Pain during dressing change: how does attachment style affect pain in the older adults?

By

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A thesis submitted in conformity with the requirements for the degree of PhD
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Abstract:

Wound-related pain is complex, integrating the experience of noncyclic acute wound pain, cyclic acute wound pain, and chronic wound pain (Krasner 1995). More than 80% of chronic wound patients report pain during wound dressing change. A constellation of physical and psychological factors may be involved in the mediation of pain during wound dressing change. A burgeoning body of evidence suggests the intricate relationship between anxiety and pain. In this study, the attachment framework was examined to determine how personal views of self (attachment anxiety) and others (attachment avoidance) may affect pain during dressing change. Attachment styles are systematic patterns of expectations, emotional reactivity, strategies for distress management and social behaviour that are based on an individual's belief about the self and others. Internal working models are cognitive-affective schemas that guide the attachment patterns.

Purpose: The purpose of this study was to explore the relationship of attachment style and pain during dressing change in an older population. In particular the study focussed on the role that anxiety, anticipatory self reported pain, and behavioural expression of pain play in this relationships.

Method: A questionnaire was used in this cross-sectional study to classify 96 older subjects into four different categories of attachment styles. Subjects were
asked to rate their levels of anticipatory pain and actual pain levels at different
times during wound care using a numerical rating scale.

Results: The results indicated that subjects experienced more pain during
dressing change than at baseline. Secure subjects reported less pain and
anxiety than subjects with other attachment styles. Results of regression
analysis indicated that anxiety mediated the relationship between attachment and
pain.

Conclusion: The results of this study also support the role that attachment plays
in the experience of pain in older adults. Clinicians must be cognizant of the
impact of personality, anxiety, and anticipation of pain on the actual pain
experience.
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Chapter 1  Introduction

The purpose of this thesis was to examine the hypothesized association among attachment, anticipation of pain, anxiety, and pain intensity at dressing change in a sample of older adults.

The impact of pain (acute and chronic) on any individual is tremendous affecting many aspects of life and causing significant amount of stress and anxiety. Pain is a subjective, personal experience that has no objective reference in the external world. Unfortunately, pain is also a common experience, especially in the elderly, that is modulated by various psychological processes and social contingencies. Pain has multiple biological, intrapersonal and interpersonal correlates. In the current study, hypotheses based on attachment theory which predict that the relationship between cognitive appraisal (anticipation of pain), emotional reaction (anxiety), and conditioned behavioural response (communication and expression) to pain are guided by interpersonal styles of relating were generated and tested.

Organization of the Dissertation

In order to address the relationship between attachment, anxiety, and pain, the current thesis begins with a brief review on pain mechanisms and the influence of emotions on pain perception. Relevant literature that links anxiety to pain is examined to develop a
background for understanding the significance of anxiety in the overall pain experience.

The next segment of the thesis summarizes the debate over alteration in pain experience with aging and highlights the need for further research.

To limit the number of confounding variables, subjects with chronic wounds were evaluated for pain during dressing change. The prevalence and impact of pain on individuals with chronic wounds is reviewed and discussed.

It is argued that pain as a stressor may trigger a cascade of physiological events that stall wound healing. The next section of the thesis reviews the various factors that can exacerbate pain, and advances a hypothesis that patients will express more intense pain during dressing change.

In order to explain how personality, emotional reactivity, and interpersonal relationship may influence pain, attachment theory is selected and discussed as the theoretical framework that guides this study. The detailed review of the literature in this section concentrates on four attachment patterns derived from two dimensions representing self and others and includes the association between attachment and pain as well as a review of the relevant neurobiological pathways and the literature on attachment in the elderly population.
Finally, a model that describes the mediating effect of anxiety between attachment and pain is proposed and the exhaustive literature review provides a sound argument for the need to evaluate how attachment may influence pain.

Following the literature review are the descriptions of the study methodology, results, conclusions and implications for practice.

Summary of the theoretical model

According to attachment theory, early experiences lead to the development of perceptions about self and others that strongly influence the individual's tendency to experience negative emotions such as anxiety. Intense anxiety in people with insecure attachment is presumed to exacerbate pain. Unrelieved pain may then reinforce negative images of self and others which in turn increase anxiety and create a vicious cycle. The key variables and their relationships are described in figure 1. Although depicted in a circular and unidirectional fashion, the relationships of these variables are often complex and interactive.
Figure 1  Proposed relationship among pain, attachment, and emotional response in older adults

The premise of this study is based on the notion that pain is generally accepted as a multidimensional construct. A biopsychosocial model of pain posits that pain experience and its impact on the individual involves the interplay of physical factors (somatic input, nociception), psychological processes (e.g., beliefs, emotional and coping repertoire) and environmental contingencies (social context, cultural rules and expectations) (Turk & Okifuji, 2002).

From a functional perspective, pain alerts the individual to the actual or potential injury that threatens the integrity of the body. Driven
by a survival instinct, behaviours are mobilized to minimize the pain experience by terminating the cause of injury, preventing further insult, or promoting recovery (Sullivan, 2008). Overt displays and expression of pain convey the internal state of emotional distress (e.g. fear and anxiety) and the need for protection or care from others.

According to the basic tenents of attachment theory, the propensity to seek and maintain proximity to supportive others (attachment figures) in times of threat or need is innate to humans across the entire life span. Attachment figures provide a physical and emotional safe haven to alleviate distress. As pain is often perceived as a form of physical and emotional stress to the individual, pain may activate attachment behaviours as a means to adapt to or restore a state of security. Kolb (1982) identified attachment-related behaviours as an attempt to elicit empathy and responses from caregivers. These diverse interpersonal responses to pain may include complaining, clinging, questioning, making demands, criticizing professionals, denying distress, erratic appointment attendance, anger, and threatening to abort treatment. Cognitive appraisals are central to understanding how individuals respond to stress and threat. In attachment theory, cognitive appraisals are based on internal working models that reflect perceptions or abstract representations of self and others from past experiences of interpersonal exchanges (Meredith, Ownsworth & Strong, 2008).
Attachment styles vary between individuals, predicated on variations in internal working models. Internal working models vary along two continua representing comfort with others and anxiety over acceptability of the self. Securely attached individuals are more likely to perceive 'self' as capable of coping with the stress of pain and worthy of love, care, or attention. They tend to perceive others as accessible and responsive to the self both physically and emotionally. In contrast, insecure individuals anticipate rejection, abandonment, and a lack of empathy from interpersonal exchanges (presumably a result of a developmental history in which attachment behaviours have been repeatedly frustrated). These expectations have a direct effect on interpersonal behaviour. As a result, the wide variability observed in the degree of emotional distress evoked by pain, the expression of pain, the report of pain to another individual (often a health care provider), and the pain behaviours, despite comparable levels of pain intensity, are best viewed and understood in a social and interpersonal context within which the attachment system operates.

Mikail, Henderson and Tasca (1994) assert that secure individuals are likely to describe their pain succinctly, express their concerns openly, seek help willingly, and expect the help to be forthcoming. They respond favourably to remedial interventions that require lifestyle adjustment (e.g. adhere to sometimes awkward or painful compression bandaging therapy for the treatment of venous leg
ulcers) and long term self-management. It is, therefore, hypothesized that secure individuals are less susceptible to pain than those who are insecure about their attachment (Mikail et al., 1994; Meredith, Ownsworth, & Strong, 2008).

In contrast, insecure attachment has been shown to be associated with negative cognitive dispositions and deficient emotional regulation that may exacerbate the experience of pain. Insecure individuals are particularly vulnerable to the distress incurred by pain and are resistant to treatment interventions. They tend to engage in catastrophizing thinking, maintain hypervigilance to noxious stimuli, and have lower self-efficacy to manage pain (Ciechanowski, Sullivan, Jensen, Romano, & Summers, 2003; Meredith, Strong, & Feeney 2006). Insecure individuals describe pain as more threatening and distressing and they are more vulnerable to experiencing negative emotions including anxiety and depression (McWilliams & Asmundson, 2007). It is argued that high anxiety plays a definitive role in the pain experience by enhancing sensory receptivity and priming the individual with anticipation of harmful consequences (Feeney & Ryan, 1994; Stewart & Asmundson, 2006; Zech, De Ree, Berenschot, & Strobe, 2006).
Chapter 2  Literature Review

Pain Definition and Dimensions

The International Association Study in Pain (IASP) Task Force on Taxonomy defines pain as “an unpleasant sensory and emotional experience that is associated with actual or potential tissue damage or described in terms of such damage” (http://www.iasp-pain.org/AM/Template.cfm?Section=Pain_Definitions&Template). This conceptualization explicates the need to understand pain as more than a physiological phenomenon involving a sensory electrical impulse that is conducted linearly from the peripheral nociceptors, ascends through the spinal pain pathways, and ultimately projects to higher centers in the brain where pain perception is constructed. Instead, pain is a subjective, unique, and conscious experience that is modulated by various cognitive, affective, contextual, structural and interpersonal determinants (Tracey, 2008). Despite seemingly comparable levels of pain intensity, persons with pain experience varying degree of physical limitations, emotional distress, and suffering (Sullivan, 2008). Simply put, pain is whatever the experiencing person says it is, existing whenever he/she says it does, even if it seems out of proportion to the physical presentation (McCaffery 2001).

To operationalize the complexity of pain, Melzack (1999, 2005) introduced the term ‘neuromatrix’ to describe interactions between
complex circuitry and networks that modulate the perception of pain.

A simplified illustration of this complicated pain mechanism involving multiple pathways and various dimensions can be seen in Figure 2.

**Figure 2. Pain mechanisms and dimensions**

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The model proposes a multidimensional structure of pain that encapsulates three key dimensions: sensory-discriminative, affective-motivational, and cognitive-evaluative dimensions (Melzack 1999;
Through the neuromatrix, the pain signals from various brain regions are synthesized and processed to generate a neuro-signature of pain. New avenues of intervention may become perceptible as emotions and interpersonal relationships are considered to be independent predictors of pain. Understanding of the interactions between nociception and psychosocial factors may help guide effective management of pain.

**Pain mechanism**

Over the last few decades, understanding of the pain mechanism has advanced (Melzack, Coderre, Katz, Vaccarino, 2001; Price, 2002; Tracey & Mantyh, 2007). The neurophysiology of pain begins with specialized sensory receptors (nociceptors) that are designed to detect noxious chemical, thermal, and mechanical stimuli. The signal is promptly transduced into sodium-dependent action potentials that propagate from the nerve endings toward the spinal cord along the small diameter unmyelinated (C-fiber) or myelinated (Aδ-fiber) axons of primary afferent nociceptive fibers (Chapman, Tuckett & Song, 2008; Machelska & Stein 2002; Rainville, 2002). The electrical signal then precedes orthodromically to the spinal cord and antidromically to adjacent sensory axons (Chapman, Tuckett & Song, 2008; Machelska & Stein 2002; Rainville, 2002).
At the dorsal horn level, complex interactions among afferent fibers, interneurons, local intrinsic spinal neurons, and the endings of descending fibers from the cortical and subcortical structures are integrated. (Vanderah 2007; Tracey, 2005). Melzack and Wall (1965) proposed a ‘gate’ mechanism that is located in the dorsal horn of the spinal cord where pain transmission can be modulated. (Tracey et al., 2007).

Increased effort has been gathered to elucidate how affective or cognitive processes can modulate the perception of pain through cortical and subcortical structures (Tracey, 2008). Some of these pathways involve the midbrain periaqueductal gray matter (PAG) and the nucleus raphe magnus and adjacent structures of the rostral ventromedial medulla (RVM). The connections that link the PAG to the stress-response systems and other cerebral structures (frontal cingulate and insular cortices; limbic system, septum, amygdala, and hypothalamus) establish its crucial role in connecting emotions to pain perception (Kevin Benuzzi, Lui, Duzzi, Nichelli, & Porro, 2008; Ren & Dubner, 2002; Vogt, 2005). Fairhurst, Wiech, Dunckley, and Tracey (2007) documented that subjective anticipation pain ratings are correlated to enhanced activity within the PAG, ventral tegmental area of the brainstem, and the entorhinal cortex. Activation of the PAG has been shown to stimulate the descending serotonergic and noradrenergic pathways that originate within the rostral ventromedial medulla and the dorsolateral pontine tegmentum of the brain stem,
respectively (Mollet & Harrison, 2006; Rainville 2002). Electrical stimulation of the PAG releases endogenous opioid, serotonin, and norepinephrine that produce local analgesia effects and inhibit afferent neural conduction of pain (Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Ploghaus, Becerra, Borras, & Borsook, 2003). In addition, the anticipation of impending pain involves changes in functional activity of the medial thalamus and certain mesial cortical areas (Porro, Cettolo, Francescato, & Baraldi 2003).

The amygdala is a key component of the limbic system and has been implicated in the generation and development of fear, anxiety, emotional memory and behaviour, as well as somatomotor responses to threatening stimuli (Apkarian, Bushnell, Treede, & Zubieta, 2005). In a review of the common neural mechanisms that are shared between sensory and affective dimensions of pain, Price (2002) discussed the evidence that the ventral and medial thalamic nuclei (ventralmedial portion of posterior nuclear complex and ventrocaudal portion of the mediodorsal complex) are most involved in the affective motivational processing of pain.

The anterior cingu late cortex (ACC) of the limbic system has also been identified as the encoding center of perceived unpleasantness or the aversive aspect of pain (Rainville, Duncan, Price, Carrier, & Bushnell, 1997). The most dorsalcaudal aspect of the ACC may contribute to motor control during pain, whereas the activation of more
anterior and ventral regions may reflect the arousing effect of painful stimuli. Electrical stimulation in the perigenual region has been shown to evoke fear and other emotional responses (Derbyshire, 2000). Observations of patients with chronic pain following neurosurgery that interrupts the ACC reveal a lack of affective response even if the ability to discriminate the noxious stimulus remains intact (Santo, Arias, Barolat 1990). In a series of studies using hypnotic suggestion to enhance the unpleasantness of heat-induced pain, Rainville et al (1997) reported a correlation between increased unpleasantness and increased blood flow to the midcingulate region (A24). Pain intensity was related to changes confined to the S1 cortex. Using event-related functional magnetic resonance imaging (FMRI), Ploghaus, et al (2001) documented that anxiety induced hyperalgesia was associated with activation in the entorhinal area of the hippocampal formation and correlated activity in the ACC and insula. Another study (Gracely et al., 2004) involving fibromyalgia patients illustrated that pain catastrophizing was significantly related to increased activities in brain areas that were associated with anticipation of pain (medial frontal cortex, cerebellum), attention to pain (dorsal ACC, dorsolateral prefrontal cortex), and emotional aspects of pain (claustrem).

The identified neuronal circuitries substantiate the link between emotions and perception. To summarize, the pain experience involves
interplay of physical, emotional, and cognitive factors involved in the pain experience.

**Pain and anxiety**

Pain is an unpleasant sensory and emotional experience. Although the exact mechanism is still ill-defined, pain appears to be a combination of physical sensation and a negative emotional experience that is intricately linked to anxiety. The ultimate pain experience can be modulated by various factors that account for the variation in individual responses to a similar noxious stimulation. Chapman et al (2008) discuss individual susceptibility to the development of chronic pain and associated negative emotions. They commented that the experience of pain is a function of genetics, cognitive and belief system, emotional states, pain expectancy, awareness (vigilance), anxiety, personality, and social environment.

A substantial amount of work has been done to establish the reciprocal relationship between anxiety and pain. While pain may evoke anxiety in anticipation of an unpleasant sensation, anxiety can increase pain through various mechanisms. The following review will elaborate on the relationships between pain and anxiety by appraising relevant physiological, clinical and neuroimaging studies. Anxiety has been defined as a trait, a state, a stimulus, a response, a drive, an emotion, and a motive (Endler & Kocovski 2001). In general, anxiety denotes an
unpleasant feeling of tension, apprehension, distress, fear, or worry that is activated in response to an impending or anticipated threat.

Anxiety symptoms are pervasive in patients with medical problems with an estimated prevalence of 10 to 20% among individuals visiting an outpatient clinic (Mackenzie & Popkin 1983). Wells, Golding and Burnham (1989) found that patients with chronic medical conditions had a significantly higher adjusted lifetime prevalence of anxiety disorder than individuals without chronic diseases (P<0.005). These findings were drawn from a record review of 2554 patients with chronic medical conditions. It was estimated that 15.6 % of people aged 55 and over in the general population met the criteria for clinical anxiety in one US study (Cohen, Magai, Yaffee, & Walcott-Brown 2006). Individuals who were deemed more anxious, were likely to be older, had higher education and more lifetime trauma, handled conflicts with prayer, had higher levels of daily functioning, and reported more physical illnesses and depressive symptoms than the non-anxious individuals.

According to Spielberger (1999), anxiety can be distinguished and measured as a trait versus a state. The concept of trait anxiety conveys a relatively enduring predisposition or general personality propensity to react to situations in a consistent manner with anxiety (trait anxiety). In contrast, state anxiety is a transitory but defined emotional state at a particular moment in time. High trait anxiety may stem from inherited behaviour or early difficult relationships in childhood. Brawman-Mintzer
and Lydiard (1997) reviewed research studies as they pertain to patients with anxiety disorders. They documented that patients with high levels of anxiety are biologically distinct as many of them have deficits in the regulatory mechanisms of the hypothalamic-pituitary-axis associated with an abnormal response to stress. Convincing data suggested strong associations between anxiety and several neurotransmitter systems including the excitatory amino acid glutamate, the inhibitory amino acid, \( \gamma \)-amino-butyric acid, and other neuroactive compounds such as catecholamines, benzodiazepines, serotonin, cholecystokinin, corticotrophin-releasing hormone, and somatostatin (Connor & Davidson, 1998; Davidson 2002; Gorman, Hirschfeld, & Ninan 2002). Abnormalities in the cholecystokinin system and significant change in brain activity were also commonly observed in patients who develop severe anxiety. Functional imaging studies consistently implicate anterior limbic and paralimbic regions (cingulate and orbital frontal cortex) in addition to amygdala and thalamus in anxiety disorders.

With the help of magnetic resonance spectroscopy, Grachev and Apkarian (2000) studied the relationship between anxiety (measured by the Spielberger State and Trait Anxiety Inventory or STAI) and regional brain chemistry (including N-acetyl aspartate, choline, glutamate, glutamine, \( \gamma \)-amino-butyric acid, inositol, glucose, and lactate) in 16 healthy subjects. Anxiety-related differences in chemical concentrations were rather localized, especially to the orbital frontal cortex (OFC). The
mean concentrations of all studied chemicals in the OFC were 32% higher in subjects with increased anxiety (F=60.8, p<0.01). The most significant differences were observed in the concentrations of N-acetyl aspartate or NAA (F=21.5, p<0.00) and GABA (F=3.8, p<0.05) between subjects with high versus low anxiety (both trait and state). The higher the anxiety score, the higher the local chemical concentrations measured (p<0.05).

In a later study, Grachev, Fredrickson, and Apkarian (2001) examined the brain regional variations of NAA in normal subjects (n=16, mean age = 44± 3 years) and patients with low back pain (n=9, mean age=45 ± 6). The NAA activities in the OFC and dorsal lateral prefrontal cortex (DLPFC) were positively related to pain (measured by McGill Pain Questionnaire or MPQ) for all patients. Anxiety was correlated to activities in the OFC in chronic pain patients as opposed to both OFC and DLPFC in normal subjects without painful complaints. The results suggest that chronic pain or anxiety may contribute to the re-organization of regional brain chemistry illustrating the intricate relationships among pain, personality, and anxiety.

To measure the two dimensional structures of anxiety (state versus trait), the STAI (Spielberger, Gorsuch, & Lushene 1970) is a common instrument used in research studies. While trait anxiety is a stable personality attribute, state anxiety is dynamic and viewed as existing on a continuum. People experience varying degrees of anxiety influenced by other psychological and environmental factors. A person, who scores high on trait anxiety, when placed in a stressful situation that is congruent with
their personality, will likely experience increased state anxiety. The relationship between state and trait anxiety is dependent on both the person and the situation.

Although the exact neurobiological mechanism remains elusive, anxiety may reduce the descending inhibition signals allowing pain to gain access through the ‘gate control mechanism’ to the central nervous system. Previous research reports have demonstrated that anxiety can lead to increased self-reported pain intensity, reduced pain tolerance, and decreased pressure pain thresholds. In a small sample of 16 healthy individuals, those with high state anxiety (STAI) reported lower pressure pain thresholds of the masticator muscles than those with low anxiety (p=0.003) (Michelotti, Farella, Tedesco, Cimino, & Martina. 2000). It is surmised that anxiety lowers the sensory threshold rendering the anxiety prone individual more sensitive to painful sensations. Among patients who underwent coronary artery bypass graft (CABG) surgery, strong correlations between state anxiety and pain were present on postoperative day 2 (p<0.0001) and 3 (p<0.01) (Nelson, Zimmerman, Barnason, Nieveen, & Schmaderer 1998).

There is a paucity of research focused on the pain-anxiety relationship in the geriatric population. In a study of elderly patients in a rehabilitation hospital, Paquet, Kergoat, and Dubé (2005) reported that the ability to maintain certain desirable emotional states (emotional regulation) and pain were correlated. The intensity of pain was predicted by how
successfully older persons can keep their anxiety under control (p=.006). Feeney (2000; 2004) studied the relative contributions of state anxiety, trait anxiety, depression, state anger, and trait anger to acute pain after knee or hip replacement surgery. Included subjects were 65 years and older in an inpatient rehabilitation unit (n=100). State anxiety was positively and significantly related to pain (r=.52, p<0.001). State anxiety was also the most significant predictor for pain measured by MPQ (F (1, 94)=25.86, p<0.0001) and accounted for 27% of the variance in pain prediction. In contrast, the trait anxiety, state anger, and trait anger were not related to pain and accounted for merely 3.8% of the variance in total pain. Perhaps the highly significant relationship between pain and state anxiety may have obscured the influence that trait anxiety had on pain in the study.

Pain and anxiety are frequently encountered during aversive medical procedures. Kudo (2005) demonstrated that injection pressure for local anaesthesia during dental procedure was significantly correlated to state anxiety (0.0098) in a group of 28 healthy men. With liver biopsy, state anxiety level before the procedure was significantly correlated with mean pain intensity that was measured at 5, 10, 15, and 30 minutes and at 1, 2, 4, 6 hours after the procedure (r=0.415; p=0.0001) (Eisenberg, Konopniki, Veitsman, et al., 2003). Subjects who experienced high levels of anticipatory anxiety reported higher levels of pain across time than those with low anxiety levels. Among women who underwent procedures
to terminate their pregnancies after the first trimester (Pud & Amit, 2005), pain magnitude was measured by using a visual analog scale (VAS) at 15, 30, and 60 minutes following the procedure. Pain scores were the highest in the first 15 minutes (mean VAS=49.9; median VAS=63.5) and gradually subsided at 30 (mean VAS=29.2; median=32.0) and 60 minutes (mean VAS=8.4). Pain magnitude was correlated to state anxiety at 15 minutes (p=0.013) and trait anxiety at 30 minutes (p=0.013).

In another experiment conducted by Tang and Gibson (2005), 32 healthy volunteers were asked to rate the pain level induced by an electrical stimulation. Anxiety was instigated by warning signals (including both visual and auditory) that preceded the noxious stimuli. There was no difference in the levels of pain threshold between the participants who scored high or low on the trait anxiety measure (STAI). However, participants did rate the stimuli as significantly more painful with heightened state anxiety.

Hong, Jee and Luthardt (2005) evaluated pain and anxiety in 150 women who underwent oocyte retrieval for *in vitro* fertilization. Mixed emotions and expectations were implicated in this procedure. Subjects were dichotomized into high versus low anxiety groups using the median score as the cut off point on a visual analogue scale. Findings indicated that increased preoperative anxiety was significantly correlated with elevated postoperative wound pain (r=0.240; p=0.009). More interestingly, anxiety was correlated with previous pain experience of the
similar procedure \( (r=0.252; \ p=0.031) \). Women who had experienced intense pain with the similar procedure in the past were more likely to report higher levels of anxiety that in turn inflated their perceived levels of pain.

Data collected from 85 women having major abdominal surgery (Carr, Nicky, Thomas, & Wilson-Barnet 2005) also demonstrated that anxious patients experienced higher levels of pain between day 2 to 10 post-surgery than non-anxious patients. More specifically, anxiety was predicted by pain that interfered with walking \( (p=0.026) \). Katz and her coworkers (2005) evaluated pain and anxiety in 109 women following breast cancer surgery. According to logistic regression analysis, preoperative state anxiety (STAI) was the only significant predictor of increased pain \( (\geq 5 \text{ a numeric rating scale}) \) on day 2 \( (p<0.003) \) and day 30 \( (p<0.03) \) after the surgery.

In a different surgical population, preoperative anxiety and postoperative pain were evaluated by STAI and VAS respectively in 40 female patients requiring abdominal gynaecological surgery (Hsu et al., 2005) Patients who expressed higher preoperative anxiety experienced significantly more intense pain in the post-anaesthesia care unit than the less anxious individuals \( (87\pm 25 \text{ versus } 65 \pm 28) \) \( (p<0.05) \). However, the relationship was no longer significant 24 hours after the surgery. Attenuation of the relationship between pain and anxiety could be explained by the improvement of pain by an average of \( 31 \pm 10 \) units on
the VAS 100 unit scale. The findings reported by Dahlen, Zimmerman, and Barron (2006) also illustrate that the relationship between pain and anxiety may be dependent on pain intensity and/or timing of the assessment. The investigators examined anxiety and pain after total knee arthroplasty on postoperative days 3, 14, 42, and 84 (n=23). The relationships were significant between anxiety and sensory quality of pain measured by the McGill Pain Questionnaire (R=0.553, p<0.01), affective component of pain (r=0.455; p<0.05), and day 3 and 14 pain intensity on VAS (r=0.499; p<0.05). However, these findings were no longer significant as pain subsided on day 42 and onward.

Jones, Zachariae, and Arendt-Nielsen (2003) recruited 114 healthy university students to determine their pain threshold and pain tolerance in response to a contact heat stimulation and during a cold pressor test with their hands submerged in cold water (1°C). Feelings of anxiety were evaluated by the State-Trait Anxiety Inventory while subjective ratings of pain intensity and unpleasantness were documented by 11-point numerical rating scales. Participants were classified into either high or low anxious groups using median splits on the STAI scores. Male participants expressing high anxiety disposition (high Trait Anxiety Inventory scores) reported significantly greater pain intensity (15.0%), pain unpleasantness (17.5%) and exhibited lower pain tolerance (54.4%) compared to the less anxious males on the cold pressor test measures (all p values <0.05).
Contrary to previous findings, anxiety was not found to be associated with any of the pain outcome measures in women.

