effect may not be as clear using recognition tasks because in most investigations of this sort the recognition is often preceded by a recall task (Pincus & Morley, 2001). Pincus et al. (1998) found that although chronic pain patients failed to show an attentional bias for pain-related information on a Modified Stroop task, a memory recall bias was present. Memory bias was assessed using a free-recall task in which the participants were asked to recall the stimuli presented in the preceding Modified Stroop task. Memory biases using a free-recall task have also been demonstrated among children with chronic pain (Johnson & Spence, 1997). Although researchers have suggested that this effect is mediated by the affective or sensory state of the individual (Edwards et al., 1992), the effect remains even after anxiety and depression are controlled (Pincus, Pearce, & Perrott, 1996). Furthermore, the specificity of the bias has been investigated and it has been found that it seems to occur when the participant processes the to-be-remembered word with a reference to himself or herself. That is, a bias is shown in chronic pain patients when words are encoded with reference to the self, but this bias is not shown in other conditions (e.g., encoding without imagining the to-be-remembered word with reference to the self) (Pincus et al., 1993). This pattern of recall also has been demonstrated among pediatric pain patients (Koutantji, Pearce, Oakley, & Feinmann, 1999). It is noted that memory bias for pain-related words seems to cease following reductions in pain intensity (Edwards, Pearce, & Beard, 1995).

In studying memory biases for anxiety-related information in individuals with anxiety disorders, researchers have found mixed results. Amir, Foa, and Coles (2000) investigated whether implicit memory biases for threat relevant information exist among individuals with generalised social phobia. They found that this occurred when a group of individuals with generalised social phobia were compared to a control group. People with generalised social phobia also display a similar memory bias for negative facial expressions (Foa, Giboa-Schechtman, Amir, & Freshman, 2000). In addition, Becker, Rinck, and Margraf (1994) found that panic patients showed enhanced memory for panic-related words, compared to positive or negative words, on a free-recall task. A memory bias has also been demonstrated in somatoform patients (Pauli & Alpers, 2002). However, Banos, Medina, and Pascual (2001) studied panic patients and did not find a memory bias for panic-related words by means of either free recall or word-stem completion tasks. For patients with social phobia, there has been insufficient evidence for explicit and implicit memory biases, although results indicated an implicit memory bias for the subgroup of patients with non-generalised social phobia concerning social threat words (Lundh & Ost, 1997). Furthermore, individuals with health anxiety have not shown recognition biases for illness-related words (Owens, Asmundson, Hadjistavropoulos, & Owens, in press). Although numerous researchers have attempted to determine whether a memory bias exists in people with anxiety disorders, the results have been quite inconsistent. This may be indicative of selective processing of threat-related material at early stages of cognitive processing (i.e., attention) but not at the latter stages (i.e., encoding into long-term memory) (Dalgleish, 1994).

Recall memory biases for condition-related stimuli have been shown to exist in chronic pain patients. The results among patients with anxiety disorders have been inconsistent. The possible presence of a memory bias in non-clinical samples with elevated levels of fear of pain has not been investigated. Individuals scoring high on the construct of fear of pain, like pain patients, may show memory biases for mood-congruent stimuli (e.g., pain-related words). Age differences will also be investigated because there may be differences with respect to the focus of younger vs. older participants (e.g., older participants may be more concerned about falling than their younger counterparts). Congruent with the method most often employed with chronic pain patients, a free-recall task will be used in this investigation.

1.10 Measurement Issues

1.10.1 *Fear of Pain*

Several instruments have been developed to measure fear of pain. The PASS (McCracken et al., 1992) contains subscales designed to assess somatic anxiety, cognitive anxiety, fear, and escape/avoidance responses. It was developed for use with chronic pain patients and the questions are structured with the assumption that the individual is experiencing pain or has experience with pain (McNeil & Rainwater, 1998). The PASS and its subscales demonstrate good reliability and validity (McCracken, Zayfert, & Gross, 1993). The FABQ (Waddell et al., 1993) was designed to measure fear-avoidance beliefs regarding physical activity and work among patients with low back pain. The FABQ contains two subscales designed to assess fear-avoidance beliefs regarding pain and fear-avoidance beliefs regarding physical activity. Because the FABQ is largely work-focused, it may not be appropriate for seniors who are retired. It has been shown to have satisfactory reliability and validity (Waddell et al., 1993). The TSK (Kori et al., 1990) measures fear of physical activity and fear of re-injury during physical activity. It has satisfactory psychometric properties (Vlaeyen, Kole-Snijders, Rotteveel, Ruesink, &

Heuts, 1995). The Fear of Pain Questionnaire-III (FPQ-III; McNeil & Rainwater, 1998) consists of three subscales designed to assess fear of medical pain, fear of minor pain, and fear of severe pain. It has satisfactory validity and reliability (McNeil & Rainwater, 1998). The FPQ-III has been used on samples of non-clinical participants (e.g., Keogh et al., 2000; McNeil & Rainwater, 1998). Because the FPQ-III specifically targets fear of pain and has been used on non-clinical samples, it was chosen as the objective measure of fear of pain for this investigation.

1.10.2 *Fear of Falling*

A number of measures have been developed to assess fear of falling in seniors. The FES (Tinetti et al., 1990) was designed to assess perceived self-efficacy about avoiding falls during non-hazardous daily activities. The scale consists of 10 activities of daily living (ADLs). Participants are asked to rate their confidence regarding their ability to complete an activity without falling. The FES has adequate reliability and validity (Powell & Myers, 1995; Tinetti et al., 1990) but has been criticized for using a limited range of ADLs (i.e., basic activities such as getting dressed). Thus, it may not be suitable for assessing fear of falling among higher functioning community-residing seniors (Lachman, Howland, Tennstedt, Jette, Assmann, & Peterson, 1998). A related scale, The Activities-Specific Balance Confidence (ABC) Scale (Powell & Myers, 1995), assesses self-efficacy for avoiding a fall during a broader range of activities. The ABC scale has been found to have good psychometric properties (Powell & Myers, 1995).

A newer instrument, the Survey of Activities and Fear of Falling in the Elderly (SAFE; Lachman et al., 1998) was designed to include social and leisure activities in the assessment of fear of falling. Exercise and social activity represent measurement domains that are important because, although ADLs may be crucial for independent living, the consequences of fear of falling may begin in more advanced activities, that may not be essential for independent functioning. The SAFE assesses fear of falling during several activities, activity level (i.e., participation in these activities), and activity restriction due to fear of falling. The SAFE shows acceptable psychometric properties (Lachman et al., 1998). However, because the SAFE was designed for administration in an interview format, it is not suitable to be used as a brief large-scale screening tool. Therefore, because of the broad range of ADLs and the ease of administration, the ABC scale was deemed as the most appropriate measure of fear of falling for this research.

1.11 Rationale for Studying Seniors

It cannot be assumed that seniors will respond to anxiety and fear in the same way as younger adults without validation. Thus, it is imperative for models to be generalized to seniors through empirical research. Seniors differ from younger people in many important ways with respect to pain and anxiety. For example, pain sensitivity changes as people age. Several researchers suggest that age contributes to an increase in pain threshold, especially in response to thermal stimulation (Gibson, Katz, Corran, Farrell, & Helme, 1994; Harkins & Chapman, 1977). Moreover, prevalence rates for chronic pain increase with age (Ferrell, Ferrell, & Osterweil, 1990; Gagliese & Melzack, 1997). The sources of chronic pain in seniors also change. Migraine headache and pain become less common, while muskuloskeletal problems such as osteoporosis and osteoarthritis become more common (Gallagher et al., 2000). Finally, pain management for elderly persons becomes more of a challenge because of high prevalence rates of comorbid psychological and physical conditions, financial limitations, social factors such as isolation, and the inaccessibility of geriatric pain assessment and treatment (Gibson et al., 1994; Gloth, 2000; Lansbury, 2000).

Anxiety and fear also change with age. Anxiety disorders appear to be less prevalent among seniors (Flint, 1994). Seniors do not report many worries apart from those associated with health (Powers, Wisocki, & Whitbourne, 1992; Wisocki, Handen, & Morse, 1986). Furthermore, anxiety in this population may manifest in somatic symptoms (Turnball, 1989). Owens, Hadjistavropoulos, and Asmundson (2000) found that seniors scored lower on the Anxiety Sensitivity Index (Reiss et al., 1986) than do younger adults. Anxiety sensitivity has been related to fear of pain (Asmundson & Taylor, 1996). Because of age-related changes concerning pain and anxiety, empirical study of the fear-avoidance model of pain as it applies to seniors is warranted. In this investigation, an attempt will be made to generalize aspects of the fear-avoidance model of pain to seniors, with emphasis on fear of pain and fear of falling as contributors to attentional biases.

1.12 Hypotheses

1.12.1 *Hypothesis 1*

It was expected that fear of pain and fear of falling would be found to be distinct yet related constructs. Specifically, a positive relationship between fear of pain and fear of falling was expected. However, it was also expected that the magnitude of this correlational relationship would be greater among older people. Moreover, the pattern of correlations between fear of falling and level of pain, state anxiety, trait anxiety, depression, education, vocabulary, cognitive functioning, and age was expected to differ from the pattern of correlations between fear of pain and the aforementioned variables.

1.12.2 *Hypothesis 2*

It was expected that people who were pain-fearful, regardless of age, would selectively attend to pain-related stimuli (i.e., it would take them longer to name the colour of pain words) using the Modified Stroop task. Confirmation of this hypothesis will facilitate the generalization the fear-avoidance model of pain to seniors.

1.12.3 *Hypothesis 3*

Taking into account reported pain intensity, it was expected that seniors with high levels of fear of pain would show greater levels of bias with respect to fall-related words than their younger counterparts. On the other hand, both groups were expected to attend equally to pain-related words.

1.12.4 *Hypothesis 4*

A memory bias for pain-related words was expected in individuals with high levels of fear of pain. That is, people who were pain-fearful were expected to recall more pain-related words than their non-pain-fearful counterparts. Furthermore, it was expected that seniors would show a greater memory bias for fall-related words than younger participants after controlling for the effect of age.

2. METHOD

2.1 Phase I: Initial Assessment of Fear of Falling and Fear of Pain

2.1.1 *Participants*

One hundred and twenty-eight seniors who were 65 years or older (85 females, 43 males; mean age = 73.63 years, *SD* = 5.98; mean education = 13.20 years, *SD* = 3.55) were recruited. Recruitment took place through community organizations such as the Seniors Education Centre at the University of Regina, the Senior Citizens Centre of

Regina, and the Saskatchewan Seniors Mechanism, church groups, and arts and craft groups. Through group announcements, the researcher (or the class facilitator) explained the purpose of the investigation, stressing the voluntary nature of participation. To those who were interested, a questionnaire package was given out. The researcher either arranged a date to pick up the completed questionnaires or a self-addressed envelope was provided for return.

A comparison sample of 122 participants who were 55 years of age or younger (82 females, 40 males; mean age = 34.29 years, *SD* = 12.54; mean education = 14.47 years, *SD* = 2.39) were recruited in three ways. First, the seniors provided contact information of friends or relatives. A letter explaining the purpose of the investigation and the voluntary nature of participation was given to participating seniors. They were asked to give the letter to a younger adult (e.g., a relative). If the younger person was willing to participate (this was indicated by the senior giving the younger person's name and contact information and ticking off a box signifying that the younger person was interested), the experimenter contacted him or her and mailed a questionnaire package out. The younger participants were provided with a self-addressed stamped envelope to return the package. As a second means of participant recruitment, undergraduate students at the University of Regina were solicited through the Psychology Department Pool of Potential Research Participants. Finally, younger participants were recruited through community organizations such as church groups and arts and craft groups. Through group announcements, the researcher explained the purpose of the investigation stressing the voluntary nature of participation. A questionnaire package was given to interested individuals. The researcher arranged a date to pick up the completed questionnaires or a self-addressed envelope was provided for return.