In a recent study (Elsenbruch, Haag, Lucas, et al., 2007), 18 healthy subjects who volunteered for painful rectal distensions displayed an anticipatory stress response, reflected by elevated baseline anxiety, and increased baseline ACTH and cortisol. Lucas, Holtmann, Gerken et al., (2006) recruited 11 healthy subjects to experience three conditions: rectal distension, public speaking, and rest. Subjects rated their anxiety levels and provided blood for endocrinological and immunological analyses at baseline and after each experimental condition. Anxiety scores were higher in the rectal distension condition even before (mean STAI-S scores 41.6+/-.9 vs. 32+/-.2 rest, p<.01) the procedure suggesting an anticipatory effect. Compared to the resting state, this anticipatory effect was accompanied by physiological changes that included elevated baseline cortisol (p<.05) and baseline ACTH (p<.01) levels, as well as circulating lymphocytes and lymphocyte subsets, including decreased basal CD3+CD4+ cells (p<.05) and increased CD16+CD56+ cells (p=.06).

To encapsulate this unique phenomenon in which pain is incurred or intensified by patients’ anticipation and associated anxiety, Colloca and Benedetti (2007) eloquently explained the “nocebo effect” (versus placebo effect). A nocebo effect involves experiences of harmful, injurious, unpleasant, or undesirable consequences caused by the suggestion or
pessimistic belief that something is harmful. Of importance, anticipation of pain and associated anxiety are more than psychological phenomena and they have been demonstrated to trigger the activation of cholecystokinin that plays a crucial role in pain transmission. Neuroimaging studies documented that the anterior cingulate cortex, the prefrontal cortex and the insula are activated during the anticipation of pain suggesting a specific neurocircuitry pathway.

To demonstrate the nocebo effect, Benedetti Amanzio, Vighetti, and Asteggiano (2006) recruited 49 healthy volunteers to document their experience of ischemic pain-induced experimentally by means of the tourniquet technique to their arms. All subjects were tested twice. At the second test, one group of subjects was randomly assigned to undergo tourniquet test alone. The other three groups of subjects randomly received an inert talc pill, diazepam (benzodiazepine), or proglumide (CCK antagonist) plus verbal suggestions that the tablet was a powerful vasoconstrictor that may potentiate the tourniquet-induced ischemia and therefore introduce more intense pain.

Subjects who received the inert pill expressed a significant increase in pain ($F_{(19,228)} = 133.855; \ p < 0.001$) accompanied by an increased plasma concentrations of ACTH and cortisol. Self reported pain scores and the plasma ACTH /cortisol concentrations were similar between the first and the second tests in the diazepam group. Diazepam as an anxiolytic agent was effective in lessening the anxiety or nocebo-induced
hyperalgesia and hyperactivity of the HPA axis (ACTH and Cortisol plasma concentrations). In contrast, proglumide only blocked the nocebo-induced hyperalgesia but it was ineffective in reducing the nocebo-induced hyperactivity of the HPA axis. Subjects in the proglumide group experienced less pain but the ACTH and cortisol plasma concentrations remained elevated. Results validated that anxiety induced hyperalgesia is mediated by CCK and amenable to the treatment with CCK antagonist proglumide.

Warbrick, Sheffield, and Nouwen (2006) studied the pain response to electrical stimuli in 14 healthy students. In preparation for the electrical shock, subjects were randomly assigned to instructions written with either neutral or anxiety provoking contents. Contrary to previous research findings, in this study with a small number of patients, pain and anxiety were not correlated. This experimental study was conducted in a controlled, albeit artificial environment with healthy individuals that may not be applicable to real life or clinical situations.

There is compelling evidence that certain individuals are more sensitive to anxiety and its aversive consequences. Anxiety sensitivity is defined as the fear of anxiety-related sensations and is conceived as an intrinsic personality trait. The link between anxiety sensitivity and increased pain has been tested and validated in various populations including women in labour (Lang, Sorrell, Rodgers, & Lebeck, 2006) and volunteers who were subjected to electrical shock (Conrod, 2006). In a
study of patients undergoing dental procedures, Klages, Kianifard, Ulusoy, and Wehrbein (2006) documented that anxiety sensitivity was related to both high levels of anticipatory pain and actual pain experienced.

To further delineate the causal relationship between anxiety and pain, Granot and Ferber (2005) studied a cohort of patients (n=38) who underwent elective abdominal surgery. Pain was rated on a VAS in the first two days after the operation at rest and during activity. The mean pain intensity was significantly related to preoperative anxiety level (measured with the STAI); the higher the preoperative anxiety level, the more pain was reported after the surgery. However, this relationship was attenuated at high levels of anxiety displaying an overall curvilinear pattern. Although postoperative anxiety was not evaluated, subjects who were overwhelmed by excessively high levels of anxiety even after the surgery may be less vigilant and sensitive to physical pain. Alternatively, anxious individuals may be more inclined to seek relief from their pain than those who experienced less anxiety. Results of regression analysis revealed that state anxiety was a significant predictor of postoperative pain (B=0.620; p<0.001). Further analysis performed according to the methods proposed by Baron and Kenney (1986) suggested that the relationship between anxiety and pain was mediated by ‘pain catastrophizing’. Trait anxiety was a significant antecedent to catastrophizing which in turn contributed to significant variance in the pain experience. These findings propose other intervening variables that may
modulate the relationship between trait anxiety and pain. Sullivan (2001) demonstrated that emotional distress was highly correlated with experienced pain ($r=0.50$, $p<0.001$). Catastrophizing was significantly related to pain expectancy ($r=0.23$, $p<0.02$), experienced pain (11-point numerical scale), expectancy for emotional distress ($r=0.44$, $p<0.01$), and experienced emotional distress ($r=0.59$, $p<0.001$). Results of regression analysis revealed that pain expectation played a mediating role between catastrophizing and pain.

By definition, pain catastrophizing is an exaggerated and negative orientation to aversive stimuli that involves rumination about painful sensations, magnification of the painful threat, and perceived inability to cope with pain (Granot & Ferber 2005). **Catastrophizing** is an exaggerated negative belief that pain results in a hopeless situation that one is powerless to change. The person may continue to ruminate about painful sensations leading to magnification of the impact of the painful stimulus. Other cognitive constructs are rooted in beliefs about how pain can be controlled by self or by powerful others. Personality may render individuals more vulnerable to anxiety and anticipation-induced hyperalgesia. For patients with headache, anxiety sensitivity together with pain catastrophizing were both significant predictors of more intense pain (Drahaval Stewart, & Sullivan, 2006). White and Farrell (2006) speculated that pain complaints may be initially provoked by stress and exacerbated by anxiety. Results from latent variable structural analysis validated
anxiety as a mediator between external stressors (i.e. problem situations, witnessing violence, and victimization factors) and pain in early adolescents. Sullivan, Martel, Tripp, Savard, Crombez (2006) argued that catastrophizing actually may serve an important function to elicit support and caretaking from others. Taken together, the complex and intricate interplay between pain and anxiety is influenced by many personal, emotional, and cognitive factors.

Based on the relationship between pain and anxiety, it is hypothesized that anxiety alleviating strategies may be effective in relieving pain. To test this hypothesis, Shupp and colleagues (2005) randomly allocated patients to receive standard care, empathic attention, or self hypnotic relaxation treatment for the management of pain and anxiety during interventional radiological procedures. Results indicated that all patients experienced decreasing anxiety over time. Paradoxically, as anxiety abated, pain increased significantly during standard care (p<0.01), remained unchanged in the attention group and slightly decreased in the hypnosis group. The difference in pain perception between standard care and the non-pharmacological treatment groups over the study period reached significance only in patients with low state anxiety. Non-pharmacological approaches may be effective at low anxiety levels.

In sum, pain and anxiety are interrelated even in the aging population. Individuals who express high levels of anxiety also rate pain
as more intense in anticipation of and during painful stimulation, such as dressing changes, in various patient populations. Anxiety increases sensitivity to painful stimulation through multiple mechanisms substantiated by neurophysiologic data. Probably, an increased degree of sensory receptivity is a key reason for increased pain perception (McCracken, 2006). With heightened anxiety, environmental and somatic signals are brought to the patient’s attention. Cognitive self appraisal of one's ability to manage pain, capacity to regulate associated emotional distress, together with available social support, and coping resources may also affect the pain experience. At a deeper level, the lack of security with others may be linked to anxiety sensitivity that amplifies a person's vulnerability to experiencing anxiety thereby drawing increased attention to physiological changes and pain perception (Stewart & Asmundson, 2006).
Pain and aging

Pain is a common concern in the elderly population (Krulwich, et al., 2000; Leong & Berendt, 2007). Lomranz and Mostyofsky (1997) put forward an argument that pain and suffering are synonymous in the elderly population. Loss of physical reserves and interpersonal relationships may manifest as psychosomatic illness compounding the experience of pain. While pain is undeniably a common concern in the elderly population, much debate continues over the influence of aging on pain experience.

Aging has been associated with changes in the nociceptive and sensory system (Karp, Shega, Morone, & Weiner 2008). Age-related reduction in the primary afferent fibers is estimated to be approximately 50% loss in unmyelinated fibers and 35% in myelinated fibers in persons between 65-75 years of age (Mc Cleane, 2008; Verdu, Ceballos, Vilches, Narvarro, 2000). Notable neuronal death, loss of dendritic arborisation, and neurofibrillary abnormalities are evidenced throughout the aging cerebral cortex including areas that are responsible for nociceptive processing (Gibson & Farell, 2004). Immunohistochemical examination reported a reduction in production and activities of various neurotransmitters such as substance P, somatostatin and CGRP in the dorsal horns of aged animals (Bergman, Johnson, Xhang, et al., 1996; McDougall and Schuelert, 2007). The progressive loss of serotonergic and noradrenergic neurones in the superficial lamina of the spinal dorsal horn has also been demonstrated to affect the descending endogenous pain-
suppressing mechanisms (Laporte, Doyen, Nevo, et al., 1996; Moore & Clinch 2004). Using laser induced pain, Chakour, Gibson, Bradbeer, and Helme (1996) measured and compared reaction times before, during, and after superficial nerve block between younger and older adults. The investigators reported a relative deficit in A-δ fiber function in the older subjects. Cole, Farrell, Gibson and Egan (2008) documented increased pain evoked activities in the contralateral putamen and caudate in younger subjects (n=15; mean age 26 years) in comparison to the older subjects (n=15; mean age 79 years). The question that is central to this discussion is to what extent the physiological changes related to ageing can alter the perception and experience of pain.

Gibson and Helme (2001) reviewed over 40 studies that examined pain threshold and tolerance in the elderly. Twenty-one studies reported an increase in pain threshold with advancing age, 3 reported a decrease, and 17 reported no change. Meta-analysis revealed a significant increase in pain threshold with advanced age with the effect size being 0.74 ($P<.0005$). As far as pain tolerance is concerned, 10 studies were examined suggesting an age-associated decrease in the willingness to endure extremely strong pain. The decrease in pain tolerance effect size is estimated at -0.45 ($P < .001$) across these studies. In one of the reviewed studies, Lasch and colleagues (1997) examined pain introduced by graded intraesophageal balloon distension in healthy young (n=10, mean age 27 year, range 18-57 year) and old adults (n=17, mean age
72.5 year, range 65-87 year). Five of the elderly subjects felt no pain even at the maximum inflatable volume of the balloon (30 ml). Mean pain threshold volumes was 17 +/- 0.8 ml of air for the young subjects (+/- SE) as opposed to 27 +/- 1.4 ml for the elderly subjects (P < 0.01 and 95% confidence interval = 7.1-13.3). The volume of air inflated into the balloon to elicit esophageal pain was significantly higher in older subjects. The investigators surmised an age-related decrease in visceral pain threshold.

Lariviere, Goffaux, Marchand and Julien (2007) designed an experimental study to evaluate age effect on descending inhibitory control mechanism and pain perception. Three different age groups (young 20-35, middle-age 40-55, and elderly 60-75) each consisting of 20 subjects were asked to evaluate painful thermal (heat) stimulations before and while the participants’ hands were immersed in a bath of cold water. It was hypothesized that cold water immersion could trigger the bulbospinal endogenous pain inhibitory control mechanism elevating the pain threshold and therefore rendering the subsequent thermal stimulation less painful. Comparing the pain scores (VAS) before and during cold water immersion, only the young and middle aged adults exhibited significant pain reduction (p<0.05). No significant difference was noted in the elderly group (p=0.09). Immersion-induced increase in pain threshold was greatest for the younger group (p<0.05). Results may suggest that the pain inhibitory mechanism is impaired in the elderly.
In contrast to the findings from previous studies, Kunz, Mylius, Schepelmann and Lautenbacher (2008) showed that age did not have any significant effect on pain ratings. Sixty-one elderly subjects (mean age=72.3 years) and 40 younger subjects (mean age=24.1 years) were asked to rate their pain (6-point word descriptor scale) in response to electrical and pressure painful stimuli. Between the young and elderly subjects, there were no significant differences in the ratings of pain evoked by pressure [F (1,99)=0.96, p=.33] or electrical [F(1,89)=.27, p=.60] stimulations.

Overall, while interesting, results of experimental studies are derived from artificial environments which may not necessarily be extrapolated to real life situations. The alleged age differences may be due to sensory deficits, heightened vigilance, delayed response, reluctance to report, a more conservative attitude toward pain, or interactions of these factors (Gagliese & Melzack 1997) and age cohort factors in the elderly. For example, Gagliese and Katz (2003) revealed that age-related differences in nociception may be influenced by methodological designs and the types of instrument used to measure pain. The investigators recruited 200 men who underwent radical prostatectomy. The older subjects (n=105, mean age=66.8 years) assigned lower pain levels on the McGill Pain Questionnaire (MPQ) and Present Pain Intensity Scale than the younger men (n=95; mean age=56.4 years) (both p values <0.05). However, there was no significant difference
in VAS pain intensity scores. In a later study, Gagliese and Melzack (2003) found that older subjects (n=139; mean age=70.12 years) reported lower MPQ pain scores than younger subjects (n=139; mean age=42.93) from a pain treatment center (p<0.05). The MPQ contains various word descriptors such as sharp, tender, burning, nagging that articulate the sensory quality of the pain experience. The evidence indicates that age related differences in pain perception were possibly found in the quality but not the intensity.

Overall, it is unclear whether the experience of pain in the elderly population differs from younger adults. Some studies show decreased pain tolerance and increased pain threshold while others indicate no significant differences. Further investigation seems warranted to evaluate poorly understood variables that may influence pain perception, especially those operating within a psychosocial and interpersonal framework to understand the dynamic nature of this construct. The purpose of the current study was to determine whether interpersonal relationship can influence pain experience in a cohort of older adults with chronic wounds.
Wound Related Pain

Pain in patients with chronic wounds

Pain is a common experience in patients with chronic wounds (Beitz & Goldberg, 2005; Briggs, Bennett, Closs, & Cocks 2007; Budgen, 2004; Mahe et al., 2006). This section will describe the prevalence of wound related pain and its impact on patients. Physical manipulation of wounds during dressing change and psychosocial factors that may aggravate pain and associated psychosocial factors will be discussed.

A study of pain in patients with chronic wounds during dressing change can restrict the number of confounding variables by controlling the noxious stimulation, circumstances, and pathology involved. The experience of wound related pain is influenced by various causative factors, recurring trauma, the presence of neuropathy, and wound related treatments and procedures. With dressing changes, patients often experience the exacerbation of wound-related pain that warrants further examination.

Chronic wounds (including pressure ulcers, leg ulcers and diabetic foot ulcers) are common in the elderly population and the prevalence is increasing as our society continues to age. On average, 26 % of hospitalized and community care patients have pressure ulcers across a continuum of health care settings (Woodbury & Houghton, 2004).

Once developed, these wounds are recalcitrant to healing. In a study of patients with leg ulcers, half of the affected population had a
previous leg ulcer history spanning 5–10 years and a third of affected individuals had a history exceeding 10 years (Lorimer, Harrison, Graham, Friedberg, & Davies, 2003). Among patients with diabetes, 2–3% will develop a foot ulcer annually, while the lifetime risk of a foot ulcer is as high as 25% due primarily to neuropathy or loss of protective sensation with undetected local trauma (Brem, Sheehan, & Rosenberg, 2006). In patients with diabetes and neuropathy followed for one year, 7.2% of this population developed their first foot ulcer (Abbott, Vileikyte, & Williamson, 2004). Together these various types of non-healing wounds constitute an exorbitant disease burden on health care systems as well as suffering associated with pain for patients and their families.

**Prevalence of wound related pain**

Studies of patients with venous leg ulcers indicated that more than 80% of patients reported acute or chronic wound pain with half of them rating pain as moderate to the worst possible pain. Even after the leg ulcers were healed, patients were able to provide vivid descriptions of the pain experiences.

Of the patients who developed pressure ulcers, Dallam and colleagues (1995) reported that 59% experienced some type of pain in a hospital setting. The study cohort was comprised of 78 women and 54 men between 24 to 100 years of age (mean age = 71.4 years;
The VAS pain scores were significantly and inversely correlated with age \( (r = -0.36, p < 0.02) \).

In another study of patients with pressure ulcers, Szor and Bourguignon (1999) reported that as many as 84% of their subjects experienced pressure ulcer associated pain at rest while 88% acknowledged pain at dressing change. Subjects with stage 2 ulcers were more likely to experience transient pain whereas subjects with stage 3 and 4 pressure ulcers reported constant pain. Most (75%) of these individuals rated their pain as mild discomforting or distressing while 18% described their pain as horrible or excruciating. However, the sample was small consisting of 32 subjects with a mean age of 74.7 (SD=12.8). Consistent with previous findings, Meaume, Téot, Lazareth, Martini, and Bohbot (2004) reported that 79.9% of a large sample of patients with wounds (2914 with acute wounds and 2936 with chronic wounds) experienced moderate to severe pain during dressing change, while 77% of these patients experienced spontaneous pain. Other studies had also documented that pain did not necessarily follow any temporal pattern with approximately 80% of pressure ulcer patients experiencing constant pain despite the use of analgesics. Proctor and Hirdes (2001) performed an analysis based on a minimum data set involving 3195 nursing home residents across three Canadian provinces. The mean age of the sample was 83.8 years (range 65 to 105 years). The result substantiated the significant
association between pressure ulcers and daily pain experience (odds ratio=3.5; 95% CI=1.81-6.76).

Results of these studies not only validate the various types of chronic wound pain but the severity and pervasiveness of wound related pain in this patient population. Unfortunately, pain is not consistently assessed and documented by health care providers. Lorimer et al (2003) reviewed 66 nursing records of venous ulcer patients receiving home care. Only 15% of the records contained any documentation of pain and the assessment was not standardized. Pain was not part of a regular assessment of leg ulcers in up to 55% of the surveyed community nurses. Husband (2001) sought to explore the care provided for patients with venous ulcer in the community. They interviewed 33 community nurses and none of them expected patients with venous leg ulcers to have significant pain. Patients often express feelings of frustration at the failure of health care providers to mitigate wound related pain.

The significance of wound related pain

Unremitting and recalcitrant pain is disabling and devastating in patients with chronic wounds. Accumulating evidence confirms that unrelenting pain takes a central place in the experience of living with chronic wounds (Freedman, Entero, Brem 2004; Johnson 1995; Popescu, Salcido, 2004; Rook, 1997; Senecal 1999). Although the primary objective is often focused on healing of the wound, patients
with various types of chronic wounds consistently relate pain to be of a higher management priority (Husband 2001; Hyland, Ley, & Thompson 1994; Philips & Dover; 1991). Vermeulen, et al. (2007) asked patients (n=74) and health care providers (n=200) to rank their preferences for an ideal dressing material. Patients consistently identified the importance of a wound dressing material that could facilitate a quicker and less painful healing process while the physicians were more concerned about a shorter hospital stay. Review of documented wound care has revealed poor wound assessment and inadequate pain control.

Hyde, Ward, Horsfall, & Winder (1999) interviewed 12 women aged over 70 years who experienced leg ulceration for more than 3 years; pain was their first and foremost care concern. Puntillo and colleagues (2001) reported that adolescents rated wound care related pain to have the greatest discomfort among 5 commonly performed hospital procedures. The results of a number of venous leg ulcer (Hareendran, Bradbury, Budd, 2005; Douglas 2001; Heinen, van Achterberg, Reimer, 2004; Heinen, et al., 2007), pressure ulcer (Benbow 2006) and diabetic foot ulcer studies (Ribu, Rustøen, Birkeland et al., 2006) indicated a significant correlation between wound related pain and diminished quality of life. The high levels of wound pain not only interfered with daily physical activities but social interpersonal relationships (Beitz & Goldberg, 2005). This pain-related decrease in function is a significant predictor of psychosocial
adjustment at home (Pieper, Szczepaniak, Templin, 2000). The greater the pain interference, the more problems the person experienced at home. All 36 patients (age from 37 to 54 years, mean = 44.6, SD = 4.3) who participated in the study had a history of intravenous drug use and the presence of a venous ulcer. Results may not be generalizable to other patient populations.

Using qualitative study methodology (hermeneutic phenomenological model), Krasner (1998) identified the multifaceted aspects of pain and suffering and its negative impact on the quality of life among 14 patients with painful venous leg ulcers (age 30 to 86 years). Four major themes emerged linking pain and quality of life: feeling frustrated, interfering with the job, making significant life changes, and finding satisfaction in new activities. Wound-related pain was reckoned as all encompassing and permeated all domains of peoples’ lives (Hopkins, Dealey, Bale, et al. 2006). Activities important to maintain daily functioning such as working, walking, standing, stair climbing can often exacerbate wound related pain (Goncalves, de Gouveia Santos, de Mattos Pimenta, Suzuki, Komegae 2004; Pieper, Rossi, Templin 1998; Walshe 1995). To avoid pain, people with chronic wounds restricted mobility and social activities and complained of living a limited life (Flett, Harcourt, & Alpass, 1994). Because of excessive pain, 31% of patients were not even able to attend wound care clinics (Pieper, DiNardo 1998). It is not surprising to find that patients with venous leg ulcers often described
pain as the worst aspect of having an ulcer (Beitz, et al., 2005; Neil & Munjas, 2000).

Pain can be fatiguing as it often occurs or exacerbates at night (Flanagan, Vogensen, & Haase, 2006). Noonan and Burge (1998) reported that as many as 73% of patients reported sleep disturbance. There is a close connection between the presence of pain and decreased emotional well being. Patients often expressed a sense of imprisonment, powerlessness, anger, sadness, despair and they felt that it is a time of hopelessness, when the painful wound controls their existence (Chase, Melloni, Savage 1997; Charles, 1995, 2004; Fox 2002). Negative mood and depression are common. In a study comparing psychological well-being and general health between 14 elderly patients (>60) with leg ulcers and 14 controls of the same age category (Ebbeskog & Ekman 2001), the leg ulcer patients rated significantly lower levels of self-esteem and higher levels of negative affect than the controls (p<0.05).

Anxiety has been correlated with increased wound related pain both at dressing change and between dressing changes. In a study of patients (n=24) requiring burn dressing change (Weinberg, et al.2000), pain was positively correlated to anxiety immediately after burn dressing changes. Using a hierarchical regression model, Aaron and colleagues (2001) demonstrated that anxiety is a significant predictor of procedural pain during dressing change and accounts for 40% of the variance of reported burn-related pain. Jones, Barr, and Robinson
(2006) used the Hospital Anxiety and Depression Scale (HADS) to screen for the presence of anxiety and depression in patients with leg ulcers (n=190). They examined how anxiety might have related to other determining variables such as living alone, mobility, exudate, and pain. Only pain and anxiety were significantly related.

Chronic persistent pain may affect how people appraise their situation with a propensity to think the worst will happen, thereby raising anxiety, worry, and pain sensitivity. Roth, Lowery, and Hamill (2004) demonstrated that pain was correlated to catastrophic thinking in patients with chronic wounds. Patients afflicted with chronic wound pain may also display maladaptive coping styles and relational distortions.
Factors contributing to wound pain

Free nerve endings originate in the dermis and are distributed to the surface of the skin and its underlying structures. Perception of pain from trauma and tissue damage derives from the direct excitation of nociceptors in cutaneous free nerve terminals. Local damage has been linked to mechanical forces (pressure, friction, and shear), chemical irritation, vascular compromise (venous hypertension and arterial insufficiency), infectious agents, or inflammation (Woo, Sibbald, et al., 2008). Subsequent to tissue injury, persistent inflammation triggers the release of mediators that activate local pain receptors to produce an enhanced cutaneous sensitivity in the wound base and the surrounding wound margin. This is characterized by spontaneous pain (ectopic or spontaneous firing of nociceptors), exaggerated or prolonged responsiveness to painful stimuli (hyperalgesia), pain provoked by normally non-painful stimuli (allodynia), and spread of pain to uninjured tissue such as wound margins (Coderre & Katz, 1997).

According to a conceptual framework developed by Krasner (1995), wound-related pain is complex and dynamic integrating the experience of noncyclic acute wound pain, cyclic acute wound pain, and chronic wound pain (Figure 3). Chronic or persistent wound pain is described as the background symptom that exists at rest and between wound-related procedures (e.g. turning) or dressing changes. Persistent wound pain does not necessarily have a definite trigger but it is often
associated with the underlying wound etiology and sensitization of pain fibers. Chronic pain may be continuous and persist throughout the day or intermittent and occur in waves. Cyclic wound pain is defined as a periodic acute wound pain experience induced by recurring treatment interventions (regular dressing change). Noncyclic wound pain is provoked by more sporadic procedures, such as sharp debridement, that occur as a one time procedure or at infrequent and usually variable intervals.

Figure 3 Chronic wound pain experience (adapted with permission from Krasner, 1995)
Pain with the various stages of the dressing change procedure

Wound dressing change involves removal of soiled dressings, cleansing of wound bed, and reapplication or packing of new dressing materials. The purpose of local wound care is to promote wound closure by removing harmful debris, reducing bacterial burden, containing the exudate, and protecting the wound from mechanical injury (Stotts, Puntillo, Morris et al 2004). Although dressing changes are integral to wound management, aggravation of sensory fibers can occur. Up to 80% of nurses (n=225) noticed that patients experienced most pain during dressing change especially when the dressing is removed (Hollinworth & Collier, 2000). To validate the experience of pain during dressings change, Stotts et al (2004) examined pain associated with wound care in 412 hospitalized patients (mean age=56.3 years). Pain was significantly more intense in patients who underwent two or more wound care related procedures (removal of dressing, irrigation, packing, and/or debridement) (n=258; p=.000). The mean pain scores were 3.3, 5.3, and 3.1 before, during, and after wound care procedures on an 11-point numerical rating scale ranging from 0 (no pain) to 10 (the worst possible pain). The subjects frequently chose words such as tender, sharp, stinging, aching, and stabbing to describe the quality of pain. These painful sensations illustrated a combination of nociceptive (gnawing, aching, tender,
throbbing) and neuropathic (burning, stinging, shooting, and stabbing) pain.

In a large community based study of 5850 patients with acute (n=2914) and chronic wounds (n=2936), 47% to 59% of the subjects indicated very severe pain on a self-administered questionnaire (Meaume, Teot, Lazareth, et al., 2004). These patients were concerned about pain upon dressing removal especially when dressing materials were adherent to wound bed. Removal is painful; when dressings adhere to the wound bed due to dried out materials, with the use of aggressive adhesives, the presence of abnormal friable granulation tissue, capillary loops growing into the product matrix and the glue like nature of dehydrated or crusted exudate (Hollinworth & White, 2006; Rogers, Walmsley, Rippon et al., 1999). Enzyme rich exudate may spill over to peri-wound skin causing maceration and tissue erosions with an increased risk of trauma and pain (Thomas, 2008). In a randomized controlled trial (Chang, Alsagoff, Ong, et al., 1998), stage 2-3 pressure ulcer patients (n=34; mean age=58 years) were treated with either saline gauze or hydrocolloid dressings to determine the overall dressing performance in terms of adherence to wound bed, exudate handling ability, overall comfort and pain during dressing removal. Patients reported more severe pain with saline gauze dressings when the gauze frequently adhered to wound bed and surrounding skin compared to the hydrocolloid alternative (p<0.01).
According to a review of dressings and topical agents for post-surgical wounds healing by secondary intention (Vermeulen, Ubbink, Goossens, de Vos, Legemate 2005), there is sufficient evidence that patients experienced more pain with gauze than advanced moisture balance dressings including foam, alginate and hydrocolloid dressings. Each time the dressing was removed; potential local trauma may evoke pain perpetuating the inflammatory response with each dressing change.

Cotton gauze is not the only dressing material that tends to induce pain. Repeated application and removal of adhesive tapes and adhesive dressings can mechanically strip the stratum corneum on the skin surface from the epithelial cells. This can precipitate pain and skin damage (Dykes, Heggie, & Hill 2001). In severe cases, erythema, edema, and blistering have been observed (Brett, 2006). In a comparative study, Dykes (2007) utilized 12 normal volunteer subjects to demonstrate cutaneous irritation and impaired barrier function from the adhesive edges in 6 commonly used wound-care products. Similarly, Zillmer, Agren, Gottrup & Karlsmark (2006) identified more skin damage with hydrocolloid adhesive bases compared to polyurethane and soft silicone material. Dressings were applied to forearms and peri-ulcer area of 45 patients with open (n=29) and recently healed (n=16) venous ulcers. The adhesives were removed and replaced every second day for 14 days. After repeated removal and application of dressings, the investigators noticed a significant breach in the skin barrier function (transepidermal water loss).
or stratum corneum hydration (electrical conductance) with hydrocolloid dressings. Similar damage was not observed using other adhesives. Dressings that incorporated smaller amounts of adhesive or silicone coatings induced the least cutaneous irritation without compromising normal transepidermal water loss. Meaume, Van De Looverbosch, Heyman, et al (2003) randomized 18 patients with stage 2 pressure ulcers to either silicone dressing or polyurethane foam. Patients allocated to silicone dressing displayed less damage to wound edge and surrounding skin with less maceration and leakage. By limiting skin damage with dressing removal, it is possible to minimize pain at dressing changes.

Considering pain as an outcome indicator, Dykes and Heggie (2003) concluded that removal of the silicone dressing was less painful (n=24, p<0.01) compared to dressings that required higher peel force. However, results of studies from healthy volunteers and intact skin may not be applicable to patients with wounds and fragile peri-wound skin.

According to a database of 1891 patients receiving wound care in a nursing home facility, Viamontes, Temple, Wytall & Walker (2003) noticed minimal evidence of skin stripping (<1%) with the use of either soft silicone foam dressing or adhesive hydrocellular foam dressing. However, the study was limited by the nonrandomized retrospective design and non-standardized measurement. In another similar report, Viamontes and Jones (2003) reported that neither foam dressings incurred any significant skin stripping or pain in 403 wounds. While the reported prevalence of
wound pain is consistently high, over 99% of the subjects experienced no pain with either tested dressings. The method to evaluate pain was not reported.

Next to dressing removal, wound cleansing is also likely to evoke pain during the dressing change (Kammerlander and Eberlein, 2002; Hollinworth and Collier, 2000; Moffatt et al, 2002). To examine the influence of the irrigation solution temperature on pain, 38 patients with lacerations were rinsed with both warm (90-100°F) and room temperature (70°F) saline solution in a random order. Pain was measured with a visual analogue scale. Although the majority of the participants expressed a preference for the use of warm over room temperature solutions, there was no significant difference in pain scores (p=0.082). In a small pilot study, Woo (2004) evaluated pain in 12 patients with chronic wounds. Pain was measured using a numerical rating scale at baseline, dressing removal, cleansing, application of new dressing and 5 minutes after dressing changes. Wilcoxon signed rank test indicated that pain intensity was significantly higher at dressing removal (p<0.016) and cleansing (p<0.023) compared to baseline. Application of cold wound cleaning solutions is not only unpleasant but may be harmful to wound healing. It is hypothesized that fibroblasts and other metabolic activities are delayed hours after exposure to cold ambient environment and cleansing solution (Betts, 2003; McKirdy, 2001). Although some evidence is
available, further investigation is necessary to confirm the variables that result in pain at dressing change particularly pain with dressing removal and wound cleansing. With the unsettled debate over potential alteration in nociception in the elderly, it is not currently known if results from younger or mixed patient populations are similar for individuals over 60 proposed as the cohort in this study.

Although Krasner’s model had improved the understanding of wound related pain, this paradigm is missing the beliefs systems, personality structure, emotions, psychodynamics, and interpersonal determinants that should be elements of the tapestry of pain. Woo and Sibbald (2008) developed an explanatory wound pain model (Figure 4) that incorporates the patient centered concerns (e.g. anxiety, depression, patient expectations) along with wound cause, and local wound care issues (tissue trauma, moisture balance, infection). Patients with chronic wound pain are no longer viewed as passive victims reacting to external noxious stimulation but active existential agents creating their own narratives and interpretation of pain.
Figure 4 Wound Associated Pain Model
(Used with permission Woo & Sibbald 2008)

Pain, anxiety, and wound care

In patients with chronic wounds, anxiety is common due to frequent wound associated pain and other existing or potential threats to personal well being, physical functioning, social interactions, and body integrity (Herber, Schnepp, & Rieger, 2007). Studies that explore the relationship between pain and anxiety are lacking in patients with chronic wounds. Loncar, Bras, and Micković (2006) specifically evaluated pain at rest and
anxiety in patients with burn wounds within 2 weeks of injuries (n=70). Pain was measured by the Short Form McGill Pain Questionnaire while anxiety was captured by the Beck Anxiety Inventory. The relationship between pain and anxiety was significant (p<0.005); the higher the pain scores, the higher the anxiety.

Recognizing the need to understand pain that is often exacerbated during dressing change, Ptacek Patterson, Montgomery, and Heimbach (1995) followed 47 burn patients for 10 consecutive days. Participants were asked to rate the worst pain levels on a visual analogue scale (VAS) and the sensory and affective characteristics of pain on McGill Pain Questionnaire (MPQ) approximately 2 hours after dressing changes. Trait anxiety was evaluated with the STAI-trait version. Despite the steady decrease in daily pain scores across time, trait anxiety was consistently correlated with ratings of worst pain (0.32), sensory pain descriptors (0.36) and affective experience of pain (0.45; all p values < 0.05). The higher the likelihood of the person to experience anxiety, the more intense was the pain. The severity of pain estimated by total body surface area of burn involvement was not related to pain. In a different study of 23 adult burn patients, pain ratings were also consistently and significantly higher during dressing change than at baseline (Byers, Bridges, Kijek, & LaBorde, 2001). However, there were no significant differences in anxiety before or during dressing changes (P = .16). Both pain and anxiety were calibrated with VAS. Weinberg, Birdsall, Vail, et al., (2000) compared pain before,
immediately after, and 30 minutes after dressing change in a sample of 24 adult burn patients over a 5 day study period. Both pain and anxiety were measured by a visual analogue scale. Results of a repeated measures analysis of variance indicated statistical differences in pain levels over time, with the highest scores obtained immediately after dressing change as opposed to pain scores before and 30 minutes after the procedure. Pain and anxiety were correlated only immediately after dressing changes. The interrelationship between pain and anxiety may be contingent on how intense the pain was at the time of assessment. Results may be affected by the wide range of scores and a large standard deviation value indicating a heterogeneous sample. The patient-caregiver relationship during dressing change may have influenced how patients report their symptoms and similar contextual factors should not be overlooked.

In response to the need to address the anxiety specific to pain during and after provision of burn care, Taal and Faber (1997) developed a Burn Specific Pain Anxiety Scale (BSPAS) for the assessment of pain-related and anticipatory anxiety. Nine items were developed to include feelings of worry about wound healing, fear of losing control during dressing changes, anxious anticipation of pain related to medical procedures, and a generalized feeling of tension due to pain. Each item in the BSPAS was scored on a 100 mm line with word descriptors ‘not at all’ on one extreme and ‘the worst imaginable way’ on the other.
A total of 35 patients were evaluated 5 times a day to indicate their pain (visual analogue thermometer) and anxiety before, during and after burn care procedures. Burn specific pain anxiety was significantly related to both procedure \((r=0.59; \ p < 0.005)\) and non-procedure related pain \((r=0.38; \ p < 0.05)\). The authors contended that pain was so devastating that anxiety levels were heightened even in the absence of physical triggers associated with burn care procedures. In a later multi-center study, the BSPAS was revised to include 5 items and evaluated in a sample of 129 burn patients (Taal, et al., 1999). Factor analysis indicated a two factor model represented by procedural anxiety and anticipatory anxiety.

Using a hierarchical regression model, Aaron and colleagues (2001) demonstrated that pain anxiety measured by the original BSPAS was a significant predictor of pain \((p \leq 0.01)\) during dressing changes and accounted for 40% of the variance in pain among burn patients \((n=27)\). The same anxiety measure did not predict pain at rest. Anxiety that was measured by other global measurement tools including the STAI and Profile of Mood States (POMS) did not predict subsequent ratings of procedural and background pain levels.

Research in this area has not yet been translated into practice. Burn patients continue to experience tremendous anxiety that was rated higher than what patients endorsed to be acceptable or tolerable during burn wound care (Carrougher, Ptacek, Honari, et al., 2006; Byers,
Management approaches tested to break the vicious cycle between anxiety and pain included music therapy, (Richards, Ferguson, Sinha, & Kwekkeboom, Whitehead-Pleaux, Baryza, & Sheridan, 2006), touch therapy (Turner), hypnosis, stress reducing strategy (Frenay, Faymonville, Devlieger, Albert, & Vanderkelen, 2001), guided imagery (Danhauer Marler, Rutherford, et al., 2007) and distraction (Kwekkeboom, 2003). The results were mixed in that improvement in anxiety was not necessarily associated with pain reduction.

In a small randomized controlled trial (Whitehead-Pleaux Baryza, & Sheridan 2006), 14 children with burn wounds were randomly assigned to music therapy or verbal support (control group) during dressing change. While pain was measured with the Wong Baker FACES Pain Rating Scale, anxiety was documented by objective behavioural indicators of distress and self report fear thermometer. There were no significant differences between the experimental and control groups on pain and anxiety. Arguably, behaviours associated with anxiety may be confounded by other behaviours related to pain and unpleasantness.

Sharar et al (2002) demonstrated that more than 85% of paediatric burn patients (n=22) exhibited little or no signs of anxiety during dressing change with appropriate pain control using either transmucosal fentanyl citrate or oxycodone. Findings from acute burn wound literature may not be extrapolated to the care of patients with chronic wounds due to the
tenacious and pervasive nature of chronic wound related pain and different underlying pathophysiology.

Chronic wound patients have described pain as the most intense during dressing change and the worst part of living with an ulcer (Price et al., 2008). According to one study (Gore, Brandenburg, Hoffman, Tai, & Stacey, 2006), even diabetic foot ulcer patients with loss of protective sensation can suffer from painful diabetic peripheral neuropathy (n=255, mean age = 61 +/- 12.8 years) rated their average levels of pain as 5.0 (+/- 2.5) on a scale of 0-10 indicating moderate level of pain. Pain was disabling interfering with walking, work, sleep, enjoyment of life, mood, and general activity. As high as 35% and 28% of the subjects acknowledged moderate to severe levels of anxiety and depression (HADS-A and HADS-D scores >or=11 on 0-21 scales) respectively. Of interest, patients who experienced severe pain were more likely to concede higher anxiety (HADS-A) (p<0.05) than those with mild and moderate levels of pain (Gore Brandenburg, Dukes, et al., 2005).

Jones, Barr, Robinson, and Carelisle (2006) sought to determine the relationship between pain and anxiety in patients with chronic venous ulcers. A total of 190 subjects (72% age 60 and over) rated anxiety and depression on the Hospital Anxiety and Depression Scale (HADS). Pain was evaluated by a 0-4 numeric scale and a 5-point verbal rating scale. A total of 73% of the patients suffered some degree of pain. Of the individuals who experienced pain, 37% reported moderate to
overwhelming pain, and 14% described constant pain. Using a cut off of 9 (0-21) for both anxiety and depression subscales on the HADS, 27% of the subjects were deemed depressed while 26% were considered anxious. The results confirmed that anxiety was significantly and positively related to pain (p<0.001).

Despite empirical evidence that validates the relationship between pain and anxiety in patients with wounds, little is known of how anxiety is related to pain. Further clarification and understanding of this relationship may provide directions to plan for therapeutic interventions to mitigate the two common and devastating symptoms.

**Pain, stress response, and wound healing**

Pain not only contributes to psychological distress and erodes patients’ quality of life but may deleteriously affect wound healing through various mechanisms (Woo, Harding, Price & Sibbald 2008). Prevailing opinion considers wound-associated pain to be a major source of stress /anxiety (Woo, 2008). Chronic pain invades all aspects of everyday life including physical activity, work, sleep, social functioning, and recreation. Restrictions or inability to perform certain tasks due to pain can be frustrating. The stress response is complex and nested within multiple parallel but interconnected mechanisms linking neuroendocrine, inflammatory, and nociceptive phenomena (Charmandari, Tsigos, & Chrousos, 2005). Nociceptive C fiber releases pain neuropeptides
(substance P, and neurokinin A) that activate leukocytes and other immuno-active cells to release proinflammatory cytokines. These proinflammatory cytokines not only stimulate and amplify the pain signals but also act at the paraventricular nuclei (PVN) and along the Hypothalamic Pituitary Axis (HPA) to initiate a neuroendocrine stress response (Blackburn-Munro 2004; Bomholt, Harbuz, Blackburn-Munro, Blackburn-Munro, 2004).

The central components of the stress system are located in the hypothalamus and the brainstem. The corticotrophin-releasing hormone (CRH) and the arginine-vasopressin (AVP) producing neurons are found at the PVN while the catecholaminergic neurons are part of the locus ceruleus system. It is at the PVN where neural inputs from the sensory system, the amygdala and the mesocorticolimbic dopaminergic system, the limbic brain, and the frontal cortex are integrated. Once activated, the PVN produces CRH that stimulate the secretion of adrenocorticotropic hormone (ACTH) from the anterior pituitary. The physiological activities of CRH are not limited to the pituitary level but also receptors of immune cells (e.g. macrophages) that are responsible for the synthesis of cytokines upon activation. The ACTH targets the adrenal gland where the adrenal cortex is prompted to secrete glucocorticoids hormones (mainly cortisol) while the adrenal medulla releases catecholamine. Glucocorticoid hormones participate in many physiological functions. Cortisol can attenuate the activity of the immune system by suppressing
cellular differentiation and proliferation, down-regulating gene transcription, and reducing expression of cell adhesion molecules that are essential for cell trafficking (Blackburn-Munro 2004; Sternberg 2006). In the presence of cortisol, T-cells become less responsive to the interleukin-1 (IL-1) signalling for the production of growth factor that facilitates T-cell proliferation. To curb the over-production of cortisol, a negative feedback mechanism is built in. A rise in the level of cortisol in the blood inhibits the secretion of corticotropin-releasing hormone (CRH), resulting in feedback inhibition of ACTH (Black 2002).

Dysfunction of the regulatory system can alter patterns of serum cortisol levels that have been observed in connection with clinical depression (Bao, Meynen, & Swaab 2008; Bob, Freybergh, Jasova, et al. 2008), psychological stress (Hugo, Hilgert, Corso, 2008; Gotlib, Joormann, Minor, Hallmayer, 2008; Graham, Christian, & Kiecolt-Glaser, 2006), and such physiological stressors as pain. Numerous studies have validated and extended the findings that the administration of cytokines such as IL-1α or IL-1β to animals stimulates ACTH and GC secretion, as well as many other indices of HPA activation (Angeli, Masera, Sartori et al. 1999; Engström, Rosén, Angel et al., 2008; Muglia, Bethin, Jacobson, Vogt, Majzoub, 2000; Smith 2008). The elaboration of cytokines is not limited to injurious, inflammatory, and infectious insults, since recent studies have indicated that IL-1, IL-6, and brain-derived neurotrophic factor (BDNF) synthesis and/or secretion are altered during psychological stresses. In
one study, McBeth and colleagues (2005) selected and categorized 131 subjects aged 25 to 65 years into the following three groups: chronic widespread pain; free of chronic widespread pain but with strong evidence of somatisation; and a reference group. The investigators examined salivary cortisol levels, and serum cortisol after physical (pain pressure threshold exam) and chemical (dexamethasone suppression test) stressors. Results were in concordance with study hypotheses; high post-stress serum cortisol was related to high levels of psychological distress ($p = 0.05$, 95% CI $(0.02, 0.08)$. Subjects in chronic widespread pain and somatisation groups were also 1.9 to 1.6 more likely to have the highest serum cortisol scores.

The central nucleus of the amygdala has been shown to facilitate the activation of the hypothalamic-pituitary-adrenal (HPA) axis in response to stress and increase the release of CRF, ACTH, and corticosteroid. Myers and Greenwood-Van Meerveld (2007) undertook the task to prove the relative importance of amygdaloid glucocorticoid in the induction of anxiety and pain. By placing a high dose of corticosterone on the dorsal margin of the amygdala, the tested animals exhibit increased colonic hypersensitivity (pain) and behaviours associated with anxiety.

A substantial number of experimental studies corroborate the neuro-endocrine hormonal response to stress. Stress-induced cytokine and neuroendocrine activity will activate sympathetic outflow leading to vasoconstriction and subsequent compromised tissue oxygenation levels.
Mice that were exposed to restraint stress exhibited a serum corticosterone levels that were 4 times higher than those without restraint stress. Dermal wound healing was compromised with 27% slower healing rate in the restrained group compared to the control.

To study the effect of stress on humans, Kiecolt-Glaser, Marucha, Malarkey, Mercado, Glaser (1995) compared wound healing in 13 women caregivers (mean age=62.3 years) who had a relative with Alzheimer disease and 13 controls matched for age (mean age=60.4 years). The stress and burden of care-giving is well documented. All the subjects acquired a wound from a 3.5 mm punch biopsy at the same anatomical location (non-dominant forearms). Time to achieve complete wound closure was increased by 24% or 9 days longer in the stressed caregiver versus control groups (p<0.05). Caregivers' peripheral blood leukocytes exhibited a diminished ability to express the IL-1β gene in response to lipopolysaccharide stimulation in vitro. Interleukins play an important role to protect the host against infection and prepare injured tissue for repair by enhancing phagocytic cell recruitment and activation (Glaser & Kiecolt-Glaser 2005). Although the stress levels were not measured, results of the study are consistent with the understanding that psychological stress activates the HPA axis and cortisol production that suppresses the immune system.

Marucha, Kiecolt-Glaser and Favagehi (1998) recruited 11 healthy dental students (mean age 24.36, SEM = 1.11) who consented to have
two punch biopsy wounds placed on the hard palate. The first biopsy was
done during summer vacation while the second biopsy was obtained on
the contralateral side of the palate prior to an exam 6 weeks later.
Students served as their own control. Results indicated that the average
complete healing time was 7.82 days (SEM = 0.62) during vacation as
opposed to 10.91 days (SEM = 0.69) during examinations, F (1, 10) =
28.47, p < .001. The subjects reported a higher level of stress (p < .01)
and exhibited a drastic decline (68%) of IL-1β (p<.001) just prior to
examination compared to 6 weeks earlier. The relationship between
perceived stress, healing time, and immunologic evaluation was not
estimated in these studies.

In another study, Garg, Chren, Sands, et al (2001) observed the
skin barrier recovery rate from damage caused by tape stripping in 27
university students. Serial assessments were performed on 3 occasions:
after winter vacation when stress level was low, during examination week
with high stress levels, and after spring vacation when stress level waned.
Consistent with their hypothesis, the investigators reported that barrier
recovery was significantly slower during the high stress compared to the
low stress period (F=18.87; df=12.2; p<0.001). The correlation coefficient
for the relationship between stress and barrier recovery was significant
(r=-0.42; p=0.03) indicating the higher the stress, the slower was the
barrier recovery rate.
Based on previous findings, Glaser and his team (1999) examined psychological stress and the levels of proinflammatory cytokines in experimentally-induced skin blisters on the forearm of 36 women (mean ±SD age, 57.2 ±6.6 years). The specimens were aspirated and analysed within 24 hours of blister formation. Women who reported more stress on the Perceived Stress Scale produced significantly lower levels of IL-1α (p<0.03) and IL-8 (p<0.04).

Using a similar blister wound model, Yang, Bane, MacCallum, et al (2002) evaluated matrix metalloproteases (MMP’s) expression in 51 subjects (mean age= 41.72 range 20-74 years). All subjects were requested to indicate depressive symptoms on the Beck Depression Inventory (BDI). The mean BDI score was 5.41 with 63 being the highest possible score indicating minimal depressive complaints in the sample. Analyses of their data failed to reveal any relationship between depressive symptoms and MMP’s levels. The results may be different if subjects experienced higher levels of depression and associated distress.

In order to identify other personal covariates that may delay wound healing; Ebrecht, Hextall, Kirtley et al (2004) designed a study that examined perceived stress (measured with the Perceived Stress Scale), health behaviours (assessed with alcohol consumption, sleep, exercise and eating behaviour), dispositional optimism (measured with the Life Orientation Test), social support (measured with the Social Support Questionnaire), self esteem (measured with Rosenberg Self-Esteem
Scale), loneliness (measured with the UCLA Loneliness Scale), and emotional distress (measured with the General Health Questionnaire). All variables were measured 14 days prior, 1 day after, and 14 days after the biopsy. Wound healing was monitored in dermal biopsy sites among 24 subjects. Perceived stress and emotional distress were negatively correlated to wound healing rate between day 7 and 21 after the biopsy (p<0.05). Subjects who expressed optimism were more likely to achieve faster healing but the result was not statistically significant. Wound healing was also negatively correlated to salivary cortisol levels measured one day after the biopsy but not 14 days before or the day after the biopsy. This inconsistent relationship raises the question of measurement error. Among all the psychological variables, emotional distress at the day of the biopsy (r=.49, p<0.05) and self esteem on day 14 after the biopsy (r=-.44, p<0.05) were related to cortisol responses. Perceived stress scores were not related to any cortisol measurements. Perhaps stress-induced changes in cortisol levels are more detectable locally in wounds than systemically. Nevertheless, slow healing subjects (below median healing rate) rated higher levels of stress during the study (p<0.05) and higher cortisol levels one day post-biopsy than the fast healing group (p<0.01).

To validate the relationship between depression (psychological stressor), pain and wound healing, McGuire, et al. (2006) studied 17 women (mean age=37.65 years SD=7.79) who underwent gastric bypass
surgery. A 2mm punch biopsy wound was placed on subjects’ upper arm to monitor healing. Depressive symptoms were assessed by the Beck Depression Inventory short form and they were not related to wound healing or pain ratings (11 point numerical rating scale). Depressive scores were dichotomized into high versus low using 5 as a cut-off score. However, dichotomizing and collapsing the data generally lowers statistical power and therefore reduces the chance of finding a significant treatment effect because information from many subjects is ignored. Patients who reported less pain (median pain rating of \( \leq 8 \)) in the first 2 days post surgery, experienced faster healing by 7 days than those with more pain (log rank test, \( p=0.23 \)). More importantly, patients who experienced lower levels of pain over 4 weeks post surgery (median pain rating <4) also experienced faster healing (\( p=0.12 \)). Depressive symptoms were not related to wound healing.

Broadbent, Petrie, Alley, and Booth (2003) investigated the relationship between psychological stress and wound repair in 36 patients following inguinal hernia operation. They reported that perceived stress prior to the operation was a significant predictor of low interleukin-1 levels in wound fluids (\( p=0.03 \)), accounting for 17% of the variance. In contrast, worry about the operation significantly predicted lower levels of matrix metalloproteinase-9 in the wound fluid (\( \beta = -0.38, p = 0.03 \)) as well as increased pain over the first 20-hour postoperative period (\( \beta = 0.51, p = 0.002 \)). However, the investigators only followed the subjects for 20 hours.
after the surgery; the long term effect of stress on the immune system and wound healing remains unanswered. Indeed, chronic wound fluid analysis has demonstrated persistently elevated levels of inflammatory cytokines and proteases over and above normal acute wounds. To illustrate this, Trengove, et al. (1999) compared the protease activity in a number of wound types. They sampled wound fluids from patients after surgery (mastectomy) with those who have chronic wounds including mixed arterial and venous leg ulcers, diabetic foot ulcers, and pressure ulcers. The mean protease level in chronic wound fluid was almost 60 times higher than those in acute wounds (59.9 μg MMP Eq/ml versus 0.75 μg MMP Eq/ml, p<0.001). The exact mechanism is unclear. Chronic and repeated stress/pain may overwhelm the hypothalamic-pituitary-adrenal axis feedback mechanism. The outcome is a progression of inflammatory processes inundating the local wound milieu with inflammatory mediators.

Kiecolt-Glaser, et al (2005) studied the impact of marital stress on the healing of blister wounds in 42 couples ranging in age from 22 to 77 years (mean [SD], 37.04 [13.05]). Blister wounds were induced by suction and monitored for healing daily. Local wound and serum cytokine levels were obtained and measured after the first visit to the research unit that involved discussion on social support and a second visit that involved discussion of conflicts. The couples were classified into two groups based on the hostility they harboured towards each other. Wound healing was delayed in the couples with high levels of hostility, at only 60% of the rate
of the low hostile group (p=0.03). Contrary to previous findings (Kiecolt-Glaser, et al., 1995; Marucha, et al., 1998), subjects with highly hostile visit behaviours (conflicts) implicating higher stress levels had larger increase in plasma IL-6 (p=.04) along with both plasma and local TNF-α levels (p=0.03).

Previous studies examined healing of artificial or experimentally induced wounds that are relatively small and superficial, so interpretation of these studies warrants careful deliberation. It remains equivocal if the same results will be observed in chronic wound patients. Nevertheless, psychological stress plays a definite role that needs further clarification in wound healing and wound associated pain.