An effort was made to match the two age groups with respect to sex and level of education. The groups did not differ significantly with respect to the proportion of males and females, $\chi^2 (1) = 0.18$. They did, however, differ with respect to years of education (seniors mean education = 13.20 years, *SD* = 3.55; younger adults mean education = 14.47 years, *SD* = 2.39), $t\,(238) = -3.261, p < 0.01$.

2.1.2 *Materials*

2.1.2.1 *Fear of Pain Questionnaire-III*

Fear of pain was measured using the FPQ-III (McNeil & Rainwater, 1998). The FPQ-III consists of 30 items that gauge fear of pain. It contains phrases describing painful experiences (e.g., Being burned on your face by a lit cigarette) and participants rate the items on a 5-point Likert scale based on level of fear ranging from 'not at all' (1) to 'extreme' (5). Higher scores indicate higher levels of fear of pain. The items are categorised into three 10-item sub-scales: 1) fear of severe pain; 2) fear of minor pain; and 3) fear of medical pain. A total score can be obtained by summing the ratings for each painful experience. In this investigation, the total score on the FPQ-III was used.

The FPQ-III has been shown to have adequate predictive validity. McNeil and Rainwater (1998) found, for example, that individuals who reported high levels of fear of pain on the FPQ were more likely to avoid pain-related stimuli than those who reported low levels of fear of pain. Furthermore, the questionnaire has good internal consistency both overall and for each of the subscales (Total scale, $r = 0.92$; Severe Pain subscale, $r = 0.88$; Minor Pain subscale, $r = 0.87$; Medical Pain subscale, $r = 0.87$) and good test-retest reliability both overall and for the subscales (Total scale, $r = 0.74$; Severe Pain subscale, $r = 0.69$; Minor Pain subscale, $r = 0.73$; Medical Pain subscale, $r = 0.76$).

2.1.2.2 *Modified Activities-Specific Balance Confidence (ABC) Scale*

A modified version of the Activities-Specific Balance Confidence (ABC) Scale (Powell & Myers, 1995) was used to assess fear of falling. The ABC assesses the confidence that people have to complete activities without losing their balance or becoming unsteady. It contains 16 items and the participants rate their confidence in engaging in the activity without becoming unsteady on a 0-100% continuum. The ABC has been found to have good test-retest reliability over a two-week period ($r = 0.92$) and excellent internal consistency ($r = 0.96$) (Powell & Myers, 1995). The ABC has also been shown to correspond with measures of mobility and balance performance (e.g., the paced walk test) (Myers, Fletcher, Myers, & Sherk, 1998).

In this investigation, the 0-100% continuum was replaced with 21-point horizontal box scales (Jensen, Miller, & Fisher, 1998), consisting of 21 numbers ranging from 0 to 100. The 21-point box scale has been shown to have better psychometric properties among seniors (Chibnall & Tait, 2001) and younger adults (Jensen et al., 1998) than other numeric or verbal rating scales. The box scales were anchored by the adjectives *no confidence* (corresponding to 0) and *complete confidence* (corresponding to 100). A total score on the ABC was obtained by summing all of its items. A lower score on the modified ABC indicated less confidence in performing the activities without losing balance or becoming unsteady.

2.1.2.3 *The Geriatric Pain Measure*

A modified version of the Geriatric Pain Measure (GPM; Ferrell, Stein, & Beck, 2000) was used to assess pain. The GPM is a multidimensional pain assessment questionnaire designed primarily for use with seniors, although its questions are suitable for younger adults. Five subscales comprise the GPM and assess disengagement because of pain, pain intensity, pain with ambulation, pain with strenuous activity, and pain with other activities. In this study the total score on the measure was used. The GPM has been shown to have satisfactory psychometric properties, including internal consistency ($r = 0.94$) and test-retest stability ($r = 0.90$) (Ferrell et al., 2000). Moreover, concurrent validity has been demonstrated between the GPM total score and the McGill Pain Questionnaire total score ($r = 0.63$) (Ferrell et al., 2000).

The GPM contains 24 items, 22 of which are answered *yes* or *no*. The remaining items (items 19-20) are answered on a 10-point rating scale with 0 corresponding to *no pain* and 10 corresponding to *worst pain I can imagine*. In this investigation, the two 10-point rating scales were replaced with 21-point horizontal box scales (Jensen, Miller, & Fisher, 1998) consisting of 21 numbers ranging from 0 to 100. The box scales were anchored by the adjectives *no pain* (corresponding to 0) and *worst pain ever* (corresponding to 100). The dichotomous questions on the GPM are scored by coding the answers 1 = *yes* and 0 = *no* and summing the *yes* responses. A total score on the GPM was obtained by summing all of its items.

2.1.3 *Procedure*

Participants were given the questionnaire packages and asked to complete them and return them to the researcher. Contact and demographic information (telephone number, age, sex, and years of education) was also collected (Appendix A). Information regarding colour blindness and whether the participants had normal or corrected normal vision was elicited to ensure that they would be able to correctly discern the words and colours presented in the Modified Stroop task.

2.2 Phase II

2.2.1 *Participants*

The participants for Phase II of the project were recruited from those who participated in Phase I. Sixty-nine seniors participated (46 females, 23 males; mean age = 73.14 years, *SD* = 5.17; mean education = 12.96 years, *SD* = 3.24) and fifty-four younger adults participated in Phase II (38 females, 16 males; mean age = 34.78 years, *SD* = 12.95; mean education = 14.53 years, *SD* = 2.02). Those participants scoring in the upper and lower thirds on the FPQ-III total score were contacted.

In the upper-most third of the FPQ-III (above 80), participants scoring highest were contacted first. The researcher contacted them from highest to lowest until 35 seniors and 35 younger participants were recruited or until all individuals within that category were contacted (an effort was made to match the groups with respect to FPQ-III total scores). This group of participants was considered to have high levels of fear of pain. Thirty-five seniors (27 females, 8 males; mean FPQ-III score = 95.66; *SD* = 9.66; mean age = 73.63 years; *SD* = 4.58; mean education = 12.97 years, *SD* = 3.36) with high levels of fear of pain participated in phase II (Table 2). Twenty-six younger adults (23 females, 3 males; mean FPQ-III score = 93.71; *SD* = 12.23; mean age = 34.46; *SD* = 13.89; mean education = 14.36; *SD* = 1.75) with high levels of fear of pain participated in phase II. The researcher attempted to contact all younger participants who scored in the upper third of the FPQ-III. However, of the 38 people eligible to participate in the investigation (as the high fear of pain group), 12 people were either unavailable or not interested in participating. The seniors and younger adults who comprised the high fear of pain groups did not significantly differ with respect to their scores on the FPQ-III, t $(59) = 0.70, p > 0.05$.

In the lower-most third of the FPQ-III (under 60), participants scoring lowest were contacted first. The researcher contacted them from lowest to highest until 35 seniors and 35 younger participants were recruited or until all individuals within that category were contacted (an effort was made to match the groups with respect to FPQ-III total scores). This group of participants was considered to have low levels of fear of pain. Thirty-four seniors (19 females, 15 males; mean FPQ-III score = 45.23; $SD = 9.56$; mean age = 72.65 years; $SD = 5.74$; mean education = 12.94 years, $SD = 3.16$) with low levels of fear of pain participated in phase II. Twenty-eight younger adults (15 females, 13 males; mean FPQ-III score = 45.21; $SD = 10.51$; mean age = 35.07; $SD = 12.26$; mean education = 14.68; $SD = 2.25$) with low levels of fear of pain participated. The researcher attempted to contact all participants who scored in the lower third of the FPQ-III. Of the 40 seniors who the researcher attempted to contact, 6 were either unavailable or not interested in participating. Of the 40 younger adults eligible to participate, 12 were either unavailable or not interested. The seniors and younger adults who comprised the low fear of pain groups did not significantly differ with respect to their scores on the FPQ-III, t $(60) = 0.002, p > 0.05$.

2.2.2 *Materials*

2.2.2.1 *Stimulus Words*

Ten pain-related words, 10 social threat words, 10 positive emotional words, 10 fall-related words, and 10 neutral words were chosen for this study (Appendix B). The social threat words were included to determine whether fear of pain is related to a general negativity-bias rather than a pain-specific bias. The positive emotional words were included to determine whether fear of pain is related to a general bias for emotionally laden words. The fall-related words reflected fall-related concerns and/or images (e.g., slippery). All of the words, with the exception of the fall-related words, were derived from the 128 (32 from each category) words used by Keogh et al. (2001). Nine independent raters rated the potential stimulus words (e.g., the 128 words used by Keogh et al., [2001] and additional fall-related words) with respect to their congruence to the constructs of pain, social threat, positive, neutral, and fear of falling on a l to 10 scale (1 = not representative at all, 10 = perfectly representative). The original list of words that were rated as well as the instructions to the raters are presented in Appendix C. Intraclass correlation coefficients were calculated to determine interrater reliability. These intraclass correlation coefficients ranged from 0.85 (for the social threat words) to 0.90 (for the fall-related words) demonstrating excellent interrater reliability. The words rated as most relevant within each category were chosen as stimulus words for this study. This methodology for generating word-lists has been used widely in this area (e.g., Asmundson et al., 1997; Keogh et al., 2001). Preliminary analysis confirmed that the word categories did not differ in terms of word length, $F(4, 45) = 1.73, p = 0.16$, frequency of usage in the English language $F(4, 45) = 1.09, p = 0.37$ (Kucera & Francis, 1967), or the number of syllables $F(4, 45) = 1.89, p = 0.13$.

2.2.2.2 *Hardware and Software*

The Modified Stroop task was run on an Intel Pentium processor, 15-inch monitor, and a Labtec AM-222 microphone. The program was written in Visual Basic 6.0. The program allows the participant's voice to be passed from a microphone into the computer program. The Modified Stroop Program uses the computer's Performance Counter and Frequency to calculate the elapsed time from the moment the stimulus word appears on the screen to when the participant verbally responds. The timer resolution is in excess of one microsecond. The Modified Stroop Program is identical to that used by Owens et al., (in press).

Participants were presented with words upon the computer screen displayed in various colours. They were asked to name the colour of the word and to ignore the word's meaning. The computer recorded the voice-activated response latency and, by pressing a key, the researcher recorded the number of errors each participant made.

2.2.2.3 *Shipley-Institute of Living Scale*

The verbal sub-scale of the Shipley Institute of Living Scale (SILS; Shipley, 1940; revised manual: Zachary, 1986) was administered as a measure of verbal ability. It contains 40 target words. The participants were required to underline one of four potential words that have the same meaning as the target word. The Shipley verbal test has been shown to have excellent reliability and validity (Shipley, 1940) and has been used widely in the attentional biases literature (e.g., Owens et al., in press; Snider et al., 2000). Normative data for seniors has been collected and the verbal sub-scale of the SILS has been found to be appropriate for use with seniors. The mean SILS T-scores are presented in Table 1. Statistical analysis confirmed that the groups did not differ from one another with respect to SILS T-scores.