Pain is a common symptom for persons with chronic wounds. The totality of this experience continues to generate conceptual and methodological discourse due to the vicissitudes of this affliction. However, McCaffrey (1972) reminds us that pain is whatever the patient says it is. The pain symptom may evolve from one or more sources including wound etiologies and local wound care such as trauma resulting from various treatment procedures and dressing change. It is crucial to remember that many psychosocial factors including perceptions of self, emotional state, interpersonal relationships, and sense of well being can have a tremendous impact on pain. Anxiety has been shown to increase pain in patients with burn
wounds but evidence to support this relationship in patients with chronic wounds is lacking. Pain is not inconsequential. A growing body of evidence demonstrates that pain triggers stress response characterized by a cascade of physiological events that can be deleterious to wound healing. To improve the lives of individuals with chronic wound-related pain, the first step is to identify the key determinants of pain and their interrelationships. Pain management will only be effective if these key psychosocial determinants are taken into account.
Chapter 3 Theoretical Framework

Attachment Theory

There are a variety of internal and external influences and intervening variables that act together to produce the complexity of pain. Recognizing that certain individuals are more vulnerable to pain despite similar noxious stimulation, the importance of personal interpretation and psychosocial factors in determining the pain experience cannot be underestimated. The concept of attachment has attained considerable currency for the study of pain by proposing the personality structure, social context, and interpersonal functioning that may augment, facilitate, or suppress pain.

Attachment is a stable tendency of an individual to establish an emotional bond to another person for safety and security. According to the attachment theory, interpretation and meaning assigned to the world including symptoms such as pain is based on personal views of self (attachment anxiety) and others (attachment avoidance). John Bowlby's conceptualization of attachment stems from evolutionary, ethological, cognitive, psychodynamic, and systems theoretical perspectives (Bowlby, 1969, 1973, 1982). Bowlby posits an innate behavioural regulatory system that motivates people, beginning early in infancy, to seek proximity and maintain close contact with specific individuals for physical or psychological safety and security. This instinct is both innate and learned (Donnellan, Burt, Levendosky, & Klump, 2008). The primary biological
function of attachment behaviour is to protect the vulnerable individual from danger or threat in order to ensure survival.

When danger seems remote, the attachment system deactivates and allows the individual to learn through independent exploration of the environment. A sense of security facilitates exploration by allowing the infant/child to engage in exploratory behaviour without constantly attending to and affirming the availability and proximity of the caregiver.

Attachment figures provide physical and emotional safe haven. Children who are nurtured in protective proximity of a reliable and responsive caregiver are likely to feel secure and safe without experiencing excessive degrees of anxiety as a result of separation. Establishment of a secure base allows people to explore and learn about the world and develop their own personalities. These children are more likely to be able to develop a trusting relationship with others in adulthood than those who are deprived of a responsive attachment figure.

On the other hand, if attempts to establish and maintain attachment are repetitively frustrated during infancy, these individuals will come to anticipate rejection and abandonment. Two possible adaptive outcomes resulting from recurring frustration of unmet attachment needs are chronic hyperactivation or deactivation of affective expression (Fuendeling, 1998). Hyperactivation signifies a high degree of emotionality and hypersensitivity to rejection. Deactivation aims to down-regulate emotion through
suppression. The dynamics of the attachment system is schematically presented in Figure 5.

**Figure 5 Activation and dynamics of the attachment system**

With repeated and continued attachment events, Bowlby (1982) posited that such early relationship experiences with principal caregivers and the manner in which they respond to attachment needs and emotional signals are internalized. With the progression of time, individuals depend less on physical proximity to their caregivers and increasingly rely on mental representations of the accessibility and availability of the caregiver,
especially when stressed (Thompson, 2000). These abstract representations reflect appraisals of the degree to which the self is worthy of care, love or attention (Park, Crocker & Mickelson, 2004) and the degree to which others are emotionally available and responsive to the self. Complex cognitive-affective representations of self, the other, and the relationship interaction pattern are developed and encoded as internal working models (IWMs). These models, comprised of beliefs, attitudes and accumulated knowledge about the self and others serve as templates for attachment-related goals and strategies to attain attachment objectives (interpersonal experiences that foster a sense of security).

According to attachment theorists (Ainsworth 1969; 1984; Ainsworth, Blehar, Warters & Wall, 1978; Bowlby, 1969; 1973; 1982), these internal models can play a key role in emotion regulation, behaviour, and the development of personality. People are characterized by the internal working models that serve as interpretive filters through which individuals reconstruct their understanding of new experiences and relationships in ways that are consistent with past experiences and expectations. While these models function partially outside of awareness, they provide the person with heuristics for anticipating and interpreting the behaviours and intentions of others. A person who has experienced warm and sensitive caregiving will tend to espouse an open and positive attitude towards close relationships that, in turn, will tend to elicit a positive response from others. The result is a positive affirmation of the working
model. Conversely, a person who has experienced repeated rejection will maintain high vigilance for cues for further rejection. This guarded and suspicious behaviour elicits the feared rejection and consolidates the negativity of such a working model.

As individuals mature, their repertoire of strategies to achieve attachment security may expand. However, their beliefs and expectations about their worthiness and others’ responsiveness may remain unchanged or resistant to change. Attachment style continues to influence a wide range of relationships (Mickelson, Kessler, and Shaver, 1997; Shaver and Mikulincer, 2002) and to influence modes of regulating and controlling negative affect in interpersonal interactions.

Feeney (2000) argued that individual differences in attachment security and formation of emotional bonds with other people will shape the regulation of negative emotions. Emotion regulation concerns a person’s ability to modulate their positive and negative emotional responses to internal and external stimuli. According to Mikulincer, Shaver, and Pereg (2003), security based strategies can be divided into declarative and procedural knowledge about the self and others. Declarative knowledge consists of beliefs about distress management, a sense of trust in other’s goodwill and a sense of self–efficacy in management of threats. Procedural knowledge is defined by acknowledgement and display of distress, support seeking and engagement in instrumental problem-solving. Effective regulations of various emotions are essential for
problem solving, social functioning, and overall physical and mental health.

Patterns of attachment

Ainsworth (1969; 1985) originally described three attachment orientations (secure, anxious, and avoidant) based on their observations of infants’ response patterns to separations from and reunions with their caregivers in the laboratory (Strange Situation Assessment Procedures). Mary Main and colleagues (Main & Hesse, 1990; Main & Hesse, & Kaplan, 2005) developed a semi-structured interview to assess adult attachment based on the discourse and memories of one’s own childhood experiences. Distinctive attachment patterns emerged from a coding and classification system of personal reflection on early attachment experiences.

Main et. al. (1984) report that this produces 4 main patterns:

1. Autonomous: persons who can recall their own earlier attachment-related experiences objectively and openly.

2. Dismissive: persons who dismiss attachment relationships as of little concern, value or influence.

3. Enmeshed: persons who seem preoccupied with dependency on their own parents and still actively struggle to please them.
4. Unresolved: persons who have experienced a trauma or the early death of an attachment figure, and have not come to terms with this or worked through the mourning process.

Hazan and Shaver (1987) extended the conceptualization of attachment to romantic relationships in adults. Several original research studies utilized Hazan and Shaver’s measurement of adult attachment; approximately 55-65% of adults were categorized as secure, 22-30% avoidant and 15-20% anxious (Erwin, Salter, & Purves; 2001; Fraley, Garner, & Shaver, 2000; Mikulincer, Gillath, & Shaver, 2002; Shaver, Belsky, & Brennan, 2000). Using the same instrument, Mickelson, Kessler, and Shaver (1997) evaluated the attachment style of over 8000 individuals age 15 and 54 in the US as part of a nation wide household survey for psychiatric disorders. Consistent with the previously documented distribution, 59% were classified as secure, 25.2 % as avoidant and 11.3 % as anxious (5% were not classified).

Bartholomew and Horowitz (1991) interviewed younger individuals (age 18-23 years) and analyzed respondents’ descriptions of friendships, romantic relationships and feelings about the importance of close relationships. They found that individuals with avoidant attachment were a diverse population. One subgroup of avoidant individuals denied experiencing subjective distress and downplayed the importance of attachment to avoid rejection while another subgroup of these individuals
acknowledged strong feelings of distress and discomfort when they are close to others. Based on the disparate response patterns, Bartholomew et al (1991) used the term “dismissing” to describe those who held high self esteem and avoided close relationships to maintain independence. In contrast, people designated fearful avoidant anticipated rejection based on low opinions about self and others. Accordingly, they classified 47% of the sample as secure, 18% as dismissing, 14% as preoccupied, and 21% as fearful/avoidant.

Based on Bartholomew and Horowitz’s conceptualization of attachment (Bartholomew, 1997; Bartholomew & Horowitz, 1991), the prototypical attachment patterns or styles are defined by the intersection of two orthogonal dimensions: the positivity of a person’s model of the self and the positivity of a person’s model of hypothetical others. Bartholomew and Shaver (1998) reviewed two studies that examined attachment in young adults. Three measurements of attachment were used including the Relationship Questionnaire, the Peer Attachment Interview, and the Family Attachment Interview. Two factors accounted for more than 40% of the variance in the attachment ratings lending credence to the conceptualization of two dimensional structures that underlies Bartholomew’s attachment model.

The model of self and the model of others are most appropriately conceptualized as continuous dimensions. The self model indicates the
degree to which individuals have internalized a sense of self worth without being exceedingly anxious and uncertain of the self’s lovability. People with a negative self model are characterized by anxiety concerning acceptance and rejection in close relationships based on personal unworthiness. Anxiety over relationships tends to cumulate in a hyperactivating approach. Hyperactivating strategies are insistent attempts to elicit involvement, care, and support from attachment figures. The perception of self is perceived and portrayed as helpless and incompetent at affect regulation leading to overdependence on attachment figures as a source of protection (Shaver and Hazan, 1993). Hyperactivation is associated with a tendency to perceive threat in personal transaction with the physical and social worlds and to inflate the potential negative consequences of these threats. The excessive attention gathers momentum and creates a self-amplifying cycle of heightening mental rumination on threat–related concerns and intensifying negative emotional responses to these threatening events.

The other-model indicates the degree to which individuals have internalized a sense of other’s availability, sensitivity, responsiveness, and tendencies to be supportive. A positive model of others is characterized by trust and comfort with intimacy whereas a negative model of others predicts avoidance of close relationships and an overriding push to maintain independence (Vertue, 2003). Avoidance therefore is associated with the deactivating approach. Deactivation is typically portrayed as
avoidance of closeness, intimacy, and dependence in close relationships and emphasis on self-reliance. This may involve action, inattention and suppression of thoughts and memories related to threats, distress, and personal vulnerabilities. Mikulincer et al., (2000) demonstrated that high scores on attachment avoidance are associated with poor mental access to attachment related worries.

Four prototypical attachment patterns are defined in terms of the two dimensions (see Figure 6). These four patterns are classified as secure (positive self and positive other), and three insecure attachment styles: preoccupied-ambivalent (negative self and positive other), dismissing (positive self and negative other) and fearful-avoidant (negative self and negative other) (Bartholomew & Horowitz, 1991).
Figure 6 Four attachment styles based on views of self and others

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Similar to the dimensions identified by Bartholomew et al. (1991), Brennan, Clark, and Shaver (1998) performed factor analysis on all existing English language attachment measures and concluded that attachment styles are best represented in two dimensions. They called the dimensions: attachment-related anxiety, which describes the extent to which one worries about being unloved and abandoned, and attachment-related avoidance, which describes the extent to which one avoids closeness to others. They contend that secure persons are low on both avoidance and anxiety; preoccupied persons are high on anxiety and low
on avoidance; dismissing persons are high on avoidance and low on anxiety; and fearful persons are high on both anxiety and avoidance.

In a study of 840 college students, participants were asked to place themselves into the attachment categories defined by both Hazan and Shaver’s Romantic Attachment Questionnaire and Bartholomew’s Relationship Questionnaire (Brennan et al. 1991). A chi-square analysis indicated that the two classification systems were significantly related ($X^2 (6) = 370.31; p<0.001$). Eighty-two percent of secure individuals were classified concordantly by the two measurement systems. Of people who classified themselves as preoccupied on Bartholomew’s measure, 57% corresponded to anxious ambivalent on the Hazan-Shaver measure. Fearful individuals according to Bartholomew’s measure were marked as avoidant on the Hazan-Shaver measure in 61% of the cases. There was no category on the Hazan-Shaver measure that paralleled dismissing, 43% chose fearful which acknowledged their avoidant tendencies and 45% considered themselves secure which emphasized their autonomy and self esteem.

**Secure Attachment**

Through repeated experience in receipt of care and nurturance, the secure attachment pattern emerges out of a positive view of self and others. These early salubrious interactions with responsive caregivers facilitate embracement of a sense of self that is worthy of love and trust.
towards others who are accepting and responsive. Positive thinking about love and closeness to an attachment figure (either internal representational world or in the outside environment) may lead to a state of anticipated relief and comfort reducing the stress evoked by a threatening event (Shaver & Milkuliner 2002). Secure people find it relatively easy to get close to others, to depend on others and have others depend on them. They learned from positive interactions with attachment figures that acknowledgement and display of their distress will elicit positive responses from others.

In a seminal study by Hazan and Shaver and expanded by others (Levy, 1998, Cooper, Shaver, Collins, 1998), the secure participants used descriptors like benevolent, respectful, accepting, less intrusive or demanding to describe their mothers. Mickelson, Kessler and Shaver (1997) documented that childhood experiences of physical abuse or serious neglect could significantly influence and were good predictors of adult attachment organization. Secure attachment was negatively associated with recollections of these early emotional traumas. In a similar vein, Diehl, Elnick, Bourbeau, and Labouvie-Vief (1998) also concluded that secure attachment was associated with a positive and open climate in the family of origin. Meyers (1998) reported that securely attached individuals displayed higher levels of personal competence and lower levels of psychological distress than the avoidantly and ambivalently attached individuals (p=0.001). Secure individuals are more confident and
assertive in social situations (Collin Read 1990). They demonstrate willingness to engage in self disclosure including expressing their emotions and distress in a relatively open way. They tend to seek and anticipate helpful encounters with other people. (Shave and Brennan) They are comfortable with intimacy in close relationships and described by friends as warm, intimate, and involved in their relationships (Bartholomew, 1991). The success of having meaningful relationships with others provides an explanation of why securely attached patients relied to a greater extent on interpersonal resources (seeking attention and social support) and were less rigid in their ways of coping in comparison to those who lacked this sense of security. Studies have demonstrated that secure attachment is positively associated with socialability (Magai & Cohen, 1998) in terms of family affiliation ($r=.11, p<.003$) and friend affiliation ($r=.14, p<.0001$) (Magai, et al., 2001).

Secure individuals describe themselves as curious and are likely to take risks in exploring novel stimuli and participating in active information search (Mikulincer, 1997; 1998; Mikulincer & Horesh, 1999). They seek out opportunities for personal growth and derive fulfilment from these experiences. Daily events are more likely to be appraised as challenging by the secure individuals rather than threatening as perceived by people who are considered ambivalent and avoidant.
Expression of negative affect is considered to serve an adaptive function (Fuendeling, 1998), secure individuals are able to constructively modulate and manage negative affect (Buchheim & Mergenthaler, 2000; Cassidy, 1994; Malatesta, 1990, Magai, Hunziker, Mesias & Culver, 2000; Mikulincer, Orbach, Iavnieli, 1998). Having the confidence to manage and regulate distress, secure individuals are open to new, even threatening, information, and able to develop suitable strategies for dealing realistically with the imposed demands.

Case example:

Cheryl is a 67 year retired school teacher with venous leg ulcer. Despite ongoing shooting and burning pain in the wound base and margin, she continues to exercise regularly and volunteer at a local community center to maintain an active social life. Cheryl wears compression bandages consistently and was open to suggestion from the staff at the wound care clinic. She is engaging and willing to learn more about venous disease and different ways of managing her pain.

Preoccupied Attachment

In contrast, individuals who are described as preoccupied, also corresponding to the ambivalent style described by Hazan and Shaver (1987), maintain a high regard for others but a low opinion of self. The origins of preoccupied attachment stem from early interactions with
inconsistent caregivers who were both punitive and nurturing (Levy, 1998). Confused between love and rejection, preoccupied individuals doubt their worthiness and lovability. The result is an over reliance on others’ acceptance and approval for personal validation (Brennan & Bosson, 1998). Bartholomew depicted these individuals as having a fervent compulsion to seek acceptance and validation from others in order to attain a sense of safety or security. People who develop this attachment style desire to be completely emotionally intimate with others yet worry these people will not want to be as close to them as they would like (Collins & Read, 1990, Feeney & Noller, 1990 Simpson & Rholes, 1992). As such, they are ambivalent about self and others as they vacillate between seeking help from others and withdrawing self in fear of rejection. People with a preoccupied /ambivalent style of attachment tend to exaggerate their attachment needs by maintaining vigilance toward threat-related cues and magnifying their problems including physical symptoms. In effect, the purpose of these “hyperactivating” strategies is to keep significant others close or entangled. Not surprisingly, these individuals are described as clingy, dependent, emotional, jealous, and easily upset (Griffin & Bartholomew, 1994). They express self-deprecating comments and present themselves as vulnerable, distressed, and extremely needy. The more attention preoccupied individuals confer to the negative affect, the more anxious and distressed they become. They experience heightened anxiety and depression (Kobak & Sceery, 1988; Magai &
Cohen, 1998; Magai & McFaden, 1995; Magai & Passman, 1997). As patients, they are likely to idealize health professionals and persistently attempt to elicit care from their health care providers while expecting that their needs will not be met. They are prone to seek care promptly and frequently for relatively minor symptoms. With the worsening of these symptoms, these patients are likely to become increasingly dependent on their health care providers and have less confidence in their ability to provide care for themselves. This patient group moves from practitioner to practitioner in the hope that someone will be able to resolve their pain.

Case example:

Roger is a 62 real estate agent with a 1 cm² venous leg ulcer for 4 months. He makes frequent appointments to visit the clinic for any minor change to the wound and pain symptoms. He rated the pain as 20 out of 10. He imparts a sense of urgency as he dramatically describes his wound pain and how pain profoundly affects his sleep, appetite, family life and activities of daily living. He is concerned that he may lose his job because of the pain. Despite numerous attempts to teach Roger how to look after his wound, he insisted on having a nurse to attend his needs “I am not sure I am doing the right thing, the nurses have to tell me what to do”, he states emphatically, “they are the people that will help me!!”
Fearful Avoidant attachment

Fearful avoidant pattern of attachment reflects a tendency to regard both self and others with negativity. Parents of avoidant individuals are likely to be perceived as rejecting, punitive, and malevolent (Levy, 1998). They believe that they are unlovable and unworthy and that others are generally uncaring and rejecting. Lacking trust for others, people classified as fearful avoidant avert intimacy and close contacts with others in anticipation of rejection and associated loss. They rely on defensive deactivation of the attachment system by means of denying or repressing subjective distress in response to both internal processes and external stimuli. Avoidant individuals appear to regulate their affect by downplaying the importance of their own attachment needs and cognitively isolate them in memory so as to root out negative emotions from consciousness. These individuals tend to prolong seeking help for physical symptoms such as pain and then assume a stance of helplessness and hopelessness once help is sought. For instance, Mikulincer et al. (1993) found that people with an avoidant style were prone to endorse emotionally distancing ways of coping while in danger from missile attacks. They are the least trusting of all the attachment styles and tend to suffer increased anxiety because of their fear of rejection (Bartholomew & Horowitz, 1991; Fuendeling, 1998). These individuals report high scores on both avoidance and relationship anxiety.
They tend to adopt both hyperactivating and deactivating strategies in a disorganized manner.

Case example:

George is a 70 year old retired farmer. He developed an infected stage 4 pressure ulcer on his right heel after he was found intoxicated and lying on the floor unconscious for several hours. At the clinic, he relates a lengthy list of complaints including nurses not showing up on time for dressing change, inconsistent wound care practices among home care nurses, lack of adequate pain medication for his pain, and lack of funding for a special shoe. “I don’t trust anyone!! The system doesn’t give me what I really need. Now I have this infection, the nurses are the ones to blame.” Despite frequent counselling, George refuses to take his pain medication because he may get addicted to medications.

Dismissing Attachment

The dismissing attachment style describes individuals who espouse a positive image of self with an accompanying view of others as uncaring and unresponsive. These individuals are uncomfortable with close relationships and prefer not to depend on others. As children, the attachment experiences were influenced by caregivers who were unresponsive, unreliable, and malevolent (Levy, et al 1998). Individuals with this attachment style regulate attachment distress by mistrusting
others and distancing themselves from close relationships (deactivation) that culminate in aversive consequences and disappointment. When confronted with distressing circumstances, dismissing individuals learn to seek diversion from emotions, downplay their problems or medical symptoms, and severity of illness, and minimize the importance of support from others.

Among a sample of 795 college students (Park), people with dismissing attachment style were less likely to define their self worth by approval from other and family support compared to other attachment styles. They may appear stoical and exhibit a restricted emotionality as negative emotions are often expressed indirectly. Thompson and Ciechanowski (2003) described the dismissing type as cold and aloof, even when reporting troubling and stressful events. According to the description by Magai & Passman (1997), this attachment style is often associated with defensiveness, compulsive self-reliance, inhibited expressive behaviour and hostility. Current relationships are marked by the lack of emotional depth and intimacy, thereby providing a limited support network. (Mikail, et al., 1994)

Case example:

Wendy is a 60 year married obese woman with ischemic leg ulcer for 2 years. Although her demeanour was pleasant and friendly, she was distant and standoffish. To inquiries about her pain, she responds, ‘the
pain is bearable, will power is everything …. No problems”. She denied any significant change in her life as a result of her wound and associated pain. She displayed a rather nonchalant attitude toward her weight problem and the repugnant odour that emanates from her leg ulcers. She continues to smoke and promises that she will quit in a couple of months. She takes an herbal supplement regularly that is believed to improve circulation according to her research. The treatment plan was changed at the clinic but she was doubtful that any health care providers could help her.

**Neurobiology of attachment**

Attachment theory describes the importance of social interactions on emotional and personal development. Development of emotional bonds and regulation of emotions in close relationships plays a key role in shaping specific neural structures and circuits that are also involves in the neurobiology of pain. Sullivan (2003) argued that animals develop an odour preference and rely on their olfactory system to orient and seek proximity to their mothers. The olfactory bulb where this information is processed may be critical for attachment development. It is well established that the limbic system including the amygdala, septal nuclei, cingulate, and hippocampus mediate many aspects of social and emotional behaviours (Phan 2002). The amygdala is strongly associated with calculating emotional significance (Hare 2005). It promotes the
desire for social and emotional contacts and contains facial recognition neurons to discern the emotional significance of different facial expressions. As the septal nuclei, cingulate gyrus and the orbital frontal cortex (OFC) mature, the desire for social contact becomes more selective and discriminative. The rostral anterior cingulate cortex (ACC) is known to participate in emotion processing (Bush, 2000) while the dorsal ACC is affiliated with subjective distress (Rainville et al., 1997) and social rejection (Eisenberger, 2003). The OFC is involved in behavioural inhibition and suppression of emotions through its anatomical projections to the limbic and paralimbic regions (Cavada, et al., 2000). This frontolimbic structure functions as an appraisal mechanism of external and internal state taking into account the emotional-motivational significance of a particular environmental stressor in order to adjust appropriate emotional responses based on an elaborate feedback system (Schore, 2000). Garavan, Ross and Stein (1999) estimated that the OFC is especially developed in the right hemisphere where extensive reciprocal connections with limbic and subcortical regions are designed to exert inhibitory control.

Without sufficient social, emotional, perceptual and cognitive stimulation, neurons and dendrites in the limbic system undergo atrophy leading to formation of aberrant neural networks (Insel and Young 2001; Moriceau and Sullivan, 2005; Sullivan 2003). Humans raised in a deprived and socially impoverished environment display low intelligence,
passivity, apathy, attentional deficits, pathological shyness, and bizarre social behaviours (Insel, 1997, Sullivan, 2003). Destruction of the amygdala induces social and emotional agnosia abolishing the ability to feel love or affection and the desire for social contact. These findings explain why lesions localized to the limbic region in patients with schizophrenics and seizure disorders are described as emotionally blunted and socially withdrawn. Humans who have undergone amygdaloid removal cease to respond in an appropriate emotional manner to friends and family (Insel, 1997).

The limbic system and associated social or emotional functioning can be adversely affected by emotional trauma, neglect, abuse and even separation from the attachment figure (Joseph, 1999). In a study of neural correlates to attachment, Gillath, Bunge, Shaver, Wendelken, and Mikulincer (2005) recruited 20 women in a functional MRI experiment. Subjects were asked to imagine five scenarios that were neutral and not related to relationship, neutral and relationship related, and emotionally negative and relationship-related. Toward the end of each scenario, subjects were asked to stop thinking about that particular scenario to assess their abilities to suppress thoughts. Brain images were taken after each scenario. According to the analyses, attachment anxiety was positively correlated with activation of the anterior temporal pole where sadness was encoded but inversely correlated to activity in the OFC for emotion suppression. Perhaps anxious individuals were not able to recruit
brain regions to inhibit negative emotions. Low attachment avoidance was associated with low activation in the subcallosal cingulated cortex (SCC) during general thought suppression (p<0.05) and lateral prefrontal cortex during relation related-thought suppression (p<.001). Results suggested that non-avoidant participants’ ability to suppress thoughts and deactivate certain brain regions during thought suppression were more complete and effective than avoidant people.

Oxytocin and vasopressin are neuropeptides that may play a role in attachment development through their influences on sexual behaviours, formation of the mother-infant bond, and affiliation. Mice that lack functional oxytocin gene fail to develop social recognition even after repeated introduction to a same group of fellow mice (Ferguson, Young, Hearn, Insel, and Winslow, 2000). In prairie voles, high densities of oxytocin receptors are found in the nucleus accumbens and prelimbic cortex that constitute the dopamine reward pathway for conditioned learning.

A growing body of evidence highlights the involvement of the hippocampus and the prefrontal cortex in regulating the HPA axis and its relationship to attachment. Early experience of unresponsive care has been linked to increased HPA reactivity, increased risks for substance abuse, psychopathology, and poor biobehavioural regulation throughout life (De Wolff & van Ijzendoorn, 1997). Laurent and Powers (2007) reported that attachment anxiety can influence cortisol production. Higher
attachment anxiety was associated with elevated cortisol production during conflict discussion in 199 adult couples. Results were congruent with the theoretical projection such that people with increased attachment anxiety were susceptible to hyperactivation of negative emotional state and subsequent hormonal stress response. Quirin, Pruessner and Kuhl (2008) documented that attachment anxiety was significantly related to depressed cortisol production in saliva at rest upon awakening ($r=-.40, p<.01$). The relation was reversed under acute stress with attachment anxiety related to elevated cortisol responses ($r=.39, p<.01$). Subjects included 48 healthy women who were instructed to complete a stressful visual classification task in the presence of an unpredictable and uncontrollable aversive noise. Attachment avoidance was not associated with cortisol measures. Results suggest increased HPA reactivity to stress in subjects with high attachment anxiety. Attenuated basal HPA activity may be related to prolonged exposure to attachment anxiety and associated neurotoxic stress hormones or abnormal development of neural structures that regulate the HPA activity.

The ability of the parasympathetic nervous system to respond to stress tasks and recover from stress-induced emotional arousal has been implicated in emotional regulation. In one study (Diamond and Hicks, 2005), 75 men were instructed to perform serial subtraction while discouraging feedback was provided to induce anger and anxiety. Respiration and electrocardiogram were monitored continuously to
evaluate respiration-related variability in heart rate as an index of vagal tone. As predicted, vagal tone was negatively related to attachment anxiety and positively related to their sense of relationship security.

The limbic system is a network of brain structures including the hippocampus, amygdala, anterior thalamic nuclei, and limbic cortex, which support a variety of functions including emotional response to pain, attachment development, and stress reaction. The limbic system plays an important role in psychosomatic medicine. It is reasonable to surmise that pain, attachment, and negative emotions are connected through common neural pathways. By acting on the limbic system, pain may trigger distress signals, attachment behaviours, and negative emotions (e.g. anxiety).

**Attachment and older adults**

Although the original formulation of attachment theory was primarily based on observations of infants and children, attachment relationship continues to be active and play a pivotal role throughout life into old age. Amongst adults, the primary attachment figure is often a friend or partner (Hazan & Shaver 1987), although attachment to parents still persists.

In the older population, the relationship between attachment style and patterns of emotional regulation continue to be substantiated. Magai, Consedine, Gillespie, O’Neal, and Vilker (2004) have found that securely attached individuals exhibit higher sociability whereas avoidantly attached
individuals’ exhibit higher scores on shyness, emotional lability, and intensity of emotion expression, anger, and contempt. Avoidant individuals also demonstrated a higher degree of inhibited emotion and emotional distance than both secure and ambivalent individuals. Antonucci, Akiyama, and Takahashi (2004) purported that the attachment relationships acquired by adults over time constitute a sense of protection and security that is often needed to confront challenges in life. According to a study reported by Anderson and Stevens (1993), older adults who recalled low parental responsiveness were more likely to experience high levels of anxiety and low self esteem. The effect is stronger among those older persons who lack a current attachment figure in the form of an affectionate partner. It is concluded that early negative attachment experiences can have a definite impact on the well being of older people but the potential effects are modulated by life experiences and interpersonal relationships.

Attachment style may also play an important role in behavioural symptomatology in patients with dementia. In a study of 168 older adults (mean age 76.2 years) with middle to late stage dementia, caregivers rated attachment and emotion styles before the onset of illness (Magai and Cohen, 1998). Magai and Cohen (1998) reported that patients who were rated by their caregivers to be avoidant prior to the onset of dementia had the highest levels of disturbed activity, diurnal rhythm disturbance, and delusions. Patients who were considered to have a
premorbid ambivalent style had the highest levels of depressed affect and anxiety.

Representations of the physical and psychological accessibility of the attachment figure form the security base for attachment relationships. However, it is unclear how this mental representation may change throughout life. Some researchers argued that, once crystallized, the individual's beliefs about whether the self is worthy of love and whether others can be trusted to provide love and are effective in regulating stress and emotions may remain relatively stable.

Thompson and Raikes (2003) proposed that with increasing age attachment security increasingly becomes an attribute of the person and his/her personality rather than of a specific circumstance or relationship. Several research endeavours that focused on adult attachment in old age were specific to intimate romantic relationships such as marriage. Research that investigates attachment development in old age is still lacking.

On the other hand, as individuals mature, their repertoire of strategies to achieve safety and security may evolve and expand, becoming more complex and sophisticated with the development of cognitive abilities and various life experiences. Representations may be modified as individuals enter and leave different types of attachment relationships across their life span. Attachment style may be amenable to change over time. Kirkpatrick and Hazen (1994) reported that 30% of their
subjects were classified into a different attachment style over a 4-year period while Bartholomew and Shaver (1998) documented 40% of people in their study changed over an 8-month period. Compared to the attachment distribution of studies with younger individuals, Magai and Cohen (1998) found a diminution of ambivalently attached persons (6.5%) and a higher representation of avoidant individuals (36.9%). Persons with secure attachment constituted slightly more than half (56.5%) of the sample. The high prevalence of secure attachment in the cohort may be skewed by the cultural norm that placed a high value on independence and discouraged free expression of emotion. Integrity of the findings may also be threatened by measurement bias due to the retrospective nature of the study design and proxy evaluations.

Magai, Hunziker, Mesias, and Culver (2000) evaluated attachment in the older population. Of interest, 78% of older subjects were classified as dismissing/avoidant (Magai, et al., 2000) in contrast to a range of 13% (Scharfe and Bartholomew, 1994) to 25% (Mickelson, Kessler, & Shaver, 1997) in the younger population. When subjects were asked to respond directly to an attachment questionnaire, Webster reported that up to 52% of older adults were classified in the dismissing category whereas only 33% were classified as secure. Magai, Hunziker, Mesias, and Culver (2000) found that age was negatively correlated with secure attachment and positively correlated with dismissing attachment.
In a later study, Magai et al., (2001) conducted a study of attachment comparing older Americans of European descent to those of African descent. An overwhelming proportion (83% for African Americans and 65% for European Americans) of the sample was represented by the dismissing type; only 22% of the sample was securely attached. It is important to point out that both dismissing and fearful avoidant were clustered under the same label. Nevertheless, aging is associated with a shift from secure attachment to more dismissive attitude. Magai et al., (2001) hypothesized that dismissing attachment was a result of maturity with repeated exposure over time to adverse circumstances. In fact, the status as an immigrant with a low income and perceived prejudice were associated with the tendency to be dismissing. The other possibility is the fact that older individuals in a stable environment are more likely to attain self actualization at the top of Maslow’s hierarchy of needs. A self actualized person remains unflappable amid confusion and is often ‘dismissive’ of personal misfortunes. Similarly, older individuals often accomplished ego integrity at the final stage of Erikson’s (1982) theory, with a mature satisfaction and contentment.

Previous works support the importance of attachment in older adults. People who are assigned to the insecure categories tend to experience difficulty in emotional regulation (e.g. high levels of anxiety and depression). Future research is needed to determine how internal
working models of self and other can influence the appraisals of health issues and health related behaviours.

**The relationship among attachment, anxiety, and pain**

Accumulated evidence suggests that the variability of the pain experience may be influenced by the emotional reaction toward pain such as anxiety. This study examines the relationship between pain and anxiety which may be mediated by personal views of how an individual relates to other people according to attachment theory.

Among the most relevant clinical applications of attachment theory is the view that personality attributes can influence the appraisal of a distressing symptom such as pain and associated behaviours. Described as an unpleasant feeling or emotional experience, pain is often perceived as a threat to the well being of an individual. This distress signal activates the attachment system and precipitates a sequence of behaviours in an endeavour to restore a balance. According to this perspective, individual differences in the perception and expression of pain reflect the individual's attachment needs and ability to regulate negative emotions (Bowland, 1994; Feeney & Ryan, 1994).

However, little is known about the relationship between pain and attachment due to the paucity of research. Empirical studies indicate that secure attachment is related to a balanced emotional repertoire. As a group, securely attached individuals are associated with positive affect
and low levels of anxiety, sadness, and anger (Magai, et al., 2000; Mikulincer & Orbach, 1995). They have the ability to describe their condition clearly, express their concern openly, seek help willingly, expect that help will be forthcoming and acknowledge emotional distress without being unduly burdened by it (Consedine & Magai, 2003). Secure attachment pattern has been linked to positive affect, lower anxiety (Kobak 1988, Mikulincer, 1993), and well being (Kobak 1988; Kobak 1993; Roberts and Gotlib, 1996). As such, secure individuals are thought to be less susceptible to chronic pain because of their willingness to express their concern, adhere to treatment recommendations, and to mobilize their social resources. (Porter, Davis, & Keefe, 2007).

Although the intra-psychic dynamics are different, both fearful avoidant and dismissing attachment are potentially associated with low anxiety. The prominent features of individuals high in dismissing attachment are emotional detachment, over-emphasis on independence, and emotional control. Avoidant individuals favour affect minimization (Cassidy, 1994) by using various strategies to root out negative emotion from consciousness (Hazan & Shaver, 1987; Magai et al., 2000) (Consedine, 2003, Magai, et al., 2000). In a study, Bartholomew and Horowitz (1991) validated the link of the avoidant attachment style with less anxiety while other people rated these individuals as hostile and defensive (Kobak et al., 1988; Mikulincer 1998). However, the emotional response to distress in fearful avoidant individuals is not always
consistent. Wearden (1990) evaluated attachment and the pattern of symptom reporting in 201 young females. His analysis indicated that insecure attachment was a significant predictor of negative emotions and these insecure individuals were more likely to dwell on the emotions and associated distress exacerbating physical symptoms. In particular, fearful avoidant individuals were noticed to be excessively preoccupied with their own distress and have a tendency to ruminate on negative thoughts and adopt emotionally focused coping strategies which exacerbate rather than diminish distress. Further research is required to examine how fearful avoidant individuals may respond to pain and associated anxiety.

On the other hand, individuals who are considered to be ambivalent or preoccupied in their attachment assume a maximizing or heightening style of emotion regulation. They are described as hypervigilant to rejection cues and distress. Several research studies found that preoccupied individuals reported higher anxiety (Magai et al., 1995) but they were rated by their peers as being even more anxious than the self ratings (Kobak et al., 1988). What was implicated in this heightened fear and anxiety is the conflict between the desire to engage with others and the fear of rejection (Conseedine, et al., 2003). Fraley (1994) documented that people with high levels of attachment related anxiety tend to judge the facial emotional changes earlier than less anxious people. This suggests that anxious people are hypervigilant to social and emotional cues facilitating the rapid detection of possible signs of disapproval or
impending abandonment. Their tendency to experience high levels of anxiety and display heightened emotion has been conceptualised as a strategic function to gain/maintain attention from others (Main & Hesse, 1990).

Recognizing that anxiety predominates in certain attachment styles and inflates pain perception, attachment styles may influence how the pain is experienced under the mediating effect of anxiety. Attachment is a pattern of behaviour designed to evoke responses from others that provide comfort and a sense of security. Based on the above premise, specific relationships emerge between attachment and symptom reporting (Feeney, 2000). Whether a reported physical symptom can be construed as an appropriate response, an irritating appeal for attention, a demand, or an expression of anger depends on the nuances that underlay the conceptualization of self and others. Individuals with a negative model of self (preoccupied and fearful/avoidant attachment) tend to focus on negative affect or negative emotionality and are more likely to report somatic symptoms than individuals characterized by other attachment patterns.

Waller, Scheidt, and Hartman (2004) reported that insecure patterns of attachment are more prevalent (more than 70%) in patients with somatoform disorder compared to controls (40%). Somatization including pain symptoms correlated negatively with the secure dimension.
of attachment and positively with the dismissing and the deactivating (correspond to fearful avoidant) attachment (p<0.05). Insecure dismissing individuals tended to engage in somatization in order to elicit caregiving response from others and divert attention from internal feelings of distress. They suppress attachment-related emotions, memories, and cognitions. People with somatization disorder learn to use expression of pain to convey emotional distress and to escalate their demands for care via somatic symptoms (Stuart & Noyes, 1999). Waller et al., (2004) also found that attachment style is associated with health care utilization. Insecure dismissing attachment is correlated with an increase in the number of hospital admissions whereas insecure preoccupied attachment correlated with an increase in the number of family doctor visits. This could represent a form of attachment seeking behaviour.

In patients with arthritis-related conditions, there is evidence that insecure attachment is related to increased self-reported levels of pain and disability (McWilliams at al., 2000). Perhaps, secure individuals are less susceptible to pain because of their willingness to consult, comply with the health care professionals’ suggestions, and to mobilize their social resources. Feeney and Ryan (1994) found that among insecure individuals, avoidant individuals reported the fewest health problems while anxious/ambivalent individuals had the greatest numbers of both physical symptoms and visits to health professionals. This finding is consistent
with the theoretical perspective in which fearful individuals are dismissive of initial symptoms and are likely to delay seeking help (MiKail, Henderson, Tasca, 1994). Similar results were reported from a study of eating disorders and depression in female college students, with preoccupied students reporting the most symptoms and secure individuals the fewest (Cole-Detke & Kobak, 1996). Individuals with preoccupied attachment style are deemed to have a tendency toward high symptom reporting as well as their tendency to overly rely on others for a sense of self-esteem.

According to a study of female participants (Ciechnowski, Walker, Katon, Russo, 2002), attachment style was significantly associated with number of somatic symptoms reported after adjusting for age, marital status, income, ethnicity, and depression. Individuals with preoccupied and fearful attachment style reported a greater number of somatic symptoms than securely attached subjects. In a similar study of young female students (Wearden, Cook, & Vaughan-Jones, 2003), anxious attachment and avoidant attachment were correlated to the frequency of symptom reporting. The relationship between insecure attachment and symptoms was mediated by negative affect or the general tendency to experience negative emotions. It remains equivocal if exclusion of male subjects may have affected the findings of the study.
Similar results were reported in another study by Schmidt et al (2002). Secure individuals displayed the lowest symptoms while people assigned to anxious/fear of loss subtype of attachment yielded a higher incidence of pain symptoms. It cannot be determined from the available data whether individuals with anxious/fear of loss attachment also experience higher levels of pain symptoms than other types of attachment. Ciechanowski, et al., (2003) showed that fearful attachment was related to higher levels of depression and catastrophizing than secure attachment style. It can be surmised that catastrophizing may lead to more intense pain but pain intensity was not related to attachment style in the reported findings. The study was limited by self selection.

In several studies, Meredith et al. (2005; 2006; 2007) examined attachment styles in various patient populations with chronic pain. Based on the four attachment style model proposed by Bartholomew, they estimated that about 30% of the patients were secure, 17-19% fearful, 10% preoccupied, and 22 % dismissing. Schmidt, Nachtigall Wuethrich-Martone and Strauss (2002) examined the distribution of attachment in three disease conditions including patients with leg ulcers. Twenty-nine percent of the leg ulcer patients were represented by an ambivalent or preoccupied attachment style as opposed to 15 % by avoidant (fearful) orientation.
McWilliams and Asmundson (2007) evaluated a total of 278 university students without a history of chronic pain. All participants were requested to provide a pain history and respond to multiple self reported questionnaires including: the Experiences in Close Relationships Questionnaire (18 item Model of self scale and 18 item model of others scale), Fear of Pain Questionnaire, Pain Vigilance and Awareness Questionnaire, and Pain catastrophizing scale. While the model of others only correlated with pain catastrophizing, the model of self was positively associated with all of the pain related measures suggesting that this dimension may be more sensitive to the pain experience. Hierarchical linear regression analysis confirmed that subjects with an insecure model of self reported high levels of pain related fear, hypervigilance and catastrophizing (p<0.001). People with high levels of attachment anxiety may engage in hyperactivation including pain catastrophizing. Ciechanowski, Walker, Katon, and Russo (2002) assessed 701 females in primary care settings with non-pain related complaints. Patients with fearful and preoccupied attachment reported higher numbers of symptoms than the secure and dismissing individuals. According to results from a study of chronic pain patients alone (n=111), Ciechanowski, Sullivan, Jensen, Romano, and Summers (2003) found that pain measured by VAS was positively related to depression and catastrophizing. However, the results failed to substantiate an association between pain intensity and attachment style.
Meredith et al. (2005) conducted a study assessing attachment and pain related variables in patients with chronic pain at rehabilitation centers. People who endorsed attachment anxiety were more likely to experience higher levels of general anxiety and depression, engage in catastrophizing, and appraise pain as more threatening. Regression analysis revealed that the relationship between attachment anxiety and catastrophizing is mediated by threat appraisal. Although causality cannot be confirmed, individuals with attachment anxiety were vulnerable to feelings of low self-worth and abandonment. They often rendered pain as threatening and catastrophizing to elicit attention from others. Attachment anxiety together with threat appraisal may also contribute to heightened general anxiety levels. The combined effect of attachment anxiety and threat appraisal explained 25.2% of the variance in general anxiety (p<0.001). To determine the divergent responses in pain appraisal across attachment groups, post hoc analysis was carried out. The results were compatible with the theoretical prediction showing the highest attachment related anxiety in the preoccupied group followed by the fearful/avoidant group. However, it was the fearful and dismissing groups that reported significantly higher levels of general anxiety (p<0.05) and were more likely to interpret pain as threatening than the secure group. This finding was contrary to the study hypothesis that dismissing individuals were likely to avoid activation of the attachment system by minimizing or denying their distress. The deactivation defence mechanism may eventually fail to
operate effectively due to the chronicity of pain (mean time=3 years and 9 months). This unexpected finding may partially explain why the relationship between pain ratings and the various attachment styles was not significant.

More recently, Meredith and her research team (2007) explored the relationship between attachment, depression, and pain in a sample of patients from chronic pain clinics. A measure of the two underlying attachment dimensions, attachment related anxiety and comfort with closeness (versus avoidance on the other extreme), were calibrated by the Attachment Style Questionnaire developed originally by Feeney et al (1994). Attachment anxiety emerged as the strongest predictor of depression prior to initiating treatment at the clinics (p=0.001). Subjects with higher attachment anxiety were more depressed. In contrast, comfort with closeness was associated with low depression scores. It was evident that avoidance was the strongest predictor of depression after the subjects had acquired various skills to cope with pain within a therapeutic environment at the clinic. The results supported the importance of attachment insecurity as a risk factor for emotional response (depression) to chronic pain. Similar to previously reported findings, there was no direct relationship between attachment dimensions and pain intensity. Attachment as a moderator between pain and depression was not substantiated.
Not all studies concur with the lack of an association between pain and attachment. In a study of individuals who were subjected to pain induced by coldpressors, Meredith et al. (2006) found that attachment anxiety was a significant predictor of a lower pain threshold ($p=-.04$). The high levels of attachment anxiety were associated with low pain threshold. However, low pain threshold was not indicative of increased pain perception. Instead, pain perception was found to be influenced by interactions between age and attachment styles. Younger and fearfully attached individuals were more likely to catastrophize than older, dismissing subjects. Older subjects expressing secure attachment reported less pain compared to younger, dismissing individuals. Contrary to their hypothesis, fearful attachment was associated with less pain intensity at one minute of the coldpressor test ($p<0.05$). Individuals with fearful attachment may adopt either hyperactivating or deactivating strategies to cope with stress but in a disorganized manner.

In another effort to verify the relationship between pain and attachment, Meredith et al. (2006) investigated adult attachment, anxiety, pain intensity, and pain self-efficacy. A sample of 152 chronic pain patients participated. As expected, attachment anxiety, fearful attachment, and preoccupied attachment were positively related to general anxiety. Anxiety and other variables including self-efficacy, disability, duration, and age were associated with pain intensity. Anxiety and pain self-efficacy accounted for 22% of the variance in pain intensity.
Although not reaching significance level, the higher pain VAS scores were positively linked to fearful and preoccupied individuals but inversely associated with secure and dismissing attachment. Findings revealed that comfort with closeness moderated the associations between disability and pain self-efficacy ($F(1, 101) = 5.8, p = .02$), between pain intensity and pain self-efficacy ($F(1, 122) = 7.1, p = .01$) and between disability and anxiety ($F(1, 101) = 4.7, p = .03$).

Taken together, a few hypotheses about attachment and pain can be deduced. First, individuals characterized by insecure attachment particularly, fearful avoidant and ambivalent styles of attachment, are associated with anxiety that may exacerbate pain. Second, insecure individuals may experience more intense pain since they are more likely to maintain hypervigilance and catastrophize their symptomology than secure individuals. Third, insecure individuals may be inclined to report more somatic symptoms than those who are securely attached. Fourth, attachment, anxiety, and pain may be interrelated. The hypothesized model that depicts the relationship among attachment, anxiety, and pain is proposed in Figure 7.
In this study, it is proposed that anxiety plays a mediating role in the relationship between attachment and pain. A mediator variable represents an intervening variable or mechanism through which an independent variable is able to influence the dependent variable (Baron & Kenny, 1986). In other words, the selected mediator should be able to explain how and why a relationship exists between the predictor and dependent variable (Kim, 2001).
Purpose of the study:
The specific objectives of this study involving elderly subjects are:
1. To determine the levels of pain related to wound dressing change.
2. To determine the relationship between procedure anticipatory pain and anxiety, perceived pain during the procedure, post-procedure pain and anxiety.
3. To determine the relationship between wound dressing pain and attachment style.
4. To determine the relationship between anxiety related to treatment procedure and attachment style.
5. To determine the mediating effect of anxiety between attachment and pain in older adults with chronic wounds.

Hypotheses of the study
H 1: Subjects will report higher levels of pain during dressing change than baseline with dressing removal being the most painful.
H 2: Pain during wound dressing change is related to anxiety and pre-procedure anticipatory pain.
H 3: Secure individuals will report lower levels of pain and anxiety during dressing change than insecure individuals.
H 4: Anxiety has a mediating effect between attachment and pain in older individuals.
Design

To address the research questions, a one-group repeated measures design was used. The repeated measures design consisted of evaluating patients’ pain and anxiety at several time points:

a. Time 1 (T1): Baseline pain at rest, taking place at least 5 minutes after any activity;

b. Time 2 (T2): Evaluation of pain immediately after the dressing was removed;

c. Time 3 (T3): Evaluation of pain immediately after the wound base had been cleansed;

d. Time 4 (T4): Evaluation of pain after dressing was reapplied;

e. Time 5 (T5): Evaluation of pain taking place 5 minutes after dressing change.

Setting

Three acute care regional teaching hospitals in Toronto were selected as the setting for this study. The majority of the subjects (n=92) were recruited from outpatient wound care clinics.

Approvals were obtained from the research ethics board of the participating hospitals. After detailed explanation of the study was provided, subjects were asked to determine if they actually comprehend the purpose of the study and that they were aware of the risks and
benefits of the study. They were told that they have the right to withdraw from the study at any time. Signed consent was obtained for all participants of the study.

Patient eligibility criteria

The convenience sample consisted of patients who were either admitted to in-patient units or visited outpatient wound care clinics in the participating organizations. Eligible patients had wounds, either lower leg ulcers (arterial, venous, or mixed ulcers), pressure ulcers or both.

Inclusion criteria:
1. 60 years old and over;
2. presence of chronic lower leg ulcer or/and pressure ulcer that was present for more than four weeks;
3. a wound that required dressing change including removal of dressing, cleansing of the wound, and reapplication of dressing at the time of study;
4. able to understand, speak, read, and write English.

Exclusion criteria:
1. Recent documentation in patients’ record of the presence of psychiatric problems (DSM-IV: TR Axis I), disturbances of
2. Patients with neuropathy confirmed by monofilament testing.
3. Patients with surgical wounds.

**Measurement**

**Pain measurement**

For the purpose of this study, three pain measurements were used.

**Numerical Rating Scale for pain intensity (NRS):**

The numerical rating scale (NRS) (Appendix A) consists of a 100-mm vertical rating scale with anchors of ‘no pain’ at the bottom representing one end of the pain intensity continuum and ‘the most intense pain imaginable’ at the top representing the other extreme of pain intensity. Displayed on the line in order are each of the numbers from 0 to 10 (11-point scale) (Jensen & Karoly, 1992). Patients will be asked to select the number that best describes the intensity of their pain at the present time. The NRS has low verbal and high numeric features (Jensen, et al., 1998). Because the NRS is concrete and easy to interpret, it is preferred by individuals across all age groups (Herr, 2004 Ware 2006). The NRS is a unidimensional simple instrument that is easy to administer and score. It has been used in a variety of patient populations including geriatric patients. Clinicians preferred the NRS because it offered an immediate
score for a dynamic concept like pain without extra calibration and calculation (Nemeth Graham, & Harrison 2003). Up to 87.9% of venous leg ulcer patients were able to complete pain assessment using the NRS compared to 75% using VAS, and 96.3% using Present Pain Inventory (PPI).

The validity of NRS has been supported in various studies. Herr and Mobily (1993) demonstrated that the NRS was significantly related to the pain thermometer that consisted of a diagram of a thermometer with word descriptors that showed increasing pain intensities (r=0.91), the vertical- visual analogue scale (r=0.92), and the verbal descriptor scale (r=0.91) in the elderly population. NRS has also been shown to be more reliable than visual analogue scales (VAS), particularly among patients with a lower educational level. Using a quasi-experimental design, Herr et al (2007) measured pain before and after joint infection using the pain thermometer, NRS, VNRS (Verbal Numerical Rating Scale), FPS (Faces Pain Scale), and VAS. All correlations were significant between NRS and other instruments (.79-.91, p<0.05) in the older subjects.

Measuring pain in older African American adults who have cognitive impairment (Taylor & Herr, 2003), the pain ratings elicited by NRS were significantly correlated to ratings elicited by a verbal descriptor scale, face pain scale and pain thermometer (r=0.64-0.83). Consistent with previous findings, Galiese (2005) reported that the correlation between NRS, VAS and MPQ ranged from 0.72 to 0.91 in the elderly
In a comprehensive review of pain assessment in cognitively impaired elderly, Gagliese (2001) indicated that a large proportion of elderly were not able to indicate their pain using VAS. Herr et al (2007) reported that the relative risk for subjects to make an error (failure rate) using a VAS (RR=3.25) was two times higher than NRS (RR=1.50). Manz et al. (2000) examined five pain assessment tools including the COOP, MPAC (Memorial Pain Assessment Card verbal subscale), PPI (Present Pain Intensity), FACES and NRS in institutionalized elderly who are cognitively intact or moderately impaired. Sensitivity and specificity were estimated to determine if the subjects were able to complete each of the selected pain tools. No significant difference was reported between NRS and the other pain tools. Intraclass correlations between NRS and other pain tools ranged from 0.68 to 0.82. Test-retest reliability for the NRS, as measured by the intraclass correlation coefficient (ICC), was 0.58 among nursing home residents and 0.72 among community home dwellers (Weiner, et al., 1999). An ICC of 0.87 comparing two NRS ratings that were obtained 48 hours apart was reported by Kaasalainen and Crook (2003) for elderly persons with intact cognitive functioning. Among hospitalized geriatric patients aged 60 to 80 years and over, NRS demonstrated the highest correlation ($r=0.82$) between their first ratings of pain and repeated measurements after five minutes in comparison to visual analogue scale and graphic rating scale (Bergh, Sjostrom, Oden, Steen, 2000). To a less but acceptable degree, test-retest coefficients at
a 2-week interval were 0.57 for people with cognitive impairment (Taylor, 2003). The weaker relationship is expected considering memory deficits in this group and changes in pain levels over time. The NRS can also be used to differentiate usual, worst, and least pain. Factor analysis indicated that each loading value corresponding to usual, worst, and least pain exceeded 0.80.

Another important psychometric property is scale failure rate which is operationalized as the number of incorrect ratings or an inability to use a scale in the prescribed manner. Including those who exhibited cognitive impairment, none of the hospitalised older subjects failed to indicate their pain using the NRS. Pain was rated daily and weekly over a 14 day period that yielded 72 ratings for each subject (Chibnall & Tait, 2001). In another study, a 2.2% failure rate was reported (Herrr, et al., 2004).