Table 1

Means and Standard Deviations for the FPQ-III, Modified ABC Scale, CES-D, MMSE, SILS T-Scores, & STAI

	FPQ-III	Modified ABC	CES-D	MMSE	SILS T-Score	STAI (State)	STAI (Trait)
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Seniors							
High Fear of Pain	95.66 (9.66)	1123.21 (315.80)	10.09 (6.80)	27.63 (1.70)	52.86 (7.06)	26.00 (6.71)	31.10 (7.48)
Low Fear of Pain	45.22 (9.56)	1336.41 (311.64)	9.26 (7.76)	28.41 (1.76)	53.20 (8.97)	26.42 (7.53)	30.67 (8.25)
Total Sample	71.30 (21.57)	1226.22 (337.12)	9.68 (7.24)	28.02 (1.76)	53.02 (7.71)	26.20 (7.05)	30.89 (7.80)
Younger Adults							
High Fear of Pain	93.71 (12.22)	1458.56 (171.98)	13.52 (12.28)	29.04 (0.93)	52.72 (6.64)	29.12 (8.69)	32.58 (7.29)
Low Fear of Pain	45.21 (10.51)	1413.57 (367.05)	7.86 (6.86)	29.04 (1.23)	50.07 (8.48)	28.07 (7.57)	31.41 (8.15)
Total Sample	68.70 (20.63)	1449.64 (244.93)	10.41 (10.00)	29.04 (1.09)	51.32 (7.71)	28.57 (8.06)	31.97 (7.71)
High Fear of Pain (Total Sample)	94.83 (10.77)	1266.32 (311.04)	11.45 (9.42)	28.22 (1.58)	52.80 (6.83)	27.30 (7.69)	31.73 (7.37)
Low Fear of Pain (Total Sample)	45.22 (9.92)	1371.26 (337.15)	8.63 (7.34)	28.69 (1.56)	51.76 (8.81)	27.20 (7.53)	31.02 (8.14)

Note. FPQ-III = Fear of Pain Questionnaire-III; ABC = Activities-Specific Balance Confidence Scale; CES-D = Center for Epidemiologic Depression Scale; MMSE = Mini Mental State Examination; SILS = Shipley Institute of Living Scale; STAI = State Trait Anxiety Inventory

2.2.2.4 *The State Trait Anxiety Inventory*

The STAI (Spielberger et al., 1970) is a 20-item self-report questionnaire that has been found to be both reliable and valid (Spielberger et al., 1984). Although normative information for seniors on the STAI is available (Knight, Waal-Manning, & Spears, 1983), previous research has not detected substantial differences between seniors' scores and those of younger adults (Tuokko & Hadjistavropoulos, 1998). The means of the groups on both versions of the STAI are presented in Table 1. The groups on the State and Trait versions of the STAI using multiple t-tests and did not differ significantly from one another.

2.2.2.5 *The Center for Epidemiologic Studies Depression Scale*

The Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977) is a 20-item self-report index of depression that was developed for use in the general population. The CES-D has been found to have high internal consistency ($r = 0.85$) and can discriminate between clinical and non-clinical groups (Radloff, 1977). CES-D normative data for seniors are available (Canadian Study of Health and Aging Work Group, 1994). The means for the groups on the CES-D are presented in Table 1.

2.2.2.6 *Mini-Mental State Examination*

The Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) was used to establish that all participants were cognitively intact. It is composed of 11 items that are designed to assess orientation, registration, attention, calculation, and language. It has been found to have adequate inter-rater and test-retest reliabilities (usually well above 0.80) and has been shown repeatedly to be a valid test when used with seniors (Tuokko & Hadjistavropoulos, 1998). A cut-off score of 23 was used to determine whether the participants were cognitively intact (Tombaugh & McIntyre, 1992). One participant scored below this cut-off point and her data were removed from subsequent analyses. The mean MMSE scores are presented in Table 1.

2.2.3*Procedure*

2.2.3.1 *Stroop Task*

Participants were administered the Modified Stroop task in a quiet room. The experimenter and each participant tested the microphone to ensure that the volume iwas adequate for the computer to recognise the participant's verbal response. The participants then engaged in a practice session. They were required to respond to 10 words by saying the name of the colour the word was printed in. The word and the colour were randomly determined from the four colours of RED, BLUE, YELLOW and GREEN and the words RED, BLUE, YELLOW, and GREEN. Finally, the participants were required to complete the Modified Stroop task.

The Modified Stroop task consisted of 200 trials. The first 100 trials were presented to the participant and then he or she was allowed a five-minute break. Following the break, a second block of 100 trials was presented. The 50 stimulus words were each presented in four colours so that each word was shown four times. The four colours were RED, GREEN, YELLOW, and BLUE. Each stimulus word appeared in the middle of the computer screen and the lettering was 30 mm high. The computer was programmed to randomly select stimulus colours and to ensure that each stimulus word was presented in each colour. In this way, each colour was presented to the participant 50 times. In addition, the 200 stimulus words were shown in a different random order for each participant.

The computer screen background was black. The stimulus word remained on the screen until the participant responded verbally. The verbal response triggered the computer screen to become blank. The screen remained blank for one second and then the participant was presented with the next stimulus word. The software was programmed to record the colour-naming latency on each trial. The colour-naming latency was the time between the presentation of the word and the participant's verbal response. The participants were asked to name the colour of the word as quickly as possible and to ignore the meaning of the word.

Immediately following the participant's response, the experimenter recorded the accuracy of the response by pressing a key. Incorrect responses were excluded from the analysis. In addition, trials during which the participant activated the microphone by his or her breathing and not by a verbal response were excluded from the analysis.

2.2.3.2 *Recall Memory Task and Self-Report Instruments*

Following the Modified Stroop task, the participants were asked to complete a filler task (counting backwards by threes from 300 for two minutes). They were then tested for memory of the previously presented words in the Modified Stroop task by means of free-recall.

Following the Modified Stroop and free-recall task, the participants were administered the self-report instruments including the CES-D, the MMSE, the SILS: Vocabulary Test, and the STAI. The SILS Vocabulary Test (Shipley, 1940) was administered as a measure of vocabulary. The MMSE (Folstein, Folstein, & McHugh, 1975) was administered to ensure that all participants scored within the normal, cognitively intact range (Canadian Study of Health and Aging Work Group, 1994).

3. RESULTS

3.1 Group Comparison of Depression, Anxiety, and Other Related Variables

Independent sample *t*–tests were conducted to compare the groups with respect to the variables of interest. The means for these measures are presented in Table 1. First, the seniors and the younger participants were compared. The seniors scored significantly higher on the GPM compared to the younger participants, $t\ (120.13) = 2.04, p < 0.05$. The seniors also reported significantly lower scores on the ABC, indicating greater fear of falling, $t\ (119.44) = 3.71, p < 0.01$. Seniors were also found to have lower scores on the MMSE than did younger adults, $t\ (115.30) = -3.94, p < 0.01$. The age groups did not differ on the CES-D or the STAI (state or trait version).

With respect to the two groups of seniors (high fear of pain vs. low fear of pain), no differences were found regarding mean age, years of education, CES-D scores, STAI scores (state and trait versions) or MMSE scores. Between the two groups of younger adults (high fear of pain and low fear of pain), no differences were found regarding mean age, years of education, CES-D scores, STAI scores (state and trait versions) or MMSE scores.

When the two high fear of pain groups were considered (seniors vs. younger adults), no differences were detected regarding years of education, CES-D scores, or STAI scores (state and trait versions). The seniors with high levels of fear of pain did, however, have significantly lower MMSE scores than the younger participants with high levels of fear of pain, $t\ (54.94) = -4.12, p < 0.01$. When the two low fear of pain groups were considered (seniors and younger adults), the seniors were found to have significantly fewer years of education than the younger adults, $t\ (59) = 2.44, p < 0.05$.

The two low fear of pain groups did not differ with respect to CES-D scores, STAI scores (state and trait versions) or MMSE scores.

3.2 Fear of Pain and Fear of Falling

Using the data obtained from the total sample (i.e., those who participated in Phase I), two independent sample t-tests were performed to determine whether the group of seniors differed from the younger group with respect to their scores on the fear subscales of the ABC and FPQ-III total scores. The means are presented in Table 1. The seniors and younger adults did not differ with respect to their scores on the FPQ-III, $t(248) = 0.97, p = 0.33$. The same groups, however, were found to differ with respect to ABC total scores, $t(219.22) = -5.580, p < 0.01$.

Using correlational analysis, the inter-relationship of the FPQ-III scores and the SAFE scores was examined separately for each age group, anticipating higher correlations among seniors as compared to younger adults (hypothesis 1). For the seniors, the correlation coefficient was found to be significant in the expected direction, $r = -0.27, p < 0.01$. That is, the negative correlation indicates that as ABC scores decrease (signifying less confidence) FPQ-III scores increase (signifying greater levels of fear of pain). For the younger participants, the variables were not significantly related, $r = 0.14$, $p > 0.05$. The magnitudes of the correlations were compared using the procedures described by McNemar (1962). These correlations were significantly different, $Z = -3.26$, $p < 0.01$.

To explore the relationship between fear of pain and fear of falling, the data obtained in Phase II of the investigation was utilized. To determine whether the constructs of fear of pain and fear of falling had different correlates, Correlation coefficients were computed between ABC total scores and GPM scores, ABC and STAI scores (state and trait versions), ABC and CES-D scores, ABC and years of education, ABC and SILS T-scores, ABC and MMSE scores, and ABC and age. ABC total scores were significantly correlated with GPM scores, CES-D scores, years of education, MMSE scores, and age (Table 2). No other significant correlations were found. This suggests that as level of efficacy for engaging in a task without falling or becoming unsteady decreases, level of pain increases, level of depression increases, years of education decreases, MMSE scores decrease, and age increases.

The same types of correlation coefficients were computed for FPQ-III total scores and GPM scores, FPQ-III and STAI scores (state and trait versions), FPQ-III and CES-D scores, FPQ-III and years of education, FPQ-III and SILS T-scores, FPQ-III and MMSE scores, and FPQ-III and age. It was determined that FPQ-III total scores significantly correlated with MMSE scores (Table 2). This suggests that as level of fear of pain increases, MMSE scores decrease. No other significant correlations were found.

To further explore the relationship between fear of pain and fear of falling, the above analyses were repeated separately for the seniors and younger adults. It was found that ABC scores significantly correlated with age for the seniors, but not for the younger adults. Moreover, independent *t*-tests suggested that for the seniors the high fear of pain group had significant less confidence (lower ABC scores), $t\,(67) = 2.81, p < 0.01$. This same difference was not present in the younger participants. ABC scores were found to significantly correlate with GPM scores for both the seniors and the younger adults. Similarly, MMSE scores and ABC scores were significantly related for both the seniors and the younger adults. CES-D scores and ABC scores were only significantly related

Table 2:

Correlations Between ABC and GPM, STAI, CES-D, Education, SILS T-scores, MMSE, and age. Correlations Between FPQ-III and GPM, STAI, CES-D, Education, SILS T-Scores, MMSE, and Age

	ABC Scores							
	GPM	STAI-State	STAI-Trait	CES-D	Years of Education	SILS-T Scores	MMSE	Age
Total Sample	-0.45**	0.03	-0.16	-0.20*	0.21**	-0.06	0.36**	-0.33**
Seniors	-0.48**	0.02	-0.18	-0.24*	0.24**	-0.11	0.27*	-0.28**
Younger Adults	-0.29**	-0.09	-0.21	-0.21	-0.04	0.09	0.36**	-0.03
	FPQ-III Scores							
	GPM	STAI-State	STAI-Trait	CES-D	Years of Education	SILS-T Scores	MMSE	Age
Total Sample	0.12	0.03	0.11	0.18	-0.07	0.06	-0.20*	0.03
Seniors	0.19*	0.02	0.10	0.12	-0.06	-0.04	-0.25*	0.03
Younger Adults	0.004	0.08	0.15	0.24	-0.05	0.20	-0.10	-0.08

Note. ABC = Activities-Specific Balance Confidence Scale; GPM = Geriatric Pain Measure; STAI = State Trait Anxiety Inventory; CES-D = Center for Epidemiologic Depression Scale; SILS = Shipley Institute of Living Scale; FPQ-III = Fear of Pain Questionnaire-III; MMSE = Mini Mental State Examination

* Significant at the $p < 0.05$ level

for the seniors and years of education and ABC scores were only significantly related for the seniors. Moreover, it was established that FPQ-III scores correlated significantly with GPM scores only for the seniors. MMSE scores and FPQ-III scores were significantly correlated for the seniors but not for the younger adults (Table 2). No other significant correlations were found.