The NRS has been used to evaluate the effectiveness of intranasal fentanyl and oral morphine for procedural pain during wound care in adult patients with burns (Finn, Wright, Fong, et al., 2004). Pain was measured at baseline, at the beginning of wound care after analgesia was administered, during wound care, at the end of wound care, and 10 minutes and 30 minutes after the procedure. Pain was rated the highest during the procedure and continued to be elevated 10 minutes after the wound care procedure.
Previous studies indicated that preprocedure-anticipatory pain is higher than post procedure pain ratings. Patients who anticipated higher degrees of pain before urodynamic procedures reported higher (but not statistically significant, \( r=0.214 \)) degrees of perceived pain after the procedure (Ellerkmann et al., 2004). Goncalves, de Gouveia Santos, de Mattos Pimenta, Suzuki, and Komegae, (2004) reported that patients with venous leg ulcers rated their worst and best pain of the week at 7.46 and 2.04 respectively on NRS. They tested consistency of pain ratings by comparing present pain to best pain (\( r=0.54 \)), and worst pain (\( r=0.34 \)). In a recent study of an ibuprofen impregnated foam dressing, mean pain intensity scores elicited by a variation of NRS called numeric box scale (where each number is written in a box) was reduced from seven to 2.5 (Jorgensen, Friis, & Gottrup 2006).

For the purpose of this study, the NRS was used to evaluate the levels of anticipatory pain before dressing change and real-time pain experienced during the procedure. Other studies demonstrated that individuals across all age groups consistently selected the NRS as the most preferred pain tool because it is concrete and simple with minimal risk of misinterpreting the instruction (Herr, Spratt, Mobily, & Richardson, 2004; Ware, Epps, Herr, & Packard, 2006). In one study of pain following surgery, 504 patients were asked to evaluate the visual analogue scale (VAS), McGill Pain Questionnaire (MPQ), NRS and verbal descriptor scale (VDS) (Gagliese, Weizblit, Ellis, & Chan, 2005). Both
younger and older patients chose the NRS as the easiest, most accurate and most preferred scale to indicate their pain levels. Herr et al. (2004) examined the psychometric properties and usability of the NRS and 4 other commonly used rating scales to measure pain in 86 younger (age 25-55) and 89 older (age 65-94) adult volunteer subjects. Following successive exposures to thermal pain, the NRS ratings were consistent as indicated by a relatively high Cronbach`s alpha of .88 for older adults.

The numerical rating scale is a direct, simple, and easy to use instrument for individuals to indicate the intensity of pain. The numerical rating scale has been tested in studies of older adults and chronic wound patients demonstrating superior validity and reliability. For these reasons, it was selected for this study.

**McGill Pain Questionnaire-Short Form (MPQ-SF):**

Pain has several dimensions that include both its severity and quality. To capture the complexity of pain, multidimensional tools may be considered. The McGill Pain Questionnaire (MPQ) is one of the most commonly used multidimensional pain measures (Appendix B). To reduce the burden of response, the short form of the McGill Pain Questionnaire (MPQ-SF) (Appendix E) was developed to provide a brief assessment. It contains 11 word descriptors referring to the sensory quality of the pain experience and four related to the affective dimension. Subjects are asked to rate each descriptor on a four point intensity scale.
Melzack (1975) reported that consistency of word choices by ten cancer patients over three days ranged from 50% to 100%, with a mean of 70.3%.

In addition, the patients rated the overall intensity of pain on a visual-analogue scale (1 to 10), and “present pain intensity” by choosing an appropriate word (this is a 0 to 5 scale). For the purpose of this study, only the word descriptors were used.

The scale has been found to be valid, reliable and reproducible in a variety of acute and chronic conditions, and has been used successfully in geriatric patients. The Cronbach’s alpha coefficient for the subscales and the total scales have been shown to range from 0.76 to 0.94 in a sample of 23 adult burn patients (Byers, et al., 2001). The Intraclass Correlation coefficient of the MPQ for this sample of older individuals with chronic wounds was .83 (95% confidence interval: .78 to .88). Word descriptors on the MPQ-SF have been used to evaluate neuropathic pain in numerous studies. In one study, patients after femoropopliteal bypass surgery were asked to rate their pain using the MPQ-SF and NRS (Greiner, Rantner, et al., 2004). Of interest, more than 40% of patients experienced mild to moderate stabbing pain while 76% of subjects ranked their pain at 0 level on the NRS. This finding suggests that the MPQ-SF and NRS assessed different aspects of pain and may help to differentiate nociceptive from neuropathic pain. Nociceptive pain (response to injury) is often described with the words gnawing, aching, throbbing and tender.
(GATT) while neuropathic pain is more likely to be burning, stinging, shooting or stabbing.

Rowbotham et al. (1998) demonstrated that elderly subjects treated with gabapentin reported more significant improvement in sensory and affective pain scores on the MPQ-SF than individuals administered placebo. Median age of the sample was 73. Similar results were reported by Gilron, et al. (2005); pain scores on the MPQ-SF were significantly lower in subjects who received a combination of gabapentin-morphine than those who received placebo or single agents. The ICC values were 0.95, 0.88, 0.89 and 0.96 for the sensory, affective, average and total pain components on the SFMPQ respectively over 2 time points (5 days apart) (Grafton 2005).

The MPQ-SF has been used in the evaluation of pain during wound care. Among burn patients who received wound care, the most frequently used pain descriptor on the MPQ-SF was tender followed by other descriptors such as throbbing, hot-burning, and aching (Byers, Brides, Kijek, & LaBorde, 2001). Words including throbbing (83%), drilling (78.16%), burning (72.41), and stabbing (70.11) were commonly used to describe pain in leg ulcers (Goncalves et al, 2004) implicating pain of a neuropathic origin. Nemeth (2004) also reported the consistent use of pain descriptors like aching, stabbing sharp, tender and tiring in patients with venous leg ulcers during 5 weeks of compression bandaging.
In one study, patients with chronic wounds were evaluated for psychological distress in relation to their pain that was measured by the MPQ-SF and NRS (Roth, Lowery, and Hamill 2004). MPQ-SF was significantly correlated with measurement of affective distress. NRS was not correlated with any measurement including the MPQ-SF.

Consistent with other findings, patients experienced more severe pain, as measured by the MPQ-SF for wounds that had penetrated through muscle or bone than those that did not (Roth, Lowery, & Hamill, 2004). Vuerstaek, Vainas, and White (2006) evaluated the impact of negative pressure therapy on wound healing and pain (n=11). Pain scores were derived from MPQ-SF. As wound healing occurred, there was a significant improvement in pain and quality of life at the end of the eight-week study period (p<0.05). MPQ-SF was also used to measure pain in a study comparing two foam dressings (Franks, Moody, Moffatt, et al. 2007). A total of 159 patients with venous leg ulcers rated pain according to the MPQ-SF at baseline and the end of 4 weeks treatment. The pain ratings were significantly lower at week 4 than baseline at both before and after dressing changes (p<0.001). In a small study (n=8), each subject was exposed to two kinds of aroma, two types of music (relaxing and preferred) and a control condition during dressing change (Kane, et al., 2004). Pain was measured with MPQ-SF. Interestingly, patients reported higher pain in the relaxing music condition and lower pain scores when preferred music was used (p<0.05).
The MPQ-SF was selected to capture the characteristics of wound related pain in this sample. Pain ratings between the NRS and MPQ-SF were expected to be related.

**Pain Assessment in Advanced Dementia (PAINAD) scale:**

The Pain Assessment in Advanced Dementia (PAINAD) scale (Appendix C) was originally developed by Warden, Hurley, and Volicer (2003) to measure behavioural indicators of pain in cognitively impaired non-communicative elderly patients. Although self-report of pain is the most reliable indicator of the existence and intensity of pain, observational behavioural indicators can provide proxy measures from which pain intensity can be inferred (Rakel & Herr, 2004). Face validity of the PAINAD scale was established by the selection of behaviour indicators that are consistent with those reported in the pain literature and available pain assessment tools including the Face, Legs, Activity, Cry, Consolability Scale (FLACC) (Merkel, 1997), the Discomfort Scale for dementia of the Alzheimer Type (DS-DAT) (Hurley, et al., 1992) and Checklist of Nonverbal Pain Indicators (Feldt, 2000). Five categories of common pain associated behaviours including breathing, negative vocalization, facial expression, body language, and consolability are incorporated in the final version of the PAINAD. Raters are asked to rate each indicator on a scale of 0 to 2 according to the qualified descriptors to reflect the severity of pain. Scores on the PAINAD scale range from 0
representing no pain to 10 representing maximum pain. The method of administration is described and a guide with definitions for each item is provided in Appendix D.

In the pilot study of residents from a long term care facility, Warden et al (2003) described a significant change in PAINAD scores during three conditions: no stimulation (mean score=1.3, ±1.3), pleasant activity or rest (mean 1.0 ±1.3), and caregiving (mean 3.1 ±1.7) (F (1, 17) =10.93, p<0.001). PAINAD score reduced from 6.7 ± 1.8 to 1.8 ± 2.2 after analgesics were administered (t (24) =9.6, p<0.001). Participants had a mean age of 78 years and suffered from severe dementia (mean MMSE=2.8). Construct validity was supported by high correlation coefficients between PAINAD and VAS at rest (r=.75 p<0.001). Pearson correlation coefficients between two raters was 0.97 at rest and 0.82 during unpleasant activities (all p<0.001) demonstrating satisfactory inter-rater reliability.

Zwakhalen, Hamers, and Berger (2006) tested the psychometric quality and clinical usefulness of three pain assessment tools including the PAINAD, Pain Assessment Checklist for Seniors with limited Ability to Communicate (PACSLAC), and the DOLOPLUS-2. In comparison to the 5 item PAINAD tool, COLOPLUS-2 consists of 10 items (each time is rated from 0-3) and the PACSLAC contains four subscales and a total of 60 items. A total of 128 nursing home residents with dementia (60 years
old and over with a mean age of 82.4 years) were observed at rest, immediately after the influenza vaccination, and after episodes of physical activities (washing, transfer, manipulation of the hand, wound care) that were likely to evoke pain. The internal consistency evidenced by Cronbach’s $\alpha$ ranged from .69 to .74 during painful activities. The inter-rater reliability was estimated from ratings of 2 assessors and the intra-class correlation coefficients ranged from 0.75 to 0.85.

Testing the German version of PAINAD in 99 nursing residents, Schuler et al. (2007) documented a Cronbach’s alpha of 0.85 indicating good internal consistency. The item-total correlation was as low as .49 for ‘consolability’ in comparison to other items such as vocalization (.82), facial expression (.73), and body language (.81). The inter-rater correspondence of $r=.80$ and a test-retest reliability of $r=.90$ support a satisfactory psychometric quality of the scale. Pain ratings using the PAINAD scale were significantly higher during an unpleasant event involving caregiving activities than those obtained at rest ($F (1, 17) =10.93, p<0.001$) supporting construct validity of the scale. As expected, the mean pain scores decreased from 6.7 to 1.8 after the administration of medication for pain ($t (24) =9.6, p<0.001$). Behavioural indicators of pain decrease when pain is resolved. The PAINAD scale was significantly correlated with another behavioural tool for pain (DS-DAT) and visual analogue scales for pain ($r=0.76, p<0.001$). PAINAD was correlated to the Pain VAS, DS-DAT, discomfort VAS at rest ($r=.75, .76, .76$).
respectively). The Pearson correlation coefficient between VAS and PAINAD for this sample was 0.64 (p<0.01).

Although originally developed to evaluate pain in people with dementia, PAINAD has been demonstrated to be a valid behavioural checklist for older adults without dementia. DeWaters and her research team observed 25 elderly patients (mean age=81.24 ± 6.71) on the first and fourth day after their surgical repair of hip fracture. Pain-related behaviours were observed using the PAINAD during transfer and compared to those noted at rest, sitting or lying. Each subject was asked to rate their pain intensity with the NRS. The correlations between PAINAD and NRS were robust in the cognitively impaired group (n=12, r=.915, p<.001) and cognitively intact individuals (n=13, r=.735, p<.001) providing support for the concurrent validity of the PAINAD. Wilcoxon signed rank test indicated that PAINAD scores were significantly higher during transfer than at rest (z=-4.086, p<.001, N=25) confirming discriminate validity. The Cronbach’s alpha was .846 for the cognitively intact group and .847 for the impaired group.

The PINAD was selected as a valid and easy to administer tool to provide a checklist for the behavioural aspects of pain. Although it was originally developed for people with dementia, it has been validated in other studies of older adults without dementia.
**Mini-Mental State Examination (MMSE):**

The MMSE (Appendix E) is a screening instrument originally developed by Folstein and his colleagues (1975) to detect cognitive deficits among psychiatric inpatients. Further evaluation of the instrument has been documented with medically ill patients and community outpatients. The MMSE assesses various aspects of cognitive functioning including: orientation (10 points), immediate registration of three words (3 points); attention and calculation (5 points); short-term recall of words (3 points); language (8 points); and visual construction (1 point). The MMSE score ranges from 0 to 30 with lower scores indicating poorer cognitive functioning. A cut off score of 24 has been suggested as indicating cognitive impairment. A score of 18 to 23 may suggest mild impairment while 9 to 17 may indicate moderate impairment and 0 to 8 severe impairment (Tombaugh & McIntyre, 1992). Cronbach’s alpha coefficients of the MMSE ranged from 0.68 to 0.77 for community samples, 0.75 to 0.96 with medical patients. Test-retest reliability coefficients of 0.83 to 0.95 have been reported (Anthony, LeResche, Niaz, Von Korff, & Folstein, 1982; Dick, et al., 1984; Folstein et al., 1975). Criterion validity was established by a high correlation between MMSE and the Wechsler Adult Intelligence Scale Verbal Intelligence Quotient (Folstein et al., 1975). Although the sensitivity for MMSE ranges from 87 to 100% in people with moderate to severe dementia, sensitivity decreases to 69% in separating mildly impaired from intact samples. In a longitudinal study, using the
traditional cut-off of 23/24 for the MMSE at age 85, sensitivity was 83%, specificity 96%, false positive ratio 13%, false negative ratio 6%, positive predictive value 87% and negative predictive value 94% (Aevarsson and Skoog, 2000). To improve the sensitivity and specificity of the MMSE, cut–off points will be used to categorize subjects’ cognitive status taking into account the patients’ age and level of education (Crum, Anthony, Bassett, & Folstein, 1993). (Appendix E). It has been shown that cognitive performance as measured by the MMSE is highly correlated with both age and years of schooling (Crum, et al., 1993; Grigoletto, Zappala, Anderson, & Lebowita, 1999).

In summary, the MMSE is a reliable and valid tool for evaluating cognitive impairment in the elderly population. This instrument was utilized in this study to identify the range of cognitive function in this sample. Cognitive function may affect individuals’ ability to use the measurement tools and this potential confounding effect was examined in the analysis.

**Relationship Scales Questionnaire (RSQ):**

The RSQ (Appendix F) was developed by Griffin and Bartholomew (1994) based on the phrases used from the paragraph descriptors in Hazan and Shaver’s (1987) attachment measure, Bartholomew and Horowitz’s (1991) relationship questionnaire and Collins and Read’s (1990) Adult Attachment Scale. Subjects were asked to respond to 30
statements describing characteristic style in close relationships on a 5 point likert scale with 0 representing not often and 5 representing very often. The 30 items measure four styles of attachment (secure, fearful/avoidant, dismissing, and preoccupied). For the purpose of this study, subjects were categorized under secure and insecure (fearful/avoidant, preoccupied, and dismissing) attachment. Based on the original analysis by Magai and colleagues (1998), the instrument helps to discriminate three attachment patterns, secure, avoidant (dismissing), and ambivalent. The ambivalent subscale consisted of RSQ item 5,9,11,12,13,17,18,20,21,23,24,25, and 29; the dismissing subscale consisted of RSQ items 3,4,14,15,27, and 30; the secure subscale consisted of RSQ items 1,2,19,22, and 26 (see table 1).

Table 1. Items of RAQ correspond to three attachment styles (Magai et al., 1998).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>You find it difficult to depend on other people.</td>
</tr>
<tr>
<td>2.</td>
<td>It is very important to you to feel independent.</td>
</tr>
<tr>
<td>3.</td>
<td>You find it easy to get emotionally close to others.</td>
</tr>
<tr>
<td>4.</td>
<td>You want to be totally close with another person, like a twin.</td>
</tr>
<tr>
<td>5.</td>
<td>You worry that you will be hurt if you allow yourself to become too close to others.</td>
</tr>
<tr>
<td>6.</td>
<td>You are comfortable without close emotional relationships.</td>
</tr>
<tr>
<td>7.</td>
<td>You are not sure that you can always depend on others to be there when you need them.</td>
</tr>
<tr>
<td>8.</td>
<td>You want to be completely emotionally intimate with others.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>9. You worry about being alone.</td>
<td>A</td>
</tr>
<tr>
<td>10. You are comfortable depending on other people.</td>
<td></td>
</tr>
<tr>
<td>11. You often worry that people who are important to you don't really love you.</td>
<td>A</td>
</tr>
<tr>
<td>12. You find it difficult to trust others completely.</td>
<td>A</td>
</tr>
<tr>
<td>13. You worry about others getting too close to you.</td>
<td>A</td>
</tr>
<tr>
<td>14. You want emotionally close relationships.</td>
<td>D</td>
</tr>
<tr>
<td>15. You are comfortable having other people depend on you.</td>
<td>D</td>
</tr>
<tr>
<td>16. You worry that others don't value you as much as you value them.</td>
<td></td>
</tr>
<tr>
<td>17. People are never there when you need them.</td>
<td>A</td>
</tr>
<tr>
<td>18. Your desire to merge completely sometimes scares people away.</td>
<td>A</td>
</tr>
<tr>
<td>19. It is very important to you to feel self-sufficient.</td>
<td>S</td>
</tr>
<tr>
<td>20. You are nervous when anyone gets too close to you.</td>
<td>A</td>
</tr>
<tr>
<td>21. You often worry that people close to you won't want to stay with you.</td>
<td>A</td>
</tr>
<tr>
<td>22. You prefer not to have other people depend on you.</td>
<td>S</td>
</tr>
<tr>
<td>23. You worry about being abandoned.</td>
<td>A</td>
</tr>
<tr>
<td>24. You are somewhat uncomfortable being close to others.</td>
<td>A</td>
</tr>
<tr>
<td>25. You find that others are reluctant to get as close as you would like.</td>
<td>A</td>
</tr>
<tr>
<td>26. You prefer not to depend on others.</td>
<td>S</td>
</tr>
<tr>
<td>27. You know that others will be there when you need them.</td>
<td>D</td>
</tr>
<tr>
<td>28. You worry about having others not accept you.</td>
<td></td>
</tr>
<tr>
<td>29. Other people often want you to be closer than you feel comfortable.</td>
<td>A</td>
</tr>
<tr>
<td>30. You find it relatively easy to get close to others.</td>
<td>D</td>
</tr>
</tbody>
</table>

A= ambivalent    D=dismissing    S=secure

The alpha coefficients were .83, .64, and .65 for the ambivalent, dismissing, and secure subscales respectively. More recently, Magai and colleagues (2004) endorsed that the ambivalent subscale is comprised of RSQ item 11,16, 23,and 25; the dismissing subscale comprised of RSQ
items 1,2,19,26; the secure subscale comprised of RSQ items 3,8,14, 30. The alpha coefficients were .74, .55, and .62 for the secure, dismissing, and ambivalent subscales, respectively, in older adults (Magai et al., 2004). Subjects are assigned to one of the attachment style based on their highest mean score for items that represent each prototype. By using this typological approach, Magai and her colleagues (2004) demonstrated that punitive socialization was positively related to ambivalent attachment in younger and older adults. They reported that the positive impact of punitive socialization on negative affect was mediated by attachment.

The key focus of this study was to determine the influence of attachment style on pain and anxiety. The RSQ is relatively easy to complete with minimal risk of response fatigue, a concern that is especially relevant in a study involving older adults. Although other instruments have been developed to measure attachment, the RSQ was selected because of the number of studies that had demonstrated the validity and reliability of this instrument in the elderly population. Given the fact that attachment had not been measured in a sample of patients with chronic wounds, factor analysis was performed for this study to determine the number of factors and associated items as suggested by Magai et al (2004). The RSQ is designed as a continuous measure of adult attachment, subjects were also dichotomized into secure versus insecure patterns based on their scores on the continuum.
Shortened Anxiety Scale (SAS):

The Spielberger State-Trait Anxiety Inventory (STAI) (Appendix G) is one of the most commonly used measures of anxiety with demonstrated acceptable reliability and sensitivity. The STAI has been tested in a wide variety of patient populations including patients with cardiac disease, chronic obstructive pulmonary disease, and patients undergoing a variety of surgical procedures (Kimberger, Illievich, & Lenhardt, 2007; Menegazzi, Paris, Kersteen, Flynn, Trautman, 1991; Moussas, et al., 2008; Székely et al., 2007; Twiss, Seaver, & McCaffrey 2006). The original scale that measures state anxiety consists of 20 items. The length of the original instrument may be difficult for elderly and people who are critically ill or anxious to complete due to fatigue and inability to maintain focused concentration. More than 30% of participants expressed some type of difficulty responding to the 20-item STAI (van Knippenberg, Duivenvoorden, Bonke, & Passchier, 1990). To reduce the burden of completion, especially with repeated measurement of state anxiety, Marteau and Bekker (1992) eliminated the redundant items based on correlation analysis and arrived at a six-item short-form STAI. The reliability of this measure has been reported to be high with Cronbach's alpha = 0.95. Using the six item STAI, Qureshi, Standen, Hapgood, and Hayes (2001) demonstrated that enquiry about patients' family histories regarding inherited illnesses evoked higher anxiety than regular health check (n=156, F = 6.4; d.f. = 1,73; P = 0.014). Delayed communication of
needle aspiration biopsy results has also been shown to be responsible for higher anxiety scores (6 item STAI) than prompt communication in women with symptomatic breast disease ($n=51; U = 587.0; P < 0.02$).

Based on exploratory factor analysis of data from 200 ventilated patients in intensive care units, Chlan, Savik, and Weinert (2003) created another 6-item anxiety scale. The six items were selected from the original 20-item STAI and incorporated equal numbers of positively worded and negatively worded items to reduce the chance of introducing acquiescence. The six items are frightened, worried, nervous, comfortable, pleasant, and at ease. Subjects were asked to rate each adjective on a four point Likert scale ranging from ‘not at all’ to ‘very much’. The factor analysis for the 6-item scale revealed one factor explaining a total of 66.6% of the variance. Cronbach’s alpha coefficient was 0.78 indicating satisfactory internal consistency. The correlation between the 20-item and 6-item scale was 0.92 establishing concurrent reliability. According to Spielberger et al., (1970), any 4 to 5 items randomly selected from the original 20-item STAI have been proposed to be valid and deemed appropriate to minimize the effect of testing effect in repeated measure designs. Brooks et al (2003) selected six random items from the STAI in a study of older patients with chronic obstructive pulmonary disease (Brooks, et al., 2003). Subjects were required to walk for 6 minutes and then 10 minutes, anxiety was measured at baseline
before the 6-minute walk, after a 6-minute walk, and after the 6 and 10
minute walks were completed.

The shortened anxiety scale was selected for this study because it
is a valid tool to measure anxiety at the moment with sound psychometric
properties.

**Pressure Ulcer Scale for Healing (PUSH):**

The PUSH tool (appendix H) was developed by the National Ulcer
Advisory Panel (Thomas, et al., 1997) to monitor and describe healing in
stage 2 to stage 4 ulcers. Based on principal component analysis of
collected data from 37 pressure ulcers over 8 weeks, key elements to
describe healing were incorporated in the PUSH tool. The final tool
consists of three parameters: size that is calculated by measuring the
longest length and the longest width (10 categories are created), amount
of exudate, and wound surface appearance determined by the types of
tissue present (necrotic tissue, slough, granulation tissue, epithelial tissue
and closed). Summation of the subscores from each parameter yields a
total wound status score that can range from 0 to 17. Thomas et al (1997)
reported that only 21% of the variance in the ulcer change over time can
be explained by surface area alone. The addition of two parameters,
amount of exudate and surface appearance accounted for 41% of
variance in ulcer change. Stotts et al., (2001) reported that the three
variables explained 39 to 57% of the variance in healing during the 12-
week study period of stage 2 to 4 pressure ulcers. Total score obtained at baseline and at week 1 to 4 were significantly different from scores obtained at week 12 (p<0.05). The authors concluded that the PUSH tool provides an accurate, simple, and clinically useful assessment of the ulcer characteristics including 3 parameters; surface area, exudate and surface appearance. Gardner Frantz, Berquist, and Shin (2005) followed nursing home residents with pressure ulcers (n=32) weekly for 6 months. Total PUSH scores were significantly lower in patients with healed ulcers (t= -2.74; p=.010). The total PUSH scores improved significantly from week 1 to 5 in people with healed ulcers (df=4; F =5.901; p=0.001). Wound tracings of the surface area were significantly correlated to the PUSH scores during the study (r= .7 to .83 P, <001). Saltmarche (2008) applied the PUSH along with planimetry to monitor the use of laser therapy for the healing of various chronic wound types including ulcers (n=27) related to pressure, diabetes, and venous insufficiency. The PUSH scores were correlated with the rate of wound closure over the 9 week trial. The utility of PUSH tool has been scrutinized in a sample of patients with venous leg ulcers (Ratliff & Rodeheaver, 2005). Twenty-seven patients were monitored monthly over a 2 month period. As expected, healing venous ulcers (23 out of 27) had a lower mean PUSH score, indicating ulcer improvement, than non-healing venous ulcers. Psychometric properties of the PUSH tool were not reported. A study with the objective to test the inter-rater reliability of the PUSH tool in 41 leg ulcers of various etiologies
(venous, arterial, mixed, and diabetic related) was completed by de Gouveia Santos, Sellmer and Massulo (2007). They reported a high Kappa coefficient between raters ranging from 0.97 to 1.00 (p<0.001).

Even when wound healing was not the objective of the study, the PUSH tool provided a standardized description of the wound status. It has been tested for a variety of wound types including leg ulcers.

Demographics and other clinical information

Demographic information including age, gender, marital status, education, ethnic background, and other clinical information including medications, dressing protocols, and concurrent medical diagnosis, was obtained from the patients and/or patients' medical records. (Appendix I)

Procedure for data collection

After approval was obtained from the Ethics Review Boards at the participating hospitals, the investigator conferred with nursing staff at the participating outpatient clinics to identify eligible patients. The clinic nurse initially approached eligible patients to inquire whether the investigator could contact them. Those who expressed interest in the study were identified and contacted by the investigator of the study. A more detailed explanation of the study was provided to patients by the investigator to ensure they understood the study. They were encouraged to ask questions and informed that their decision to participate in the study would
not affect their medical or nursing care in the future. Signed informed consents were obtained from patients.