3.3 Phase II: Calculation of Stroop Interference Scores, Difference Scores and Cleaning of the Data

The analysis of the Modified Stroop data allowed for the determination of whether selective attentional processes relating to fear of pain and fear of falling differed among seniors and younger persons. To correct for the heterogeneity among the participants in their reaction times (especially with respect to the seniors having slower reaction times than the younger adults), Stroop interference scores were calculated for each of the word categories. This was accomplished by calculating the average difference between each emotion word type and the neutral words (separately for each participant). Four Stroop interference scores were calculated: pain-related words – neutral words, social threat words – neutral words, positive words – neutral words, and fall-related words – neutral words. A positive difference score indicates that the reaction times were slower for the emotion word type than for the neutral word type and a negative difference score indicates that the reaction times were slower for the neutral word type than for the emotion word type.

Prior to analyses, errors and outliers in the Modified Stroop data were checked. Errors occurred on 3.02% of the 24 600 colour-naming trials. The errors were of two types. The first type were those due to the participant naming the wrong colour. The second type were those due to technical difficulties (i.e., the microphone being tripped early by the participants' breathing or by background noise). The trials with errors were removed from the analyses. Participants who had difference scores that were 3 standard deviations above or below the mean were considered outliers and were dealt with by assigning a score that was one unit larger or smaller than the next extreme score in the distribution that was not an outlier (Tabachnick & Fidell, 1989). For the seniors, 12 outliers were detected and for the younger participants 9 outliers were detected. Prior to the analysis, the distributions of the Stroop interference scores were checked for normality. The four distributions were not found to be significantly different from a normal distribution using a one-sample Kolmlgorov-Smimov D-test.

The analysis of the free-recall task data allowed for determination of whether memory biases relating to fear of pain and fear of falling differed among seniors and younger persons. To account for heterogeneity among the participants in their ability to remember the words presented in the Modified Stroop task (especially with respect to the seniors remembering fewer words than the younger adults), free-recall difference scores were calculated for each of the word categories. This was accomplished by calculating the average difference between each emotion word type and the neutral words (separately for each participant). Four interference difference scores were calculated: pain-related words – neutral words, social threat words – neutral words, positive words – neutral words, and fall-related words – neutral words. A positive difference score indicated that the participant remembered more emotion words than neutral words and a negative difference score indicated that the participant remembered more neutral words than emotion words.

Prior to analyses, the free-recall difference scores were checked for outliers (scores that were 3 standard deviations above or below the mean) (Tabachnick & Fidell, 1989). The only outliers that were detected were only one unit above or below the next score that was not an outlier. Because of the nature of the data (i.e., little variation within the data, a highly restricted range of scores) and difficulty determining an appropriate outlier transformation, they were not replaced. For example, the range of scores for some of the difference score categories was –3 to 3. Positive three was considered an outlier. However, to replace the outlier, one would have to determine the next highest score, which was not an outlier (2) and replace it with one unit larger than that (3). To replace the outlier with 2, substantial variation would have been lost in the data. The distributions of the Stroop interference scores were also checked for normality. The four distributions were found to be significantly different from a normal distribution using a one-sample Kolmlgorov-Smimov D-test. A variety of data transformations were attempted (e.g., logarithm, square root), but these failed to normalize the distributions due to the highly restricted range of scores. Given that ANOVA tends to be quite robust with respect to violations of normality, the analysis was carried out.

3.3.1 *Covariates*

Before proceeding with analyses of the Stroop interference scores and the free-recall difference scores, a variety of variables that could affect the dependent variables were considered as possible covariates.

3.3.1.1 *Levels of Pain*

GPM scores were considered as a potential covariate because in Phase II, the seniors had significantly higher scores on the GPM than the younger participants,

$t(120.13) = 2.04, p < 0.05$. To determine whether scores on the GPM significantly correlated with the dependent variables (i.e., the difference scores for the response latencies and the difference scores for the recall memory task), Pearson correlation coefficients were calculated between GPM total scores and Stroop interference scores and between GPM total scores and memory difference scores (i.e., pain –neutral words, social threat – neutral words, positive – neutral words, and fall – neutral words). The GPM total scores did not significantly correlate with either the Stroop interference scores (range of $r = -0.07$ to $r = 0.03$) or the memory difference scores (range of $r = -0.03$ to $r = 0.04$) and were not used as covariates in either analysis.

3.3.1.2 *Levels of Fear of Falling*

ABC scores were considered as a potential covariate because in Phase II, the seniors had significantly lower scores on the ABC than the younger participants, $t(119.44) = 3.71, p < 0.01$. To determine whether scores on the ABC significantly correlated with the dependent variables (i.e., the difference scores for the response latencies and the difference scores for the recall memory task), correlation coefficients were calculated between ABC total scores and Stroop interference scores and between ABC total scores and memory difference scores (i.e., pain –neutral words, social threat – neutral words, positive – neutral words, and fall – neutral words). The ABC total scores did not significantly correlate with either the Stroop interference scores (range of $r = -0.05$ to $r = 0.12$) or the memory difference scores (range of $r = -0.03$ to $r = 0.09$) and also were not used as covariates in either analysis.

3.3.1.3 *Levels of Anxiety*

State and Trait anxiety were measured to determine whether either was significantly correlated with the dependent variables of interest. Although STAI scores did not differ among the groups, State and Trait anxiety were considered potential covariates because emotional variables such as anxiety have been previously shown to impact attentional biases and memory biases (e.g., Amir et al., 2000; Pincus et al., 1998). Correlation coefficients were calculated for the state version of the STAI and Stroop interference scores (range of $r = -0.04$ to $r = 0.05$) and for the trait version of the STAI and Stroop interference scores (range of $r = -0.06$ to $r = -0.01$). Correlation coefficients were also calculated for the state version of the STAI and the recall memory difference scores (range of $r = -0.16$ to $r = -0.09$) and the trait version of the recall memory difference scores (range of $r = -0.11$ to $r = -0.03$). Neither state nor trait anxiety significantly correlated with the dependent variable so they were not used as covariates in further analyses.

3.3.1.4 *Levels of Depression*

Depression was measured to determine whether CES-D total scores would correlate significantly with the dependent variables. Although the groups did not differ significantly with respect to their CES-D total scores, level of depression was considered as potential covariate because it has been shown to impinge on attentional and memory biases (e.g., Edwards et al., 1992; Snider et al., 2000). Correlation coefficients were calculated for CES-D total scores and Stroop interference scores (range of $r = 0.01$ to $r = 0.11$) and for CES-D total scores and memory recall difference scores (range of $r = -0.01$ to $r = -0.11$). The correlations were not found to be significant. Therefore, CES-D total scores were not used as covariates for either analysis.

3.3.1.5 *Years of Education*

Because the years of education differed for the seniors and younger adults, t (119) = 3.09, $p < 0.05$, this was investigated as a covariate. Correlation coefficients were calculated to determine whether years of education significantly correlated with Stroop interference scores (range of r = -0.01 to r = 0.13) or free-recall memory difference scores (range of r = 0.01 to r = 0.13). None of the correlations were significant, so education was not used as a covariate in further analyses.

3.3.1.6 *Mini-Mental Status Examination*

Because the seniors had significantly lower scores than the younger participants both overall, t (115.30) = -3.94, $p < 0.01$, and for the high fear of pain groups (i.e., seniors with high levels of fear of pain had significantly lower MMSE scores than younger adults with high levels of fear of pain), t (54.94) = -4.12, $p < 0.01$, these scores were investigated as a potential covariate. Correlation coefficients were calculated to determine whether the MMSE scores significantly correlated with either the Stroop interference scores (range of r = -0.09 to r = 0.15) or the free-recall memory difference scores (range of r = -0.01 to r = -0.11). Because neither of the correlations were found to be significant, MMSE scores were not used as a covariate.

3.4 Stroop Task

It was hypothesised that people high in fear of pain would attend to pain-related stimuli when compared to their non-pain-fearful counterparts (hypothesis 2). In addition, it was hypothesised that there would be a significant age group by word-type by pain-status interaction (i.e., that attentional biases for fall-related words would be more salient among seniors) (hypothesis 3). In order to test these hypotheses, a 2 x 4 x 2 mixed-model factorial design was used. The between-groups factors were age (senior vs. younger adult) and level of fear of pain (high vs. low). The within-groups variable was difference score category (i.e., pain-related – neutral, social threat – neutral, positive – neutral, fall-related – neutral). The dependent variable in the analysis was the Stroop interference scores for each of the categories. The means and standard deviations are presented in Table 3.

The analysis for the ANOVA is presented in Table 4. A within-subjects main effect was found for Stroop interference score category, $F\,(3, 357) = 3.02, p < 0.05$. Post-hoc comparisons were conducted using Tukey's HSD test. The critical value for these comparisons was HSD = 8.23, $q_{(.05, 357, 4)} = 3.63$. The difference between the pain – neutral (Mean = 7.46, *SD* = 35.34) and the positive – neutral means (Mean = -2.81, *SD* = 43.64) was significant. Similarly, the pain – neutral mean was significantly different from the fall – neutral mean (Mean = -1.22, *SD* = 39.89). No other effects were significant. These comparisons indicate that the participants took longer to name the colour of pain-related words than that of positive words (after accounting for the effect of neutral words) and that they took longer to name the colour of pain-related words than fall-related words (after accounting for the effect of neutral words).

A significant interaction was found for Stroop interference score category by age, $F\,(3, 357) = 2.93, p < 0.05$ (Figure 2). Post-hoc comparisons were conducted using Tukey's HSD test. Because the number of seniors and younger adults differed, the harmonic mean was used ($N_h = 60.61$). The critical value for these comparisons was HSD = 12.68, $q_{(.05, 357, 4)} = 3.63$. Regarding the social threat – neutral difference score category, the mean Stroop interference scores for the younger adults (Mean = 12.45, *SD*

Table 3

Mean Stroop interference scores (and Standard Deviations) By Age, Fear of Pain, and Difference Score Category

	N	Pain – Neutral (SD)	Social Threat – Neutral (SD)	Positive – Neutral (SD)	Fall – Neutral (SD)	Total (SD)
Seniors						
High Fear of Pain	35	2.29 (35.57)	-9.35 (47.61)	-17.55 (49.81)	1.39 (43.44)	-5.80 (35.41)
Low Fear of Pain	34	11.23 (42.21)	0.36 (42.23)	-6.34 (46.72)	-12.29 (45.33)	-1.76 (36.31)
Total Sample	69	6.70 (38.95)	-4.57 (44.97)	-12.03 (48.29)	-5.35 (44.59)	-3.81 (35.65)
Younger Adults						
High Fear of Pain	26	16.38 (27.27)	20.60 (32.99)	12.18 (33.03)	7.54 (34.25)	14.17 (23.38)
Low Fear of Pain	28	1.06 (31.81)	4.89 (32.34)	6.00 (34.77)	0.81 (31.21)	3.19 (27.19)
Total Sample	54	8.44 (30.43)	12.45 (33.76)	8.98 (33.76)	4.05 (32.57)	8.48 (25.79)
High Fear of Pain (Total Sample)	61	8.29 (32.80)	3.42 (44.28)	-4.88 (45.61)	4.01 (39.59)	2.71 (32.21)
Low Fear of Pain (Total Sample)	62	6.64 (37.91)	2.40 (37.85)	-0.77 (41.88)	-6.37 (39.82)	0.47 (32.35)
Total Sample	123	7.46 (35.34)	2.91 (41.00)	-2.81 (43.64)	-1.22 (39.89)	1.58 (32.17)