After informed consent was obtained, participants were asked to complete the following instruments in private:

1. Mini-Mental State Examination (MMSE) to determine their cognitive status followed by questions to ensure subjects understood the purpose of the study and their rights to withdraw from the study at any time;
2. Relationship Style Questionnaire (RSQ) to evaluate their attachment style;
3. Shortened Anxiety Scale (SAS) to rate their anxiety before dressing changes;
4. Numerical Rating Scale (NRS) to rate level of anticipatory pain before dressing change and pain at rest or 5 minutes before dressing change;
5. McGill Pain Questionnaire Short Form (MPQ-SF) to rate the quality and characteristics of their pain;
6. NRS during dressing change from T1 to T5;
7. SAS to rate their anxiety 5 minutes after dressing change.
PAINAD scale was used to evaluate behavioural indicators of pain by the investigator from T1 to T5. The PUSH tool was used to describe the wound characteristics. All instruments were administered by the same person to minimize measurement error. The scales were enlarged to 20 point font size to accommodate visual impairment that is common among the elderly population.

**Sample size:**
The sample size was estimated based on Cohen criteria (1992). To evaluate the mediating effect of anxiety between attachment and pain, multiple regression analysis was to be used. Anticipating a small to medium effect size based on results of a pilot study (Woo, 2007), with power = 0.80 and \( \alpha = 0.01 \), the total sample size required to explore the mediating effect of anxiety was 97.

**Data analysis:**
Data obtained from the patients were analyzed with the Statistical Package for Social Science (SPSS) version 13.0 for personal computers. The level of significance for all statistical tests was set at 0.05. In addition to descriptive statistics, the following statistical tests were used to test the following hypotheses:
H 1: Subjects will report higher levels of pain during dressing change than baseline with dressing removal being the most painful. Repeated Measure Analysis of Variance (RM-ANOVA) was used to detect the differences in pain ratings before, during, and after dressing changes. Post-hoc comparisons were done, using paired t-test to determine the time point at which pain scores differed.

H 2: Pain during wound dressing change is related to anxiety and pre-procedure anticipatory pain. Pearson’s correlation coefficients were calculated to examine the relationships between the variables.

H 3: Secure individuals will report lower levels of pain and anxiety during dressing change than insecure individuals.

Pearson correlation coefficients were calculated between pain and attachment. ANOVA was used to detect differences in anticipatory pain, anxiety, and pain during dressing change among the four attachment groups. Post Hoc analysis using Scheffe tests were used to identify which groups differed on these variables.

H 4: Anxiety has a mediating effect between attachment and pain in older individuals.

To test the mediating effect of anxiety between attachment and pain, multiple regression analyses were used following the procedure
described by Baron and Kenney (1986). Three multiple regression analyses were performed.

In the first regression, the significance of the path from the predictor (attachment) to the mediator (anxiety) was examined. In the second regression, the significance of the path coefficient from attachment as a predictor to pain to the dependent variable was examined. In the third regression, pain was regressed on attachment and anxiety simultaneously. In this third equation simultaneous entry is used to examine the effect of the mediator while the effect of the predictor on the outcome variable is examined (Baron & Kenny, 1986). Mediating effect is established if the path from attachment to pain becomes nonsignificant or decreases in magnitude in the third equation.

Descriptive statistics were used to summarize the characteristics of the sample.
Chapter 5

Results

During the study period, a convenience sample of 96 patients was recruited from participating hospitals including inpatient units and outpatient clinics in Toronto. The sample was female predominant (Table 2). Approximately half of the subjects were married at the time of the study while the other half were widowed, divorced, or never married. Fifty percent of the subjects completed post high-school education. The largest group (45.8%) of subjects identified themselves as Anglo-Saxon/Canadian, followed by Jamaican (15.6%), Italian (8.3%), and other ethnic background (Polish, Jewish, Portuguese).

Table 2 Patient demographics

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>38</td>
<td>39.6</td>
</tr>
<tr>
<td>Female</td>
<td>58</td>
<td>60.4</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not married</td>
<td>47</td>
<td>49.0</td>
</tr>
<tr>
<td>Married</td>
<td>49</td>
<td>51.0</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; high school</td>
<td>48</td>
<td>50.0</td>
</tr>
<tr>
<td>&gt; high school</td>
<td>48</td>
<td>50.0</td>
</tr>
</tbody>
</table>

The average age of the subjects was 66.15 years (± 8.52, range 60-85 years). The mean Mini Mental State Examination (MMSE) score of
27.6 indicates a non-demented sample with only mild cognitive change (adjusted for age and education). Over 90% of the subjects had a documented leg ulcer during the study with an average duration of 8 months. The most common wound related diagnosis was venous insufficiency (78.1%) followed by pressure ulcers (8.3%) and mixed arterial and venous disease (7.3%). Other health/illness related characteristics of the subjects are summarized in table 3.

| Table 3  Health/illness related characteristics |
|-----------------|-------|----------|
|                | Range | Mean     | Standard Deviation |
| Weight (lbs)   | 105-250 | 165.97 | 35.99 |
| Height         | 51-76   | 66.43   | 3.55  |
| PUSH score     | 2-16    | 10.11   | 3.37  |
| Wound duration (months) | .02-60 | 8.38   | 14.08 |
| Length of time attending the clinic (months) | .02-72 | 10.36  | 19.12 |

According to the PUSH tool, wound surface areas were estimated by multiplying the longest length with its perpendicular longest width. The majority of the wounds (68.8%) were small to moderate in size (< 8cm²) and 31.2% of the wounds measured between 8cm² to more than 24cm² in size. The majority of the wounds (61.5%) produced moderate to heavy exudate. Epithelial and granulation tissue were predominantly found in
62.5% of the studied wounds indicating potential for healing. Characteristics of the chronic wounds in this study are summarized in Table 4.

Table 4 Wound characteristics by size, exudate, and tissue types

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Descriptions</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>&lt; 8.0 cm²</td>
<td>66</td>
<td>68.8</td>
</tr>
<tr>
<td></td>
<td>8 - &gt; 24 cm²</td>
<td>30</td>
<td>31.2</td>
</tr>
<tr>
<td>Exudate</td>
<td>None to light</td>
<td>37</td>
<td>38.5</td>
</tr>
<tr>
<td></td>
<td>Moderate- heavy</td>
<td>59</td>
<td>61.5</td>
</tr>
<tr>
<td>Tissue type</td>
<td>New Epithelial tissue</td>
<td>11</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td>Granulation</td>
<td>49</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Slough</td>
<td>31</td>
<td>32.3</td>
</tr>
<tr>
<td></td>
<td>Necrotic</td>
<td>5</td>
<td>5.2</td>
</tr>
</tbody>
</table>
Hypothesis 1: Subjects will report higher levels of pain during dressing change than baseline with dressing removal being the most painful.

Pain was evaluated before dressing change (T1), at dressing removal (T2), at cleansing (T3), with dressing reapplication (T4) and after dressing change (T5). The mean pain scores were highest at cleansing followed by dressing removal. The mean values of pain at different times of dressing change are summarized in table 5. Subjects anticipated varying intensity of pain prior to dressing change, ranging from 0-10 with a mean of 5.56 indicating moderate intensity.

Table 5 Summary of anticipatory pain and intensity of pain during dressing change (NRS from T1 to T5)

<table>
<thead>
<tr>
<th>Pain</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipatory pain</td>
<td>0-10</td>
<td>5.56</td>
<td>2.71</td>
</tr>
<tr>
<td>NRS before dressing change T1</td>
<td>0-8</td>
<td>2.91</td>
<td>2.56</td>
</tr>
<tr>
<td>NRS at dressing removal T2</td>
<td>0-10</td>
<td>4.65</td>
<td>3.08</td>
</tr>
<tr>
<td>NRS at cleansing T3</td>
<td>0-10</td>
<td>5.02</td>
<td>3.19</td>
</tr>
<tr>
<td>NRS at dressing application T4</td>
<td>0-10</td>
<td>3.10</td>
<td>2.73</td>
</tr>
<tr>
<td>NRS after dressing change T5</td>
<td>0-10</td>
<td>2.44</td>
<td>2.74</td>
</tr>
</tbody>
</table>

SD=standard deviation  NRS=Numerical rating scale  MPQ=McGill Pain Questionnaire  PAINAD=Pain Assessment in Advanced Dementia
As illustrated in figure 8, pain at dressing removal (T2), cleansing (T3), and reapplication (T4) were higher than baseline.

Figure 8. Histogram: mean pain scores from T1 to T5

A Repeated Measure Analysis of Variance (RM-ANOVA) demonstrated differences across five assessment time points between pain at baseline and during dressing change were statistically significant \((F(4, 96)=11.8; p<0.001)\). Post-hoc analysis using paired t-tests indicated significant differences in pain ratings between T1 and T2 \((p<.000)\), T1 and
T3 (p<.000), as well as T1 and T5 (p=.007). Bonferroni correction was used to reduce type I error. Reviewing the PAINAD scores also indicated increased number of pain-related behaviours during dressing changes. Results supported the hypothesis that patients with chronic wounds report higher levels of pain during dressing change.

To evaluate the relationship between age, anxiety, and pain ratings, correlation coefficients were calculated. Age was not associated with the anxiety and pain ratings obtained at any point in time (T1 to T5). T-tests indicate that pain ratings were not associated with marital status (married versus not married), and highest education level (less than high school versus more than high school).

The characteristics of pain were captured by the word descriptors on the MPQ-SF. The most commonly chosen descriptors were sharp (72.9%), stabbing (69.8%), tender (68.8%), aching (65.6%), and hot burning (62.5%) indicating a combination of neuropathic and nociceptive pain (figure 9). Descriptive statistics for each word descriptor is summarized in table 6. The highest mean scores were 1.56 for sharp, 1.46 for tender, 1.38 for stabbing and 1.22 for aching (1.22). The mean total score on the MPQ-SF was 11.59 out of a possible total score of 33. Distribution of the MPQ pain scores are summarized in table 7.
Figure 9. Frequency by percentage of words chosen to describe pain
Table 6. Range mean and standard deviation for items on MPQ during dressing change (T2-T5)

<table>
<thead>
<tr>
<th>Descriptors</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPQ rating</td>
<td>0-27</td>
<td>11.59</td>
<td>7.24</td>
</tr>
<tr>
<td>Hot-burning</td>
<td>0-3</td>
<td>1.18</td>
<td>1.11</td>
</tr>
<tr>
<td>Aching</td>
<td>0-3</td>
<td>1.22</td>
<td>1.09</td>
</tr>
<tr>
<td>Heavy</td>
<td>0-3</td>
<td>.76</td>
<td>1.02</td>
</tr>
<tr>
<td>Tender</td>
<td>0-3</td>
<td>1.46</td>
<td>1.17</td>
</tr>
<tr>
<td>Splitting</td>
<td>0-3</td>
<td>.71</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Table 7 Distribution of MPQ pain scores

<table>
<thead>
<tr>
<th>MPQ scores</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>20</td>
<td>1.0</td>
</tr>
<tr>
<td>6-10</td>
<td>35</td>
<td>10.4</td>
</tr>
<tr>
<td>11-15</td>
<td>11</td>
<td>2.1</td>
</tr>
<tr>
<td>16-20</td>
<td>13</td>
<td>2.1</td>
</tr>
<tr>
<td>21-25</td>
<td>14</td>
<td>6.3</td>
</tr>
<tr>
<td>&gt;25</td>
<td>3</td>
<td>2.1</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
<td>100.0</td>
</tr>
</tbody>
</table>

To validate the presence of pain, the PAINAD that incorporated five behavioural indicators was administered. In this study, the PAINAD was used to evaluate the behavioural indicators of pain by the investigator at baseline, dressing removal, cleansing, dressing reapplication and shortly after dressing changes. The Cronbach’s alphas for PAINAD ranged from .50 to .65 at different measurement intervals in this study.
The correlation coefficients between the two pain measures were significant (p<0.01) at T1 (.35), T2 (.69), T3 (.72), T4 (.60), and T5 (.55). As illustrated in Figure 10, facial expression was the most commonly observed behavioural indicator of pain, followed by body movement and vocalization. When subjects displayed facial expression and vocalization, these behaviours were often intense (grimacing and moaning) as indicated by high mean scores. In contrast, consolability and breathing were the least intense. Descriptive statistics are summarized in table 8.

**Figure 10** PAINAD behavioural indicators observed during dressing change by percentage
Table 8  Range, mean, and standard deviation for PAINAD items

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing</td>
<td>0-2</td>
<td>.15</td>
<td>.34</td>
</tr>
<tr>
<td>Vocalization</td>
<td>0-8</td>
<td>2.02</td>
<td>1.89</td>
</tr>
<tr>
<td>Facial expression</td>
<td>0-8</td>
<td>2.4</td>
<td>2.04</td>
</tr>
<tr>
<td>Body movement</td>
<td>0-7</td>
<td>.75</td>
<td>1.38</td>
</tr>
<tr>
<td>Consolability</td>
<td>0-7</td>
<td>.35</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Hypothesis 2: Pain during wound dressing change is related to anxiety and pre-procedure anticipatory pain.

Pearson's correlation coefficients were calculated to examine the relationships among variables (table 9). The analysis of the correlation matrix indicates that few of the observed relationships were very strong. Anxiety was measured by a 6-item short form, the Cronbach’s alpha coefficient for was .87 and .89 before and after dressing change respectively.

Anxiety prior to dressing changes was significantly and positively correlated to anticipatory pain, self reported pain (NRS), as well as observable pain behaviours (PAINAD) during dressing changes. The higher the anxiety levels, the higher the anticipatory pain and actual pain experienced during dressing changes. Of all the variables related to
anxiety, anticipatory pain demonstrated the strongest association with anxiety ($r = .674$). Subjects who experienced escalated anxiety were more likely to express higher anticipatory pain on the NRS. Anticipatory pain was also positively related to pain assessed at all the time intervals during dressing change, especially at dressing removal (T2) and cleansing (T3) as indicated by the higher correlation coefficients. Although the correlation coefficients between anxiety, anticipatory pain and the McGill Pain Questionnaire scores (MPQ) were relatively low, the relationships remained statistically significant. Based on the results, the second hypothesis that relationships exist between anxiety, anticipatory pain, and perceived pain during dressing change was supported.
Table 9 Correlation table: Anxiety, anticipatory pain, NRS pain scores, PAINAD scores and MPQ

<table>
<thead>
<tr>
<th></th>
<th>Anxiety</th>
<th>Ant pain</th>
<th>NRS 1</th>
<th>NRS 2</th>
<th>NRS 3</th>
<th>NRS 4</th>
<th>NRS 5</th>
<th>PAINAD 1</th>
<th>PAINAD 2</th>
<th>PAINAD 3</th>
<th>PAINAD 4</th>
<th>PAINAD 5</th>
<th>MPQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Ant pain</td>
<td>.674**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NRS1</td>
<td>.434**</td>
<td>.617**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NRS2</td>
<td>.530**</td>
<td>.679**</td>
<td>.781**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NRS3</td>
<td>.456**</td>
<td>.648**</td>
<td>.813**</td>
<td>.747**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NRS4</td>
<td>.409**</td>
<td>.469**</td>
<td>.676**</td>
<td>.675**</td>
<td>.739**</td>
<td>1</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NRS5</td>
<td>.439**</td>
<td>.535**</td>
<td>.808**</td>
<td>.756**</td>
<td>.758**</td>
<td>.875**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PAINAD1</td>
<td>.435**</td>
<td>.357**</td>
<td>.358**</td>
<td>.487**</td>
<td>.454**</td>
<td>.571**</td>
<td>.527**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PAINAD2</td>
<td>.484**</td>
<td>.340**</td>
<td>.403**</td>
<td>.694**</td>
<td>.420**</td>
<td>.502**</td>
<td>.473**</td>
<td>.720**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PAINAD3</td>
<td>.445**</td>
<td>.400**</td>
<td>.499**</td>
<td>.533**</td>
<td>.726**</td>
<td>.593**</td>
<td>.492**</td>
<td>.669**</td>
<td>.632**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PAINAD4</td>
<td>.473**</td>
<td>.278**</td>
<td>.242**</td>
<td>.380**</td>
<td>.350**</td>
<td>.608**</td>
<td>.426**</td>
<td>.826**</td>
<td>.686**</td>
<td>.625**</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PAINAD5</td>
<td>.538**</td>
<td>.393**</td>
<td>.384**</td>
<td>.429**</td>
<td>.426**</td>
<td>.535**</td>
<td>.556**</td>
<td>.818**</td>
<td>.551**</td>
<td>.548**</td>
<td>.762**</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>MPQ</td>
<td>.332**</td>
<td>.435**</td>
<td>.402**</td>
<td>.453**</td>
<td>.452**</td>
<td>.416**</td>
<td>.473**</td>
<td>.346**</td>
<td>.256**</td>
<td>.315**</td>
<td>.312**</td>
<td>.405**</td>
<td>1</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Ant pain=anticipatory pain     NRS=Numerical rating scale     PAINAD=Pain Assessment in Advanced Dementia
MPQ=McGill Pain Questionnaire
Hypothesis 3: Secure individuals will report lower levels of pain and anxiety during dressing change than insecure individuals.

According to the factor analysis of the RSQ, two factors emerged that corresponded to the two underlying dimensions of attachment proposed by Bartholomew et al (1994). The results showed that two factors with Eigen values of more than 1.0 (as shown in Figure 11), accounted for 44.75 % of variance in the item responses. Item 1, 2, 4, 5, 7, 8, 9, 12, 16, 19, 24, 26, 29, 30 loaded on factor one representing model of other (attachment avoidance). Items 3, 6, 10, 11, 13, 15, 17, 18, 20, 21, 22, 23, 25, 28 loaded on factor two representing model of self (attachment anxiety).

![Scree Plot](image)

**Figure 11 Factor analysis of RSQ: Scree plot**
The magnitude of the correlation between the two factors \((r=0.627)\) suggested a relationship between the models of self and others. The results were consistent with the approach to examining individual differences in adult attachment by the two intersecting dimensions. The factor scores were computed as the sum of the corresponding items. Considering the two dimensions as continuous variables, Pearson correlation coefficients were calculated between pain scores (numerical rating scale) and the two attachment variables. (Table 10)
Table 10  Correlation coefficients between attachment and pain

Anxiety Ant
pain NRS T1 NRS T2 NRS T3 NRS T4 NRS T5 Factor 1

Factor 1 (other)  .295**  .250* .060 .214* .266** .210* .104 1
Factor 2 (self)  .454** .477** .205* .388** .315** .296** .200 .627**

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

PAINAD T1 PAINAD T2 PAINAD T3 PAINAD T4 PAINAD T5 MPQ

Factor 1 (other) .203* .172 .325** .176 .152 .308**
Factor 2 (self) .187 .146 .259* .189 .207* .245*

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Ant pain= anticipatory pain

Numerical pain ratings were higher at T2 to T4 during manipulation of the wounds. These ratings were consistently and significantly related to both dimensions of attachment. Results indicated that the higher the attachment anxiety and avoidance indicating attachment insecurity, the higher the pain levels. The relationships between attachment variables and PAINAD were less robust but followed the expected trend. Different pain qualities that characterized and separated nociceptive from
Neuropathic pain were captured by words descriptors on the MPQ-SF. Nociceptive pain was represented by items including gnawing, aching, tender, and throbbing while neuropathic pain was depicted by burning, stabbing, stinging, and shooting. The two attachment dimensions were correlated to pain scores representing nociceptive pain component. Neuropathic pain scores were not related to attachment (Table 11).

**Table 11  Correlations between attachment, nociceptive pain and neuropathic pain**

<table>
<thead>
<tr>
<th>Attachment</th>
<th>Nociceptive pain</th>
<th>Neuropathic pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor1 (other)</td>
<td>.374**</td>
<td>.118</td>
</tr>
<tr>
<td>Factor2 (self)</td>
<td>.215*</td>
<td>.175</td>
</tr>
</tbody>
</table>

**  Correlation is significant at the 0.01 level (2-tailed).  
*  Correlation is significant at the 0.05 level (2-tailed).  

Alternatively, using the medians as cut-off points, individual scores were dichotomized into high or low on each dimension creating four quadrants that represent the four prototypical attachment styles (figure 11.5). Subjects were assigned to their respective attachment styles based on whether their scores were above or below the median to present positive or negative view of self and others. These four patterns were classified as secure (positive self and positive other), and three insecure attachment styles: preoccupied-ambivalent (negative self and positive other), fearful-avoidant (negative self and negative other), and dismissing
(positive self and negative other) (Bartholomew & Horowitz, 1991). The classification scheme is presented in Figure 12.

Accordingly, 36 subjects were classified as secure (37.5%), 17 dismissing (17.7%), 13 anxious preoccupied (13.5%), and 30 fearful avoidant (31.3%).

Figure 12 Attachment classifications by two factors

<table>
<thead>
<tr>
<th></th>
<th>Factor 2 (Anxiety): median 22</th>
<th>- (high values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure</td>
<td>+ low values</td>
<td></td>
</tr>
<tr>
<td>Anxious-preoccupied</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dismissing</td>
<td>- high values</td>
<td></td>
</tr>
<tr>
<td>Fearful avoidant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Secure
• high self-esteem,
• enjoy intimate relationships,
• seek out social support,
• Able to share feelings

Anxious-preoccupied
• preoccupied with attachment
• less positive view about self

Dismissing
• deny the need for close relationships
• suppress and hide feelings,
• deal with rejection by distancing

Fearful avoidant
• view themselves as unworthy
• uncomfortable with closeness
• mixed feelings about relationships

Secure individuals are generally less anxious and are more capable of regulating the distress incurred by pain. On the other hand, insecure patients may have a tendency to catastrophize and inflate their pain.
ratings. It was hypothesized that secure individuals will report lower levels of pain and anxiety during dressing change than insecure individuals.

Descriptive statistics suggested avoidant individuals expressed the highest levels of anticipatory pain and anxiety. In contrast, dismissing attachment style was characterized by the lowest anticipatory pain and anxiety scores. (Table 12)

**Table 12  Levels of anticipatory pain and anxiety by attachment styles**

<table>
<thead>
<tr>
<th>Attachment style</th>
<th>Anticipatory pain: mean (SD)</th>
<th>Anxiety: mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure</td>
<td>4.60 (2.01)</td>
<td>8.28 (3.22)</td>
</tr>
<tr>
<td>Dismissing</td>
<td>4.22 (2.31)</td>
<td>8.16 (3.22)</td>
</tr>
<tr>
<td>Preoccupied</td>
<td>6.23 (2.97)</td>
<td>8.76 (3.00)</td>
</tr>
<tr>
<td>Avoidant</td>
<td>7.20 (2.72)</td>
<td>12.03 (4.71)</td>
</tr>
</tbody>
</table>

Results of ANOVA indicated significant differences in anticipatory pain and anxiety among the four attachment groups (Table 13). Post Hoc analysis using Scheffe tests indicated that avoidant individuals reported significantly higher levels of anticipatory pain and anxiety compared to subjects assigned to secure and dismissing categories (Table 14). The other comparisons were not significant.
Table 13  ANOVA of anticipatory pain and anxiety by attachment style

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticipatory pain</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>151.00</td>
<td>3</td>
<td>50.33</td>
<td>8.41</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>550.61</td>
<td>92</td>
<td>5.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>701.62</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Anxiety</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>283.08</td>
<td>3</td>
<td>94.36</td>
<td>6.76</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>1282.91</td>
<td>92</td>
<td>13.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1566.00</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 14  Post hoc analysis of anticipatory pain and anxiety by attachment styles

<table>
<thead>
<tr>
<th>Post Hoc Tests</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent Variable</td>
<td>(I) Attachment style</td>
</tr>
<tr>
<td>Anticipatory pain</td>
<td>Secure (4.6)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dismissing (4.22)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preoccupied (6.23)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avoidant (7.20)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>Secure (8.28)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dismissing (8.16)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preoccupied (8.76)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avoidant (12.03)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The mean difference is significant at the .05 level.
Further analysis was conducted to examine differences in pain during dressing change based on attachment styles. Serial pain measurements from T1 to T5 during dressing changes are summarized by attachment styles in table 15. Subjects considered preoccupied in their attachment style consistently reported the highest levels of pain across all measurements. Avoidant individuals expressed the second highest levels of pain followed by dismissing subjects. The overall pain scores were lowest in the secure subjects.

Table 15  Serial pain measurement by attachment styles

<table>
<thead>
<tr>
<th>Attachment style</th>
<th>NRS T1 Mean (SD)</th>
<th>NRS T2 Mean (SD)</th>
<th>NRS T3 Mean (SD)</th>
<th>NRS T4 Mean (SD)</th>
<th>NRS T5 Mean (SD)</th>
<th>Overall pain Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure (n=35)</td>
<td>2.22 (2.0)</td>
<td>3.68 (2.12)</td>
<td>3.62 (2.18)</td>
<td>1.68 (1.65)</td>
<td>1.34 (1.84)</td>
<td>2.50 (1.56)</td>
</tr>
<tr>
<td>Dismissing (n=18)</td>
<td>2.61 (3.31)</td>
<td>4.00 (3.86)</td>
<td>5.22 (3.90)</td>
<td>3.72 (3.21)</td>
<td>2.61 (3.16)</td>
<td>3.44 (3.04)</td>
</tr>
<tr>
<td>Preoccupied (n=13)</td>
<td>4.15 (2.33)</td>
<td>6.30 (2.62)</td>
<td>6.69 (2.95)</td>
<td>4.76 (2.68)</td>
<td>4.46 (2.78)</td>
<td>5.14 (2.71)</td>
</tr>
<tr>
<td>Avoidant (n=30)</td>
<td>3.33 (2.57)</td>
<td>5.43 (3.30)</td>
<td>5.80 (3.31)</td>
<td>3.66 (2.84)</td>
<td>2.73 (2.87)</td>
<td>4.30 (2.59)</td>
</tr>
</tbody>
</table>
To test for the differences in pain perception among various attachment styles, a one-way ANOVA test was used. Results are presented in table 16. There were significant differences in pain ratings from T2 to T5 between attachment groups. Post Hoc analysis using Scheffe tests was performed to detect where the differences lie (Table 17). At wound cleansing (T3) and dressing reapplication (T4), subjects classified under preoccupied and avoidant attachment expressed more intense pain than secure individuals. Shortly after dressing change was completed, preoccupied subjects continued to rate pain higher than secure subjects. There were no significant differences in the pain ratings between secure and dismissing attachment styles.