Table 4

Analysis of Variance Examining the Impact of Age, Fear of Pain (FOP), and Difference Score Category (DSC) on Stroop interference scores

Source	Sum of Squares	*DF*	Mean Square	*F*
DSC	6698.12	3	2232.71	3.02*
DSC X Age	6495.98	3	2165.33	2.93*
DSC X FOP	2465.16	3	821.72	1.11
DSC X Age X FOP	5161.79	3	1720.60	2.33
Error (DSC)	263897.42	357	739.21	
Source	Sum of Squares	*DF*	Mean Square	F
Age	18815.47	1	18815.47	4.67*
FOP	1458.72	1	1458.72	.36
Age X FOP	6831.19	1	6831.19	1.70
Error	479068.33	119	4025.78	

* Significant at the $p < 0.05$ level

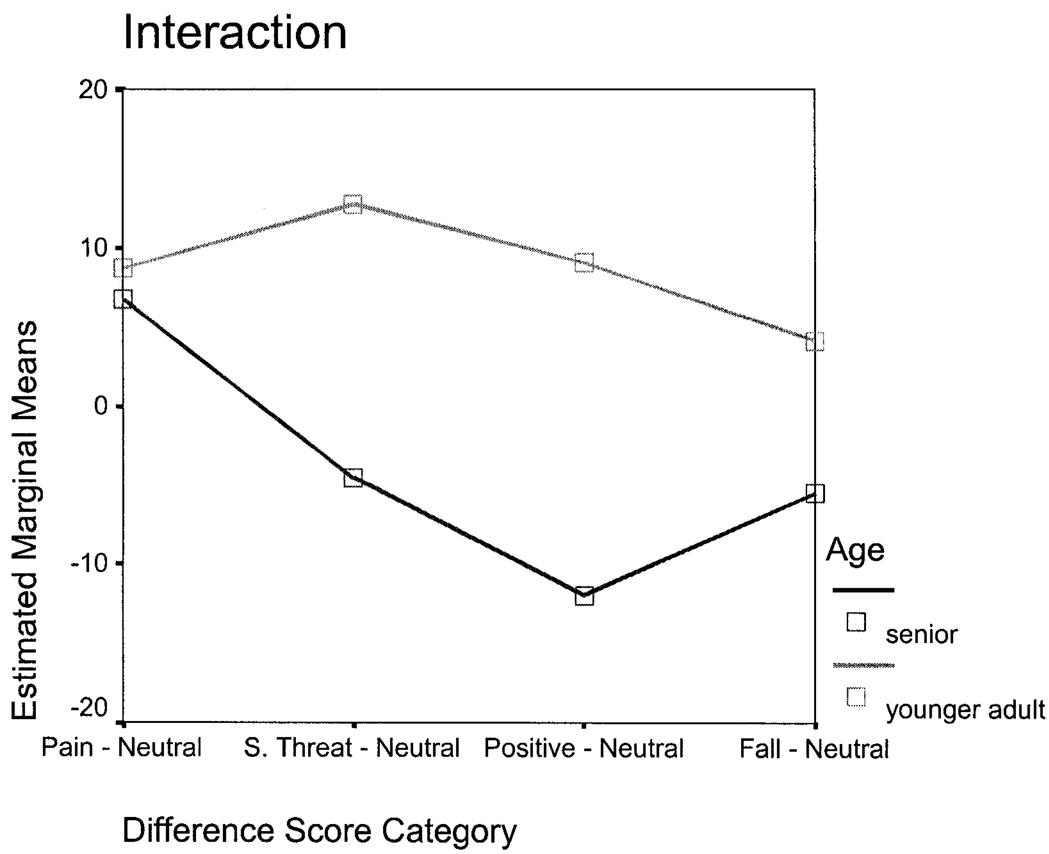

Figure 2: Interaction for Age X Difference Score Category for Analysis of Variance Examining the Impact of Age, Fear of Pain, and Difference Score Category on Stroop interference scores

= 33.76) were significantly different than the mean difference scores for the seniors (Mean = -4.57, *SD* = 44.97). In addition, with respect to the positive – neutral Stroop interference score category, the younger adults' mean interference score (Mean = 8.98, *SD* = 33.76) was found to be significantly different from that of the seniors (Mean = -12.03, *SD* = 48.29). The differences in the means indicate that the younger adults demonstrated longer response latencies than the seniors for both the social threat words and the positive words (after accounting for the effect of the neutral words). With respect to the between-subjects effects, a significant main effect was found for age, $F\,(1, 119) = 4.67$, $p < 0.05$ (Table 4). The seniors had significantly lower difference scores (Mean = -3.81, *SD* = 35.65) than the younger adults (Mean = 8.48, *SD* = 25.79). No other significant effects were found in the mixed factorial ANOVA.

It is important to note that the main analysis was also done using mean response latency scores for each of the five word categories (i.e., pain, social threat, positive, neutral, and fall). These results are not reported because they did not differ from the analyses of the difference scores pertaining to the hypotheses.

3.5 Free-Recall

It was hypothesized that people with high levels of fear of pain would remember more pain-related words than other categories of words. Furthermore, it was expected that seniors would remember more fall-related words than younger participants (after controlling for the effect of age). To evaluate this hypothesis, a 2 x 4 x 2 mixed-factorial design was used. The between-groups factors included age (senior vs. younger adult) and fear of pain (high vs. low). The within-groups variable was free-recall difference score category (pain-related – neural, social threat – neutral, positive – neutral, and fall-related

– neutral). The dependent variable in the analysis was the free-recall difference scores for each of the categories. The interaction between fear of pain status, age group, and word type was of primary interest. The means and standard deviations are presented in Table 5.

The ANOVA results are presented in Table 6. A main effect was found for free-recall difference score category, $F\,(3, 354) = 15.26, p < 0.01$. Post-hoc comparisons were made using Tukey's HSD test with p set at 0.05. The critical value for these comparisons was HSD = 0.23, $q_{(.05, 354, 4)} = 3.63$. The pain – neutral difference score (Mean = 0.29, *SD* = 1.01) was significantly different from the social threat -- neutral mean difference score (Mean = -0.19, *SD* = 0.75) (i.e., the difference score was larger for the pain words than social threat words, see Table 5). Similarly, the pain – neutral mean difference score was significantly different than the fall – neutral mean difference score (Mean = -0.11, *SD* = 1.01) (i.e., the difference scores were larger for the pain words than the fall-related words). The positive – neutral mean (Mean = 0.24, *SD* = 1.13) was different than the social threat – neutral mean and the positive – neutral mean was different than the fall – neutral mean (i.e., the differences scores were larger for the positive words than for either the social threat words or the fall-related words). Overall, the participants remembered more pain-related words than either social threat words or fall-related words. Additionally, they remembered more positive words than either social-threat words or fall-related words (after accounting for the effect of the neutral words).

A significant difference score category by age interaction was identified, $F\,(3, 354) = 3.56, p < 0.05$ (Figure 3). Post-hoc comparisons were made using Tukey's HSD test with the p value set at 0.05. Because the sample sizes of seniors and younger

Table 5

Mean Free-Recall Difference Scores By Age, Fear of Pain, and Difference Score Category

	N	Pain – Neutral (SD)	Social Threat – Neutral (SD)	Positive – Neutral (SD)	Fall – Neutral (SD)	Total
Seniors						
High Fear of Pain	35	0.17 (0.82)	-0.14 (0.69)	0.17 (1.04)	-0.03 (1.01)	0.04 (0.72)
Low Fear of Pain	34	0.12 (0.95)	-0.15 (0.74)	0.12 (1.12)	-0.03 (0.97)	0.01 (0.79)
Total Sample	69	0.14 (0.88)	-0.14 (0.71)	0.14 (1.07)	-0.03 (0.98)	0.03 (0.75)
Younger Adults						
High Fear of Pain	25	0.52 (1.12)	-0.32 (0.95)	0.24 (1.16)	-0.40 (1.19)	0.01 (0.79)
Low Fear of Pain	28	0.39 (1.20)	-0.18 (0.67)	0.46 (1.23)	-0.07 (0.90)	0.15 (0.79)
Total Sample	53	0.45 (1.15)	-0.25 (0.81)	0.36 (1.19)	-0.23 (1.05)	0.08 (0.79)
High Fear of Pain (Total Sample)	60	0.32 (0.97)	-0.22 (0.80)	0.20 (1.09)	-0.18 (1.10)	0.03 (0.75)
Low Fear of Pain (Total Sample)	62	0.24 (1.07)	-0.16 (0.71)	0.27 (1.18)	-0.05 (0.93)	0.08 (0.79)
Total Sample	122	0.29 (1.01)	-0.19 (0.75)	0.24 (1.13)	-0.11 (1.01)	0.05 (0.76)

Table 6

Analysis of Variance Examining the Impact of Age, Fear of Pain (FOP), and Difference Score Category(DSC) on Free-Recall Difference Scores

Source	Sum of Squares	*DF*	Mean Square	*F*
DSC	23.49	3	7.83	15.26**
DSC X FOP	1.02	3	0.34	0.66
DSC X Age	5.48	3	1.83	3.56*
DSC X Age X FOP	0.73	3	0.24	0.47
Error (DSC)	181.72	354	0.51	
Source	Sum of Squares	*DF*	Mean Square	*F*
FOP	0.39	1	0.39	0.16
Age	0.33	1	0.33	0.14
FOP X Age	0.86	1	0.86	0.36
Error	281.62	118	2.39	

* Significant at the $p < 0.05$ level

** Significant at the $p < 0.01$ level

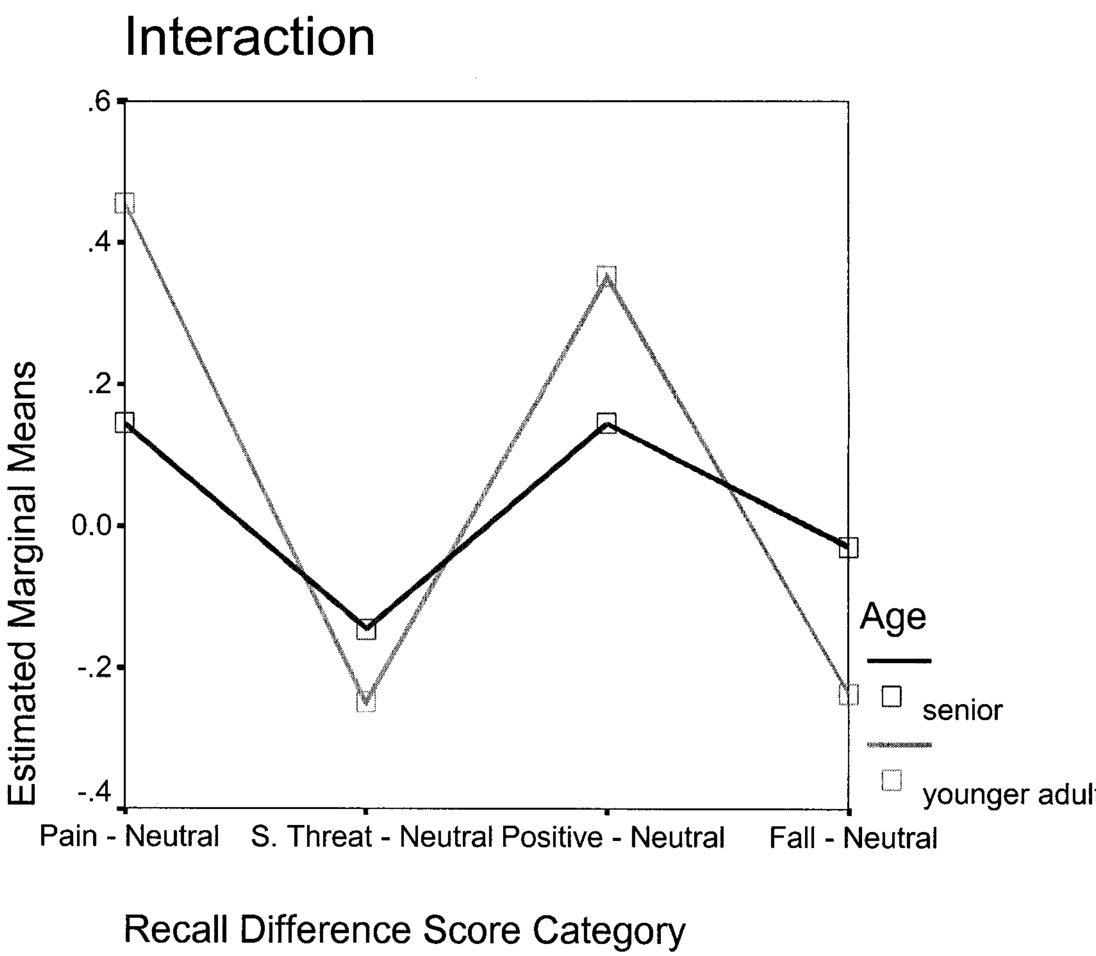

Figure 3: Interaction between Recall Difference Score Category and Age for the Analysis of Variance Examining the Impact of Age, Fear of Pain, and Difference Score Category on Free-Recall Difference Scores

adults differed, the harmonic mean was used ($N_h = 59.88$). The critical value for these comparisons was HSD = 0.34, $q_{(.05, 354, 4)} = 3.63$. No significant differences were detected in the free-recall difference score means of any of the categories. Although the means did not differ significantly for any of the four difference score categories, it was evident (see Figure 3) that the pattern of results was reversed for the pain – neutral category and the positive – neutral category. For these two categories, younger adults remembered more words (after accounting for the effect of the neutral words). However, for the pain-neutral category and the fall-neutral category, the seniors remembered more words (after accounting for the effect of the neutral words). An examination of the between-subjects effects (Table 6) revealed no main effects and no significant interactions.

It is important to note that the main analyses were also performed using the mean number of words remembered for each of the five word categories (i.e., pain, social threat, positive, neutral, and fall). These results are not reported because they did not differ from the analyses of the difference scores when pertaining to the hypotheses.

3.6 Exploratory Analyses

3.6.1 *Analysis of variance exclusively with the younger adults.*

Exploratory analyses (i.e., analyses that were not originally proposed) were conducted in order to determine whether the seniors and younger adults responded differently to the four difference score categories. That is, the main analysis pertaining to the Stroop interference scores was conducted separately for seniors and younger adults. This analysis was deemed to be more powerful in detecting differences within each group. To this end, a 2x4 mixed factorial ANOVA was conducted with the younger participants. The independent variables were levels fear of pain (high vs. low) and difference score category (pain – neutral, social threat – neutral, positive – neutral, and fall – neutral). The dependent variable in the analysis was the Stroop interference scores (see Table 7). No significant effects were found.

3.6.2 *Analysis of variance exclusively with the seniors.*

An exploratory analysis pertaining to the Stroop interference scores was conducted with the seniors. A 2x4 mixed factorial ANOVA was used. For this analysis, the independent variables were levels fear of pain (high vs. low) and difference score category (pain – neutral, social threat – neutral, positive – neutral, and fall – neutral). The dependent variable was the Stroop interference scores. The analysis of the relevant effects is presented in Table 8. A main effect was found for difference score category F (3, 201) = 4.61, $p < 0.01$. Post-hoc comparisons were conducted using Tukey's HSD test. The critical value for these comparisons was HSD = 13.13, $q_{(05, 201, 4)} = 3.63$. The pain – neutral mean (M = 6.70, *SD* = 38.95) was significantly different from the positive – neutral mean (*M* = -12.03, *SD* = 48.29), indicating that the seniors had longer response latencies for pain words than for positive words (after accounting form the effect of the neutral words).

The within-subjects effects also indicated a significant interaction between difference score category and level of fear of pain, F (3, 201) = 2.68, $p < 0.05$ (Figure 4). Post-hoc comparisons were conducted using Tukey's HSD test with a p value set at 0.05. Because the number of seniors in the high fear of pain group differed from the number in the low fear of pain group, the harmonic mean was used ($N_h = 34.48$). The critical value for these comparisons was HSD = 18.58, $q_{(.05, 201, 4)} = 3.63$. Although the means did not differ significantly at any of the four difference score categories, it is evident from Figure

Table 7

Analysis of Variance Examining the Impact of Fear of Pain and Difference Score Category on Stroop interference scores for the Younger Participants

Source	Sum of Squares	*DF*	Mean Square	*F*
Difference Score Category	1994.58	3	664.86	1.26
Difference Score Category X Fear of Pain	1110.48	3	370.16	0.70
Error (Difference Score Category)	82403.52	156	528.22	
Source	Sum of Squares	*DF*	Mean Square	*F*
Fear of Pain	6504.68	1	6504.68	2.52
Error	134485.06	52	2586.25	

Table 8

Analysis of Variance Examining the Impact of Fear of Pain and Difference Score Category on Stroop interference scores for the Seniors

Source	Sum of Squares	*DF*	Mean Square	*F*
Difference Score Category	12484.83	3	4161.61	4.61**
Difference Score Category X Fear of Pain	7271.33	3	2423.78	2.68*
Error (Difference Score Category)	181493.90	201	902.96	

Source	Sum of Squares	*DF*	Mean Square	*F*
Fear of Pain	1126.24	1	1123.24	0.22
Error	344583.27	57	5143.03	

* Significant at the $p < 0.05$ level

* Significant at the $p < 0.01$ level

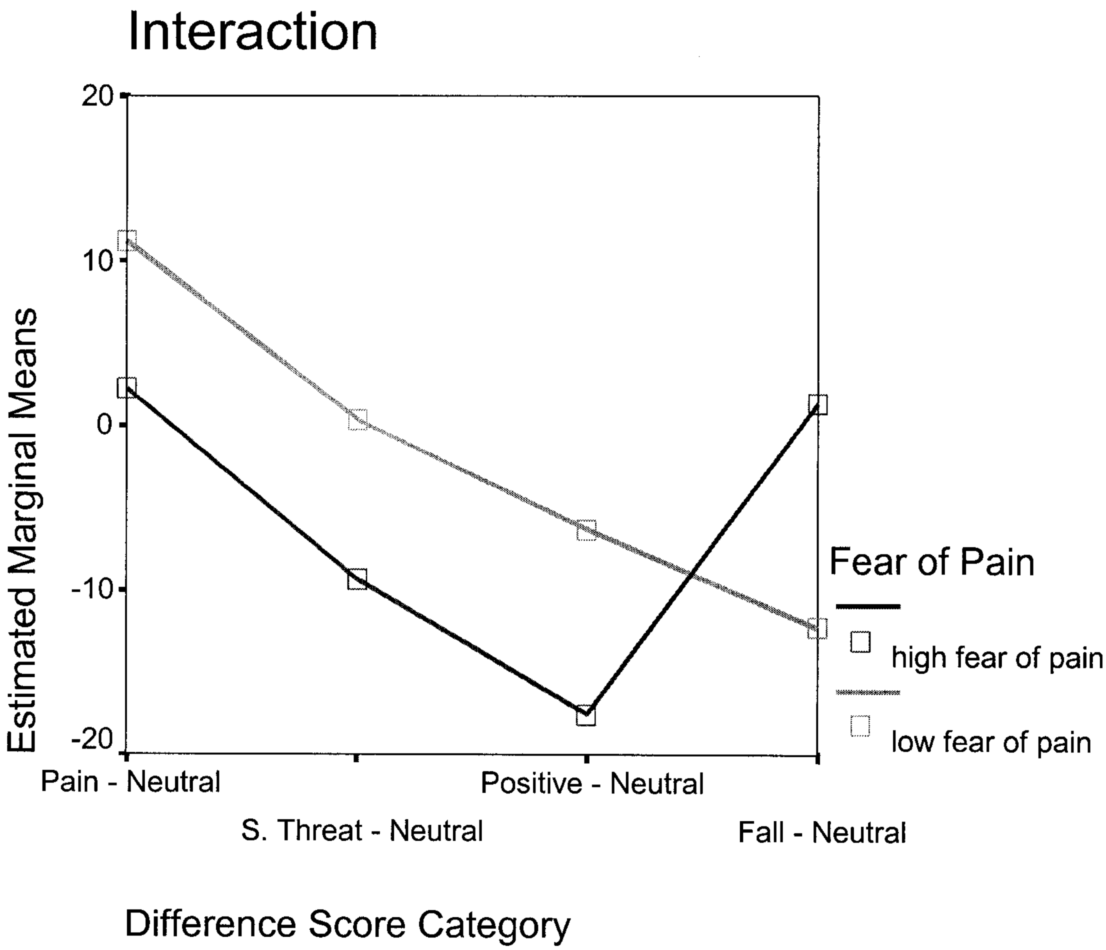

Figure 4: Interaction for Level of Fear of Pain X Difference Score Category for the Analysis of Variance Examining the Impact of Fear of Pain and Difference Score Category on Stroop interference scores for the Seniors

4 that the pattern of results was reversed for the fall – neutral category. For the pain-neutral, social threat - neutral, and positive - neutral categories, the high fear of pain group had lower difference scores (i.e., they were quicker to respond to these categories after accounting for the effect of the neutral words), but this pattern is reversed for the fall – neutral category (i.e., they took longer to respond to the fall-related words after accounting for the effect of the neutral words). No other significant main effects were identified.

4. DISCUSSION

This study investigated the generalizability of existing models of chronic pain to seniors. Using the fear-avoidance model of pain (e.g., Lethem et al., 1983; Philips, 1987; Vlaeyen & Linton, 2000), attentional and memory biases among seniors and younger adults who were pain-fearful were investigated. Prior to this investigation, attentional biases for pain-related stimuli among healthy people with high levels of fear of pain have only been studied using college samples (Keogh et al., 2000; Roelofs et al., 2002). It was expected that people with high levels of fear of pain, regardless of age, would attend to pain related stimuli. Confirmation of this expectation would help to generalize these results to seniors. This would also extend the fear-avoidance model of pain, which has not been investigated previously among seniors.

The study of memory and attentional biases among seniors is necessary, as seniors differ from younger persons in many important respects. Investigation of fear of falling and fear of pain as potential contributors to memory and attentional biases among seniors could also assess the generalizability of the fear-avoidance model of pain. Because fear of falling is prevalent and significant among seniors (Howland et al, 1998;

Yardley & Smith, 2002), the relationship between fear of pain and fear of falling was examined, with an emphasis on the impact of fear of pain on attentional biases to fall-related words among seniors as well as the relationship of fear of falling to other variables (e.g., depression, anxiety, pain). Investigation of the relationship between fear of pain and fear of falling would expand our understanding of the fear-avoidance model of pain as it applies to seniors, thus assisting in the comprehension of the cognitive processes involved in possible development and maintenance of chronic pain conditions in this population.

4.1 Fear of Pain and Fear of Falling: Distinct Yet Related Constructs?

According to Hypothesis 1, fear of pain and fear of falling are distinct but related constructs. This relationship was expected to be greater among seniors than among younger adults. It was further expected that fear of pain and fear of falling would have a different pattern of correlates. This hypothesis was supported in this study. Although fear of falling is related to fear of pain, they are not synonymous. Fear of pain and fear of falling were correlated so that as fear of pain increased, confidence decreased regarding ability to complete activities without losing one's balance or becoming unsteady. When the relationship between these constructs was examined separately among seniors and younger adults, it was found that the magnitude of the relationship was greater among the seniors.

The pattern of correlates for fear of falling was different than for fear of pain. This was evident when the total sample was considered as well as when the seniors and younger adults were considered separately. When seniors only were considered, fear of falling was found to relate to pain intensity, age, cognitive functioning, level of depression, and years of education. Fear of pain only correlated with cognitive functioning and pain intensity. The reason for this pattern of correlations may be that fear of falling is a broader construct and that fear of pain is one of the more basic underpinnings of that construct. To illustrate, cognitive functioning and pain intensity correlate with both fear of pain and fear of falling among seniors. However, fear of falling also correlates with additional constructs. Perhaps fear of pain could be one of the reasons that some seniors have a fear of falling and the common correlates included are cognitive functioning and pain intensity. Fear of pain is likely a more basic, or prepared fear (Seligman & Hager, 1972) than fear of falling as avoidance of pain has immediate repercussions for the survival of the species. Both fear of pain and fear of falling may be the result of a broader fear; namely fear of injury.

The correlates of fear of falling in the literature were fairly consistent with the findings of this investigation (e.g., Arfken et al., 1993; Fessel & Nevitt, 1997; Tinetti et al., 1990). Anxiety, however, has been found to correlate with fear of falling in the literature (e.g., Drozick & Edelstein, 2001; Tinetti et al., 1990), but not in the present study. This may be explained by the lack of anxiety among the participants. For example, in the present study, the scores on the trait version of the STAI were quite low. Although Tinetti et al. (1990) used a cutoff value of 38 to determine high trait anxiety, only 20 participants (10 seniors and 10 younger adults) in the present study had scores that were 38 or higher (compared to nearly half in the study of Tinetti et al., 1990). Therefore, little anxiety in the sample (i.e., little variability of the data) may have contributed to the low correlation coefficients between fear of falling and trait anxiety.

The pattern of correlates for fear of pain has not been extensively studied in community samples (i.e., not in chronic pain patients). The marked lack of correlates for fear of pain in this study is not wholly inconsistent with the findings in the literature for community samples. For example, although Keogh et al. (2001) found that high and low fear of pain groups differed with respect to levels of anxiety, these results were not replicated in another recent study (Keogh et al., 2003).

Additionally, fear of falling is related to many aspects of an elderly person's life, not just fear of pain. Fear of falling has been associated with a senior's ability to perform activities of daily living (restriction of activities), gait, self-rated health, and social interactions (Howland et al., 1993). Each of these aspects may have its own unique set of mediating variables. To illustrate, consider depression. Depression is another commonly found correlate of fear of falling (Arfken et al., 1993; Fessel & Nevitt, 1997; Tinetti et al., 1990). Depression was found to correlate only with fear of falling (not fear of pain) in this study. It may be that depression functions as another mediating variable, similar to pain possibly by partially mediating the relationship between fear of falling and social interactions. As fear of falling increases, depression increases, and social interactions decrease. Therefore, as a broader concept, fear of falling may have several sub-components. These subcomponents may include, among others, fear of pain.

One of the more interesting findings of the investigation was a correlation between fear of falling and level of pain in the younger adults. It is usually not anticipated that fear of falling would be a salient concern for younger adults. However, it appears that this variable may be important for a subgroup of younger adults; namely, those who are experiencing pain. Martin and Hadjistavropoulos (2003) recently investigated this issue. They studied fear of falling among individuals attending a physiotherapy clinic and confirmed that among younger adults receiving physiotherapy for pain problems, fear of falling was a significant concern. Therefore, as demonstrated by the results of this study and the study conducted by Martin and Hadjistavropoulos (2003), pain intensity appears to be related to a fear of falling regardless of the age group considered. This relationship merits further investigation among younger adults experiencing pain.

4.2 Fear of Pain and Attention to Pain-related Stimuli

It was expected that regardless of age, people who were pain-fearful would selectively attend to pain-related stimulus (i.e., it would take them longer to name the colour of a pain-related word during a modified Stroop task). This hypothesis was not supported. Participants who had high levels of fear of pain did not demonstrate attentional biases for pain-related words. These biases were not present in participants with high levels of fear of pain in the overall sample or in separate analyses of the younger adults and the seniors.

One recent study determined pain-related attentional biases in a community sample of younger adults with high levels of fear of pain (Keogh et al., 2001). However, Keogh et al. (2001) used a dot-probe task to measure attentional biases, whereas a modified Stroop task was employed in the present study. It may be that the Stroop task is not as sensitive to shifts in attention as the dot-probe task. This idea is consistent with previous studies that failed to find an attentional bias for mood-congruent stimuli using a modified Stroop task, despite the presence of the bias when a dot-probe task was employed (Dalgleish, Taghavi, Neshat-Doost, Moradi, Canterbury, & Yule, 2003; Harris

& Menzies, 1998; Roelofs et al., 2002). However, a robust effect should have been evident when using a modified Stroop task (e.g., Novara, & Sanavio, 2001; Wikstrom et al., 1999; Williams et al., 1996). The lack of clear attentional effects through the modified Stroop method suggests that attentional biases for pain-related information among community-dwelling individuals with high levels of fear of pain are not substantial enough to be detected by the less-sensitive modified Stroop task.

It would be hasty to dismiss the effect of fear of pain on attentional biases altogether. Although the findings of studies that have investigated the effect of pain status alone on attentional biases have been somewhat inconsistent (e.g., Pearce & Morley, 1989; Pincus et al., 1998), fear of pain does seem to mediate attentional biases in a chronic pain sample (e.g., Crombez et al., 2000; Roelofs, et al., 2002; Snider et al., 2000). Perhaps the interaction between high levels of fear of pain and a chronic pain state produces robust attentional biases for pain-related words detectable through in a modified Stroop investigation. Fear of pain in a non-pain sample may be analogous to a predisposition for pain-related biases. Although slight effects may be present by the fear alone (i.e., able to be detected by a dot-probe task), the situational consequence of being in pain in combination with fear may produce effects that would be of greater clinical significance (i.e., detectable by a modified Stroop task). Since the sample of this investigation was composed primarily of participants who were not suffering from chronic pain conditions, it was not feasible to investigate this possibility. Nonetheless, investigation of this hypothesis represents an avenue for future research.

4.3 Fear of Pain and Attention to Fall Related Stimulus among Seniors

It was expected that seniors who were pain-fearful would be more likely to attend to fall-related stimulus when compared to younger adults with high levels of fear of pain. This expectation was partially supported. An attentional bias for fall-related stimuli was not present in either group. Strictly speaking, the seniors with high levels of fear of pain did not pay greater attention to fall-related stimuli either in comparison to the younger adults with high levels of fear of pain or in comparison to the low fear of pain groups. However, when the seniors were examined in a separate analysis, a significant interaction indicated that although the high and low fear of pain groups did not differ on any of the word categories, those with high levels of fear of pain were indeed paying greater attention to fall-related stimulus than those with low levels of fear of pain. This pattern did not emerge when the group of younger adults was isolated in a separate exploratory investigation. This supports the notion of pain-fearfulness producing an attentional bias for fall-related words among seniors only.

It is interesting to note that scores on a measure of fear of falling were not related to attentional biases for any word categories, yet fear of pain and word type interacted for seniors as described earlier. This raises a question concerning the role of fear of pain in fall-related attentional biases among seniors. Fear of pain and fear of falling are distinct yet related constructs among seniors. Their relatedness is evident because the two constructs are correlated, indicating that the seniors with high levels of fear of pain had less confidence about being able to perform activities without losing their balance or becoming unsteady than the seniors with low levels of fear of pain. Their distinctiveness is evident because the constructs have different patterns of correlations. It was previously suggested that pain status and fear of pain could interact to produce an attentional bias for pain-related words. It may be that fear of pain and fear of falling interact to produce a bias for fall-related words in a similar manner. Fall-related words may actually be the more salient stimuli for seniors who are pain-fearful. This would explain why a bias was not found for pain-related words. Crombez et al. (2000) suggested that target words should be representative of the core concerns of the population. If falling actually were the core concern of a population of seniors who are pain-fearful, then in theory they would attend to the fall-related words and not the pain-related words. This is the pattern that was established in this study.

4.4 Memory Biases for Pain-Related Words Among People with High Levels of Fear of Pain

It was hypothesized that people who were pain-fearful would remember more pain-related words than other types of words. Furthermore, it was expected that seniors would remember more fall-related words than younger participants (after controlling for the effect of age). These expectations were not supported. A significant fear by word type interaction was not identified, indicating that participants who were pain-fearful did not remember more pain-related words than their non-fearful counterparts. Although a significant age by word type interaction was identified, post hoc tests showed that the seniors and younger adults did not differ with respect to the fall-related words. A three-way interaction (age by word type by fear of pain) was not identified. This suggests that seniors who were pain-fearful did not remember more fall-related words than their younger counterparts (after controlling for the effect of the neutral words).

Memory biases have been quite clearly demonstrated among pain patients using a free-recall task, although these biases are not as easily demonstrated when a recognition memory task is used (Edwards et al., 1992; Pincus et al., 1993). A review of the literature did not, however, uncover any studies that investigated a memory bias for pain-related information among healthy participants who were pain-fearful. A memory bias for pain-related information, however, may be related to the pain state without being dependent on pain-related fear. This is supported in the literature, as memory biases for pain-related words seem to cease following reductions in pain intensity (Edwards, Pearce, & Beard, 1995). Were the effect dependent upon pain-related fear (as may be the case with attentional biases), reductions in pain intensity should produce, at best, inconsistent effects.

4.5 Theoretical Significance: Implications for the Fear-Avoidance Model of Pain

The fear-avoidance model of pain (Asmundson et al., 1999; Lethem et al., 1983; Philips, 1987; Vlaeyen & Linton, 2000) asserts that pain, fear, and avoidance behaviours can interact and lead to increased disability and distress in the chronic pain patient. The model maintains that an initial injury or illness is often managed in one of two ways. The first, confrontation of the fear occurs if the experience is perceived as non-threatening. This tends to lead to expected recovery from the injury. However, if the experience is perceived as threatening, then maladaptive behaviours ensue and a cycle of fear and avoidance promotes disability (see Asmundson & Wright, in press).

Fear of pain, one of the elements of the fear-avoidance model, has been demonstrated to affect chronic pain patients in a variety of ways. This fear has been associated with self-reported escape and avoidance behaviours (Asmundson & Taylor, 1996), exaggerated attention to and memory for pain-related information (e.g., Crombez et al., 2000; Edwards et al., 1992; Pearce & Morley, 1989; Pincus et al., 1993; Snider et al., 2000), and diminished physical performance and disability (e.g., McCracken et al., 1993; Waddell et al., 1993). The present investigation was aimed at revealing the role of fear of pain in attentional and memory biases among community-dwelling younger adults and seniors in order to contribute to the notion that fear of pain represents a diathesis that in the presence of pain is exacerbated (Asmundson & Wright, in press). Because this model had not been investigated in seniors, the aim of this study was to broaden the scope of the model to include this population.

The findings of this study suggest that fear of pain does not contribute to attentional or memory biases for pain-related words in people with high levels of fear of pain using a modified Stroop task and a free-recall memory task. However, these findings do not negate the possibility that the construct of fear of pain represents a diathesis for the development of chronic pain conditions. The findings do suggest that the effect of fear of pain on attentional biases for pain-related information among healthy people may not be as robust as previously anticipated (e.g., Keogh et al., 2001; Keogh et al., 2003). It may be that the severity of fear of pain changes when an individual is experiencing pain and a somewhat equivocal effect (i.e., cognitive biases for pain-related information among people with high levels of fear of pain) becomes a strong effect.

Some evidence was found to suggest fear of pain among seniors contributes to an attentional bias for fall-related information. This has strong implications for the fear-avoidance model of pain as it applies to seniors. Because seniors have different types of pain complaints than younger adults (e.g., Gold & Roberto, 2000; Wijeratne et al., 2001) and pain becomes more prevalent with age (e.g., Gagliese & Melzack, 1997; Gallagher et al., 2000), one might conclude that the repercussions of fear of pain also may take on new meaning. Fear of falling was investigated as a construct of potential importance to the fear-avoidance model because the former has been demonstrated to be associated with functional decline, activity curtailment, and decreased self-rated health and social interactions (e.g., Cumming et al., 2000; Howland et al., 1993; Vellas et al., 1997). The results of this study with respect to attentional biases and the distinct but related nature of fear of pain and fear of falling, suggest that fear of falling and fall-related information may contribute not only to avoidance behaviours and deconditioning, but also to the maintenance of fear of pain and aggravation of the fear-avoidance cycle.

4.6 Clinical Significance, Limitations, and Future Research Directions

Researchers have attempted to demonstrate the presence of cognitive biases for pain-related information among pain patients (e.g., Crombez et al., 2000; Edwards et al., 1992; Pearce & Morley, 1989; Pincus et al., 1993; Snider et al., 2000). Their aim has been to understand the psychological sequelae that accompany a chronic pain condition. Understanding these cognitive processes can assist in describing the subtle nuances of subgroups of pain patients (Pincus & Morley, 2001).

Previous research concerning attentional biases has revealed some interesting findings. First, attentional biases for pain-related information among pain patients have not been an extremely robust effect. Second, emotional states such as anxiety, depression, and anxiety sensitivity seem to complicate the clarity of the effect. Because of the lack of clarity in these studies, the pain component was removed from subsequent studies (by examining a community-based sample) and the salient emotion variables (i.e., fear of pain) were investigated. Fear of pain was shown to relate to attentional biases for pain-related stimuli among healthy people (Keogh et al., 2001). Complicating the picture, research (including this study) has failed to demonstrate attentional biases for pain-related information among pain-fearful healthy participants using a modified Stroop task (Roelofs et al., 2002).

These recent findings seem to direct the line of investigation back to the chronic pain population. It may not be possible to isolate fear of pain in non-clinical samples and still tap into the same construct presented by clinical samples. It has been suggested that emotional variables (such as depression and anxiety) do not have the same expression in pain patients as in healthy people (Pincus & Morley, 2001). For example, Pincus & Morley (2001) reviewed studies that examined the pattern of symptoms of depression in patients with pain. They found that for patients with pain, somatic symptoms (e.g., fatigue, sleep disturbances) are generally frequent and severe, while symptoms of negative self-evaluation (e.g., feelings of worthlessness, guilt) are typically less frequent and less severe. Pincus and Morley (2001) reported that this pattern is somewhat different from that found in a psychiatric sample. Just as depression may not the same for a pain patient, fear of pain also may not be. An examination of the literature demonstrates that emotional variables do contribute to these attentional biases, but it may be the combination of the pain state and the emotional variables that produces robust effects (able to be consistently observed using a modified Stroop task).

One of the central findings of this investigation is that the construct of fear of falling appears to be more prevalent for seniors than fear of pain. It would be advantageous to further investigate the construct of fear of falling among seniors, specifically with regard to the impact that the construct has upon cognitive biases. This could be performed with both a community-dwelling sample as well as with a chronic pain sample. In future research, pain status should be focused on more closely. In this study, it was found that, for younger individuals, fear of falling appears to be related to a pain state. This has also been demonstrated elsewhere (Martin & Hadjsitavropoulos, 2003). This same relationship (i.e., the effect of pain status on fear of pain and fear of falling) is currently being investigated in work funded by the Canadian Institutes of Health Research (CIHR) in a major longitudinal study of seniors, with an emphasis on the impact it has on cognitive processes (Hadjistavropoulos, Asmundson & McCreary, work in progress).

Psychosocial interventions could target both fear of pain and activity restriction in seniors with high levels of fear of falling. If fear of pain is a subcomponent of fear of falling (as was suggested earlier) then targeting fear reduction may assist in alleviating some of the potential consequences of fear of falling and indirectly improve quality of life (e.g., depression, deconditioning, activity restriction, lack of efficacy for completing an activity without falling).

This study had several limitations. First, with respect to the modified Stroop task itself, alterations could assist the participant with properly focusing on the center of the screen so that they are situated correctly and able to read the word (although they are instructed to say the colour and ignore the meaning of the word). This would have to be done in a manner that would not alert the participant to the hypothesis of the investigation. If the participant is not focusing on the word (i.e., in a position to read the word), then the interference effects will not take place. Several participants stated that to make the task easier, they focused on the last letter of the word so that it was difficult for them to actually read the word. Having participants focus on the center of the screen prior to the presentation of the word may increase the clarity of the interference. Roelofs et al. (2002) utilized a procedure similar to that described above in their modified Stroop task. They presented a dot for 500 ms to alert the participants to the upcoming word. This procedure would not only alert the participants to the upcoming word, but would also focus their vision on the center of the screen so that the reading of the word would be automatic. Future investigations utilizing a modified Stroop task could revise their presentation to this effect to potentially heighten the interference.

With respect to the free-recall memory task, the data obtained had little variability. Most of the participants only remembered a few words and these words were spread across the categories (i.e., pain-related, social threat, positive, neutral, and fall-related). The proposed adaptation of the modified Stroop task may assist in reducing some of the apparent vulnerabilities of the recall data. For example, if participants were not looking at the word and not able to read the word, they would not be able to remember the word. The addition of a dot presentation prior to the stimulus would focus the participants' attention, they would be in a position to better process the stimuli and therefore, they may remember more words. Repetition of the free-recall task with the revisions of the modified Stroop task is warranted to determine the significance of the findings.

In this investigation, the possibility that individuals with high levels of fear of pain selectively attend to pain-related information using a modified Stroop task was tested. In future research in this area, it may be advantageous to examine the effects of the interaction of fear of pain with pain status on attentional biases for pain-related information. Additionally, the construct of fear of pain in a chronic pain sample could be examined in an attempt to determine whether the presentation of fear of pain differs for this population compared to a non-chronic pain population. In this study, seniors and younger adults were evaluated with a focus on the relationship between fear of pain and fear of falling. Several avenues of future research arise from this aspect of the investigation, including the study of a model of the subcomponents of fear of falling (separately among seniors and younger adults with chronic pain conditions). This model would include the correlates of fear of falling found in this study (e.g., pain status, cognitive functioning, years of education, age, fear of pain) and in the literature (e.g., anxiety, gait disturbances, balance disturbances, decreased mobility). Further investigation of the interactive role of fear of falling and fear of pain in attentional biases among seniors could also be pursued.

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APPENDIX A

Demographic Information Questionnaire

1. **First Name** ________________

2. **Telephone Number** ________________

3. **Years of Education** ________________

4. **Age** ________________

5. **Sex** ________________

6. Are you currently diagnosed as suffering from a serious medical condition(s)?

   (circle response) **YES / NO**

   Please describe:

   ____

   ____

   ____

7. Do you have normal or corrected-normal vision?

   (circle response) **YES / NO**

8. Are you, to your knowledge, colour-blind?

   (circle response) **YES / NO**

APPENDIX B

List of Words Used in the Modified Stroop Task

Pain-Related Words

Aching
Hurting
Pain
Pounding
Shooting
Sore
Splitting
Stabbing
Sting
Throbbing

Social-Threat Words

Ashamed
Blamed
Detest
Disgust
Dislike
Embarrass
Fail
Loser
Reject
Teased

Positive-Emotion Words

Adored
Rejoice
Brilliant
Enjoy
Excellent
Happiness
Joyful
Paradise
Peaceful
Wonderful

Neutral Words

Comb
Container
Mugs
Floor
Furniture

Jug
Keys
Doorknob
Towels
Vase

Fall-Related Words

Fall
Stumble
Trip
Unsteady
Slip
Fracture
Break
Injury
Accident
Collapse

Appendix C

Original Word List

Please rate these words with respect to their congruence to the category heading (e.g., how representative is the word ACHE to the category heading “pain”?). The category headings are “pain”, “social threat”, “positive”, “fall”, and “neutral”. Please use the following rating scale to rate the words:

1 2 3 4 5 6 7 8 9 10
1 = Not Representative At All *10 = Perfectly Representative*

CATEGORY 1: PAIN-RELATED
Aching
Beating
Burning
Choking
Cramps
Crushing
Gasping
Gnawing
Griping
Harm
Hurting
Inflamed
Nausea
Numb
Pain
Penetrating
Piercing
Pinching
Pounding
Pulsating
Sharp
Shooting
Sore
Spasm
Splitting
Squeezing
Stabbing
Sting

Tearing
Tender
Throbbing
Tightness

CATEGORY 2: SOCIAL THREAT
Alone
Annoyed
Ashamed
Avoid
Awkward
Blamed
Blushed
Coward
Critical
Defeat
Despite
Detested
Disgust
Dislike
Embarrass
Fail
Foolish
Hate
Idiotic
Idle
Lonesome
Loser
Reject
Revolted
Selfish
Shy
Stared
Stupid
Teased
Unkind
Useless
Wrong

CATEGORY 3: POSITIVE
Admire
Adored
Approving
Rejoice
Brave

Brilliant
Charm
Clever
Daring
Delight
Enjoy
Excellent
Fond
Freedom
Gentle
Gifted
Happiness
Helpful
Jolly
Joyful
Laugh
Lovely
Lucky
Paradise
Peaceful
Pleasure
Praise
Relax
Smart
Smile
Super
Wonderful

CATEGORY 4: NEUTRAL
Bath
Bedroom
Bleach
Bricks
Brushing
Carpet
Clean
Cleaner
Comb
Container
Cook
Decorate
Doorknob
Dusted
Floor
Furniture
Grater

Housework
Jug
Keys
Lighting
Loft
Mugs
Occupy
Pipe
Rack
Saucepan
Sink
Stair
Towels
Vase
Water

CATEGORY 5: FALL-RELATED
Accident
Balance
Break
Collapse
Crash
Fall
Falter
Footing
Fracture
Grip
Ground
Injury
Skid
Slide
Slip
Stagger
Stumble
Sway
Traction
Trip
Unstable
Unsteady

APPENDIX D

Ethical Clearance

UNIVERSITY OF REGINA

OFFICE OF RESEARCH SERVICES

DATE: September 11, 2002

TO: Jaime Williams
Psychology Dept.

FROM: P. Gingrich
Chair, Research Ethics Board

Re: The Effect of Age and Fear of Pain on Attentional and Memory Biases.

Please be advised that the University of Regina Research Ethics Board has reviewed your proposal and found it to be:

X 1. ACCEPTABLE AS SUBMITTED. Only applicants with this designation have ethical approval to proceed with their research as described in their applications. The *Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans* requires the researcher to send the Chair of the REB annual reports and notice of project conclusion for research lasting more than one year (Section 1F). **ETHICAL CLEARANCE MUST BE RENEWED BY SUBMITTING A BRIEF STATUS REPORT EVERY TWELVE MONTHS. CLEARANCE WILL BE REVOKED UNLESS A SATISFACTORY STATUS REPORT IS RECEIVED.**

_____ 2. ACCEPTABLE SUBJECT TO CHANGES AND PRECAUTIONS (SEE ATTACHED). **Changes must be submitted to the REB and subsequently approved prior to beginning research. Please address the concerns raised by the reviewer(s) by means of a <u>supplementary memo</u> to the Chair of the REB. <u>Do not submit a new application</u>. Once changes are deemed acceptable, approval will be granted.**

_____ 3. UNACCEPTABLE AS SUBMITTED. **Please contact the Chair of the REB for advice on how the project proposal might be revised.**

c.c. T. Hadjistavropoulos, supervisor

PG/sc/ethics2 dot

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