Table 16  ANOVA tests: Pain during dressing change by attachment styles

<table>
<thead>
<tr>
<th></th>
<th>ANOVA</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>NRS T1</td>
<td>Between Groups</td>
<td>43.348</td>
<td>3</td>
<td>14.449</td>
<td>2.289</td>
<td>.084</td>
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<tr>
<td></td>
<td>Within Groups</td>
<td>580.808</td>
<td>92</td>
<td>6.313</td>
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</tr>
<tr>
<td></td>
<td>Total</td>
<td>624.156</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRS T2</td>
<td>Between Groups</td>
<td>94.280</td>
<td>3</td>
<td>31.427</td>
<td>3.580</td>
<td>.017</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>807.679</td>
<td>92</td>
<td>8.779</td>
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<td></td>
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<tr>
<td></td>
<td>Total</td>
<td>901.958</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRS T3</td>
<td>Between Groups</td>
<td>123.107</td>
<td>3</td>
<td>41.036</td>
<td>4.469</td>
<td>.006</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>844.852</td>
<td>92</td>
<td>9.183</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>967.958</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRS T4</td>
<td>Between Groups</td>
<td>122.830</td>
<td>3</td>
<td>40.943</td>
<td>6.383</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>590.128</td>
<td>92</td>
<td>6.414</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>712.958</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRS T5</td>
<td>Between Groups</td>
<td>98.364</td>
<td>3</td>
<td>32.788</td>
<td>4.871</td>
<td>.003</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>619.261</td>
<td>92</td>
<td>6.731</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Total</td>
<td>717.625</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mean pain</td>
<td>Between Groups</td>
<td>41.946</td>
<td>3</td>
<td>13.982</td>
<td>2.186</td>
<td>.095</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>588.533</td>
<td>92</td>
<td>6.397</td>
<td></td>
<td></td>
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Hypothesis 4: Anxiety has a mediating effect between attachment and pain in older individuals.

To test for the mediating effect of anxiety between attachment and pain, three regression analyses were performed according to Baron and Kenny’s (1986) approach. In the first regression equation, anxiety as a mediator was regressed on attachment including the two factors/dimensions as the predictor variables (Figure 13). The two corresponding factors emerged from factor analysis of the Relationship Scales Questionnaire in this study sample, as described earlier.

Figure 13 Regression Equation 1: Anxiety regressed on attachment

![Diagram showing the regression equation]

The path coefficient was significant (B=.44, p=.000) for factor 2 representing model of self or attachment anxiety explaining 21.3% of
variance in anxiety. The path coefficient for factor 1 representing model of others or attachment avoidance was not significant (B=.005, p=.966) and it was removed from the following analyses. High levels of insecure attachment were associated with high anxiety levels prior to dressing change.

**Figure 14** Regression equation 2: Pain regressed on attachment

In the second equation, the relationship between pain and attachment was examined. An average pain score was computed across T1 to T5 to represent pain during dressing change. The average pain score was used as an outcome variable that was regressed on the self model of attachment. The relationship was also significant (B=.227, p=.022) explaining 13.7% of variance in average pain (Figure 14).
In the last equation, pain was regressed on both attachment and anxiety simultaneously. With both attachment and anxiety included, the explained variance in pain increased from 13.7% to 28.1%. The standardized coefficient for the relationship between pain and anxiety was significant ($B=.427$, $p=.000$), while the coefficient for the relationship between attachment and pain was reduced in magnitude to 0.037 and was no longer significant ($p=.711$) (Figure 15). The degree to which the coefficient was reduced indicated that anxiety was a strong mediator between attachment and pain.

**Figure 15 Regression equation 3: Pain regressed on anxiety and attachment simultaneously**
This study links attachment style to anxiety and pain in elderly patients with chronic wounds. The results of the current study support the attachment model as a credible framework to elucidate the complex interplay between psychological models of self and others, pain, and anxiety in older persons. According to the basic tenets of the theory, secure attachment is founded on the innate need to seek close proximity to attachment figures for protection, support, and relief of stress. In early childhood, young children increasingly rely on mental representations of their caregivers’ availability rather than their actual physical proximity. As children become more mature, they develop sophisticated capacities for managing the emotional stress of separations from their caregivers. Attachment security extends beyond specific infant-parent relationships experienced throughout infancy and childhood and takes on a quality as a personal attribute. The internal working models serve as interpretive filters through which people reconstruct their understanding of new experiences and relationships in ways that are consistent with their prior experiences and expectations (Thompson & Raikes, 2003).

The results of the current study support the importance of attachment across the lifespan affecting the experience and expression of anxiety and of pain. The older subjects expressed varying perceptions of
their close relationships as evidenced by their responses to the Relationship Style Questionnaire.

The results of Relationship Scales Questionnaire (RSQ) factor analysis identified two factors that corresponded to Griffin and Bartholomew’s (1994) proposed dimensions. The two dimensions identified are the two factors of the attachment theory; model of self and model of others. As described earlier, these two dimensions have been validated in multiple studies.

Results of this study indicated that the majority of the subjects (62.5%) were classified as insecure in their attachment. Of these, 31.3% exhibiting high levels of attachment anxiety and avoidance were categorized as fearful avoidant. 17.7% were dismissing and 13.5% preoccupied.

Unresolved pain is frustrating and may perpetuate the sense of abandonment, unworthiness and lack of empathy or help from others. The predominance of insecure attachment in this sample may reflect a picture of chronic pain syndrome characterized by unremitting pain, reduced physical activity, social isolation, and depression. Subsequent to the experience of chronic pain, older subjects may adjust their worldviews and espouse a more negative view about self and others.

According to attachment theory, pain is perceived as a threat that often triggers negative emotions such as fear and anxiety. To control and
regulate the impact of negative emotions, the attachment system is called into play, precipitating a sequence of events and attachment behaviours.

To date, this is the first study that confirmed a significant relationship between attachment and pain and substantiated the relationship between the two attachment dimensions (attachment anxiety and attachment avoidance) and pain intensity. Although Meredith et al. (2006) demonstrated a significant relationship between attachment and pain threshold; other studies of patients from chronic pain clinics (Meredith et al., 2005, 2007) failed to link attachment variables to pain intensity. Perhaps the relationship between attachment and pain is more readily established by acute pain induced by dressing change in this study.

In this study, subjects were assigned to one of the four attachment styles described by Bartholomew et al. (1991) and, based on the combinations of high and low scores, along the two attachment dimensions (attachment anxiety and attachment avoidance). Brenna et al (1998) collated 60 attachment scales and conducted a principal components analysis to identify their commonalities. All the items loaded on two global factors (self versus others) that were conceptually equivalent to the axes that divided the four categorical typology of attachment styles (secure, dismissing, preoccupied, and fearful avoidant). Results revealed distinctive patterns of anticipatory pain and actual pain experienced during dressing change based on various attachment styles.
Securely attached individuals are more likely to appraise the situation realistically. They are more confident in their ability to cope effectively with stress and have a relatively high threshold of attachment activation. Hence, secure individuals are less susceptible to chronic pain because of their willingness to consult and to adhere to recommendations offered by health professionals. Perhaps not surprisingly, therefore, individuals categorized as secure reported lower levels of anticipatory pain and self-reported pain than those who were assigned to the avoidant style.

Subjects who were assigned to the dismissing category also expressed low levels of pain but likely for different reasons than securely attached individuals. It is well documented that individuals characterized by dismissing attachment have a tendency to exclude distress signals from their awareness when confronted with threat. The findings that subjects with dismissing attachment reported low levels of anticipatory pain and self-reported pain during dressing change are in line with the theoretical underpinnings. Dismissing individuals are typically described as compulsively self-reliant. They are likely to disregard the pain signals and block the associated negative emotions from cognitive processing in order to keep the attachment system “deactivated”. This would explain why these individuals reported lower levels of anxiety and pain.

Individuals with high levels of anxiety about relationships (i.e. a negative model of the self) tend to adopt hyperactivating strategies. These hyperactivating strategies evoke cognitive responses that exacerbate
negative affect and cause sustained attention to real and imagined threats. McCracken (2007) has documented that heightened active vigilance has been demonstrated to be related to increased pain and related anxiety. These individuals are likely to amplify pain related distress cues, exaggerate the extent of pain, and exhibit extensive pain related behaviours in order to elicit support. Mikulincer and Florian (1998) reported that chronic back pain patients who demonstrated preoccupied and fearful attachment appraised their pain in more threatening terms. They appeared less capable of coping with pain, and relied more on emotionally focused strategies than secure patients.

The two groups of individuals with high levels of attachment anxiety are the preoccupied and fearful avoidant. In this study, consistent with my hypothesis, older adults with a predominantly preoccupied attachment style reported the highest levels of anticipatory pain and self reported pain during dressing change.

Fearful avoidant Individuals share many of the characteristics of those with a predominantly preoccupied attachment style. They may desire social contact but are curbed by fear of rejection at the same time. They may utilize both hyperactivating and deactivating strategies but in a disorganized manner. They may be more inclined to misinterpret ambiguous physical sensations as threatening or painful and therefore have an increased likelihood of expressing elevated levels of pain. They are more likely to respond to lower levels of stress with anxiety and
distress. Mikail et al., (1994) stated that fearful avoidant individuals may delay seeking help until their distress levels are sufficiently high to overcome their fears of being rejected. Even when they are helped, they tend to adopt a stance of hopelessness and a covert unwillingness to relinquish their suffering. This may explain why, in this study, their pain levels were higher than those reported by the secure and dismissing groups.

Central to this study was the evaluation of the relationships between attachment (styles), anxiety, and pain. Consistent with previous findings and the stated hypothesis of this study, anticipatory pain, pain at dressing change, and anxiety were related in patients with various chronic wound types. The higher the state anxiety prior to dressing change, the higher the anticipatory level of pain, and the more intense the pain expressed during the procedure. The correlation coefficients ranged from .39 to .52 with the highest value observed when pain was rated the most intense. Linear regression identified anxiety as a significant predictor of mean pain scores (B=.476; p=.000) accounting for 22.7% of variance. Consistent with previous reported findings, older individuals that were categorized as fearful avoidant reported the highest levels of anticipatory pain and anxiety.

While both attachment variables were correlated to anxiety and pain, only attachment anxiety or model of self accounted for significant
variance in state anxiety and self reported pain during dressing change. Individuals high in attachment-related anxiety focused on self worth, the perceived availability of relationship with partners and their willingness to provide care and support to the self. They are concerned about rejection and abandonment. Porter, Davis, and Keefe (2007) linkage of attachment anxiety to hypervigilance with exaggerated threat appraisals or rumination winding up with enhanced and prolonged emotional distress would explain why attachment anxiety was a stronger predictor for anxiety and pain than attachment avoidance.

In this study, the mediating role of state anxiety between attachment anxiety and pain was examined. A mediating model helps to explain how and why a relationship exists between an independent variable (attachment style) and its influence on a dependent variable (pain). State anxiety was a significant mediator between attachment anxiety and pain in older adults. Individuals with attachment styles that are characterized by high levels of attachment anxiety are more vulnerable and sensitive to anxiety. In other words, attachment anxiety while rooted in internal dynamics of various early relationships may also function as a general risk factor that activates anxiety. Pereg (2001), for example, illustrated the potential effect of attachment anxiety on a general disposition to emotional negativity. He requested participants to recall the headlines in a booklet after being exposed to negative affect from reading
a car accident article. The results indicated that people with high attachment anxiety recalled more negative headlines.

As discussed in the previous chapters, with heightened anxiety, pain can be exacerbated or intensified through various physiological or psychological mechanisms. Although it is presumed that the predictor variable (attachment) should not be caused by the mediator (anxiety) or the outcome variable (chronic pain), one cannot exclude the possibility that chronic unrelenting pain may alter individuals’ coping mechanisms stimulate a more dismissing attitude. This may explain why dismissing subjects reported the lowest level of anxiety and anticipatory pain in the study. Compared to other subjects with insecure attachment, dismissing individuals also reported lower levels of pain during dressing change. Dismissing individuals may adopt repression as a coping mechanism to ignore or divert attention from threatening stimuli such as pain and associated emotions. However, dismissing threatening emotions and cognitions may impede the processing, assimilation, and accommodation of the experience that are necessary to the successful management of distress. Long term impact of pain on dismissing individuals is not clear.

Previous studies evaluated the moderating role that attachment plays in various relationships including pain and depression (Meredith et al., 2007), disability and pain self-efficacy, pain intensity and pain self-efficacy in addition to disability and anxiety (Meredith, et al., 2006). This
is the first study that illustrated the mediating effect of anxiety between attachment and pain.

Taken together, anxiety (affect regulation), anticipation (emotional reactivity), and pain are influenced by one’s vulnerability to negative emotions and the need to be close to other people for support (Diagram 16). These beliefs and mental structures about self and others are consistent with the two underlying dimensions of adult attachment.

**Figure 16** Anticipation, state anxiety, and pain as a function of attachment anxiety
The attachment theory has extended the understanding of normative and individual differences in affect regulation and its relationship to somatic complaints. Global emotional regulatory functions of the attachment system, especially attachment-related anxiety have a definite impact on the specific emotional response (anxiety) to pain. This finding is important and has broadened the scope of adult attachment and psychosomatic research.

Results of the study validated the prevalence of pain in patients with chronic wounds. Wound-related pain is complex, integrating the experience of chronic persistent pain as well as acute temporary pain that is often associated with surgical debridement or recurrent wound related procedures (dressing removal, wound cleansing, and dressing application).

Pain was exacerbated with wound manipulation at dressing change especially during dressing removal and wound cleansing. The mean level of pain increased from 2.9 at rest to 4.65 and 5.02 with dressing removal and wound cleansing, respectively. The numerical increment of pain was not only statistically significant but clinically relevant to patients. Studies of chronic pain patients suggest that a 30% change or an equivalent of 2-2.5 point variation on the 11 point NRS is clinically important (Farrar, Young, LaMoreaux, Werth, Poole, 2001, Pool, Ostelo, Hoving, Bouter, & de Vet, 2007).
Previous publications have emphasized the importance of the potential trauma and pain incurred by dressing removal. Although the issue of pain and trauma at dressing change seems self-evident, pain management is not always the priority of care. Results of this study reiterate the importance of pain management in the provision of wound care, especially in the elderly population. Results from the current analysis also expand this vantage point and illustrate that wound cleansing may be the most painful step during dressing changes. A variety of cleansing techniques may be used but often this involves using forceps and saline soaked gauze to scrub the surface of the wound. This approach is traumatic to the wound bed and may activate nerve endings inducing pain. It is also possible that the incorporation of advanced moisture interactive and relatively “atraumatic” dressings at the participating clinics may have circumvented or mitigated pain associated with dressing removal. With aging, the loss of dermal thickness and subcutaneous fatty tissue, flattening of the epidermal-dermal junction, reduction in the number of elastin fibers, the skin is thinner and less resilient. Taken together, these changes render the skin of many elderly adults more prone to injury. The use of atraumatic dressings and gentle approaches is particularly relevant and crucial in the care the elderly to minimize pain and discomfort at wound dressing changes.
The MPQ-SF was used in this study to elicit the characteristics of the chronic wound pain. The different descriptors in the scale can differentiate neuropathic from nociceptive pain. Nociceptive pain is caused by direct stimulation of peripheral nociceptors associated with tissue damage as well as inflammatory processes. In contrast, neuropathic pain is spontaneous and not stimulus dependent but caused by an injury to the peripheral or central nervous system. Consistent with previous studies (Stotts, et al., 2004; Goncalves, et al., 2004), participants in the study used various terms to describe their pain. The common choice of words such as tender, aching, throbbing, gnawing, (nociceptive) and sharp, hot burning, and drilling (neuropathic) indicated that wound related pain may involve both pathological processes. Effective treatment must therefore address both components of wound related pain by considering specific therapeutic agents.

Results of the current study validated the multidimensional structure of pain. Attachment patterns and interpersonal relationship continue to play a key role in the experience of pain in older adults. Comprehensive approach to treating wound related pain should take into account patients’ attachment patterns defined by internal models of self and others. The importance of diligent pain and anxiety (including other negative emotions) assessment with standardized tools, careful selection of appropriate atraumatic dressing, and gentle cleansing cannot be
overlooked. The limitation of the study and other implications for practice will be discussed in the following chapters.

**Limitations**

Several limitations should be considered when interpreting the findings of this study. A non-probability sampling method was used. The available subjects may not be representative of the chronic wound population. A large proportion of the sample consists of patients with leg ulcers and their perception of pain may not be generalizable to patients with other types of chronic wounds. Attachment, anxiety, and pain are complex variables with multiple dimensions. The use of unidimensional instruments to assess pain and anxiety may not capture the complexity of these variables.

Other measurement issues may have affected results of the study. With respect to the NRS, there was a tendency for subjects to provide a range of scores (pain feels like 4 to 5) or a number that is out of the described range (e.g. pain feels like 20 out of 10). Some individuals had problem identifying one number to describe their pain at cleansing since the procedure may last a few minutes with varying degree of pain.

With respect to the PAINAD, behavioural indicators such as consolability and breathing were the least observed behaviours. Similar findings were reported by DeWaters et al (2008) in their study of older adults without any evidence of cognitive impairment. Zwakhalen, Hamers,
and Berger (2006) reported the corrected item total correlation was below .20 between breathing and the total PAINAD scale. Perhaps the need to be consoled or pacified and how it is operationalized (appeared content) is more relevant to the patient population with dementia toward which the original tool was aimed in contrast to the sample in this study.

The Relationship Scales Questionnaire (RSQ) is widely used based on its cogent theoretical grounding. Psychometric properties of this instrument in the older population are still lacking, and the questions pertaining to close relationships (personal and emotional) are often subject to response bias. The quality of data obtained from the self report measure of attachment could be reduced in participants who lacked insight into their relationships or who are inclined to consider a socially desirable response especially when anxiety and defences are at issue.

Dichotomizing each factor as high (positive) or low (negative) using the median as a cut off, created the four prototypical attachment patterns. Dichotomization has the advantage of robustness to outliers thereby reducing bias due to high variability/variance and accommodation to non-monotonic relations. Median split cut off points have been used to attain approximately equal cell counts of sufficient sizes. The disadvantage of this data reduction approach is a potential loss of information that is otherwise available from continuous data. According to Griffin and Bartholomew (1994), each attachment category is best conceptualized as
a prototype. A prototype is an ideal category member that possesses the most common defining features while recognizing the fact that no particular features are individually required or jointly sufficient to define group membership. Stylistic differences in attachment are best described as how well each individual fits into each prototype. Over time and across situations, it is proposed that most adults would be portrayed by varying degrees of two or more attachment patterns. For the purpose of this study, each participant was forced into only one attachment prototype using an arbitrary cut off point (the median) on the two attachment dimensions.

Despite these limitations, this study demonstrated significant relationships between attachment anxiety, pain, and state anxiety in a sample of older adults. To date, this is the first attempt that links attachment, aging, anxiety, and pain with a robust methodology.

**Implication for practice and research**

Improvement in pain has been demonstrated to enhance the subjective feelings of well-being in patients with chronic wounds (Jorgensen Friis & Gottstrup, 2006). Unfortunately, wound related pain is often under-estimated and under-treated. Hofman et. al. (1997) reported that only half of the chronic wound patients with severe pain
received appropriate morphine based analgesia. Clinical assessment and documentation of pain and associated negative emotions such as anxiety is often deficient. Assessment of pain can be challenging, requiring astute interpersonal sensitivity, standardized measures with satisfactory psychometric properties, and careful judgment.

There is a need to raise awareness of wound related pain and its emotional consequences. Results of the study validated the fact wound related pain could be exacerbated with dressing changes, especially at dressing removal and cleansing. Clinical application of non-traumatic dressing and gentle irrigation of the wounds should be integrated into routine practice to minimize pain. Consistent with previous findings, the NRS and MPQ-SF were useful and practical tools to assess pain in older adults. A comprehensive pain assessment and treatment plan should incorporate evaluation of anxiety as one of the aggregating factors for pain. Clinicians should explore how patients feel and ask them if they are worried, tense, upset, or nervous (these are valid descriptors for anxiety).

Pain is a multidimensional experience including sensory, cognitive, affective, and behavioural components. A common mistake made in responding to pain is the assumption that the severity of the injury equals the severity of pain with a specific demonstrable cause. As Hadjistavropoulos and Craig (2002) note, relationships between
feeling pain and expressing pain are context dependent; depending on the methods used to assess pain, who is conducting the assessment, the underlying reasons for pain evaluation, and the person’s perception of the consequences of reporting pain. The pain experience reflects a dynamic interplay among biological maturation, personal appraisal of the situation, and socialization of pain in specific familial or cultural context. Results of this study confirm that the cognitive internal working model of self, anticipation, and negative emotions (anxiety) can impact on the total pain experience. Communication and expression of pain is a form of attachment behaviour. Whether communication of pain is a description of a physical sensation, an appeal for attention, a need to elicit an empathic response or an expression of anger, the ways individuals communicate their pain and emotions are reflective of their internal cognitive appraisals and their perceptions about self and others. Caregivers must pay attention to the patient’s unexpressed psychological need for care in addition to the physical symptoms that are expressed.

Health care providers should be cognizant of the fact that certain individuals are more vulnerable to experiencing anxiety due to their internal models of self and others. Particularly, attachment anxiety associated with a low opinion of self has been demonstrated to be the key determinant that influences state anxiety level, anticipation of pain and actual pain experience at dressing change in this sample of
older adults. Subjects who experienced higher levels of attachment anxiety represented by fearful avoidant and preoccupied attachment patterns expressed higher levels of anticipatory pain, anxiety prior to dressing change, and pain during dressing change than individuals who are secure with their relationship (see Figure 17).

![Figure 17 Relationship between attachment patterns, anxiety, and pain](image)

Effective management of pain not only requires the use of pharmacological agents but also mindful attention to personal and social factors that may account for the variability in pain experience. A therapeutic relationship between the health care provider and the patient can enhance treatment adherence to optimize patient
outcomes (Ebberskog & Emami 2005; Morgan, et al., 2004). The facilitation of self-exploration within the safety of the therapeutic relationship is essential to vulnerable, insecure patients. As a crucial step to cultivate a therapeutic alliance, clinicians may first acknowledge that anxiety and pain are common experiences at dressing changes. While patients should be informed that these symptoms are part of a normal response, emphasis should be placed on available treatment options and achievable goals to minimize the experience of these symptoms. Based on Keller and Carrolls’ suggestions (1994), the following communication strategies are proposed:

1) Engage patients by talking about their pain and their concern about wound care and dressing changes.
2) Empathize the impact of pain for individuals with chronic wounds.
3) Educate patients by explaining procedures and how they are performed.
4) Enlist patient participation by actively engaging them during the procedure and giving them permission to call time outs.

14.1 Engage and empathize

To reduce attachment anxiety, effective communication and education allow healthcare professionals and patients to establish a credible comprehension of pain mechanisms (Ward, Hughes, Donovan, & Serlin, 2001). There is a need to reinforce the belief that
chronic wound patients do not have to live with persistent or temporary pain and we need to foster their active participation in the assessment, treatment and coping behaviours (Kerns, Otis, & Marcus, 2001).

One key issue in insecure attachment is that such patients may reject help and fail to adhere to the treatment recommendations provided by their caregivers due to mistrust. There is a need for a more sophisticated approach to assessing and treating of pain patients. To be most effective, caregivers must adapt and tailor their interaction to respond the specific attachment patterns of their patients. People with secure attachment are willing to engage in open communication and express anxiety and pain without under-estimating or over-inflating the experiences of these symptoms and their impact. They usually consider themselves to be rather resilient in times of stress but also willing to seek and accept help when needed. Compared to other attachment patterns, secure individuals are more likely to adhere and respond favourably to the treatment plan.

Anxious preoccupied individuals are highly vigilant of anxiety and pain. They tend to display distress signals, exaggerate symptom experience, express self-deprecating comments and even sabotage treatments. These behaviours are expressions of their attachment need to obtain nurturance and care from health care providers. They often feel that their needs are not understood and the gravity of their distress is discredited by their caregivers. Health professionals must refrain from pejorative labelling of non-conforming patients as malingers,
manipulative, troublesome, neurotic, psychogenic or hysterical. A direct confrontation may further distance patients confirming their perceptions that others are uncaring and untrustworthy. As a result, patients may continue to experience pain without relief or they may choose to exit this non-productive patient-caregiver relationship (figure 18).

Figure 18. Patient – caregiver relationship that fails to address attachment

To avoid this scenario and manage the care of patients who are preoccupied with their attachment needs, Maunder and Hunter (2001)
suggest setting clear limits and boundaries for this group of individuals to express their concerns without avoiding them.

Dismissing individuals are self-reliant and reluctant to seek help in general. They have a stoical attitude toward pain and often minimize the meaning of pain and its impact. Medical personnel are perceived as unconcerned and their advice is likely to be rejected. Rather than labelling these patients as 'non-compliant', there is a need to understand the meaning of pain and associated treatment from the patients’ perspective. However, health care providers should respect patients’ interpersonal space and their need to control the situation since too close attention may be threatening to dismissing individuals.

Fearful avoidant is a term used to describe an attachment pattern that is characterized by pessimistic views about self and the others. Being suspicious of health care providers, individuals with fearful avoidant attachment tend to postpone seeking help or consultation until they are feeling desperate due to worsening of their initial symptoms. Their passive-aggressive expressions of anger, hostility, and hopelessness toward their caregivers can be overwhelming and demoralizing to caregivers. A team approach to care may be necessary to avoid caregiver emotional abuse and burn out. Nonetheless, there should be clear delineation of acceptable behaviours while acknowledging their fear (Hunter & Maunder 2001; Maunder et al 2001).
Indicated in the study is the fact that pain experience can be exacerbated by anxiety. While no one is immune to the feelings of anxiety prior to a potentially painful procedure, strategies that allay anxiety may lessen the pain experience. In addition to pain, clinicians should pay attention to other sources of anxiety that may be associated with stalled wound healing, fear of amputation, body disfigurement, repulsive odour, social isolation, debility, and disruption of daily activities. Cognitive therapy that aims at altering anxiety by modifying attitudes, beliefs, and expectations has been shown to be successful in the management of pain. The may involve distraction techniques, imagery, relaxation or altering the significance of the pain to an individual. Patients can learn to envision pain as less threatening and unpleasant through positive imagery. Relaxation exercises can help to reduce anxiety related tension in the muscle that contributes to pain. Cognitive therapy begins by exploring the meaning and interpretation of their pain concerns. The primary task of the caregiver is to help the individual to gain insight into factors that increase or decrease anxiety and pain. By minimizing anxiety provoking factors, the person may develop a sense of control instead of continuing with a helpless and hopeless attitude to symptoms. Linkages made among thoughts, feelings, and behaviours may assist patients in acquiring awareness of their own responses and to create a rationale for skill development. The focus of treatment is to reframe the patient’s
internal dialogue and interpretation of the existing concern so that the problem is perceived as being controllable.

**Patient Education**

Education is a key strategy to empower patients and to improve wound related pain control. Only a small proportion of patients are cognizant of factors contributing to their chronic wounds and treatment strategies to improve their conditions. (Chase et al, 1997) Inadequate information and healthcare provider misconceptions regarding pain are barriers to effective pain management (Yates, 1998). These misconceptions can have serious ramifications hindering optimal pain management, and should be addressed while being sensitive to the patient’s beliefs. Patients are reluctant to report pain and take medications due to fear of addiction and side effects from analgesia. Culturally, some individuals believe that good patients do not complain about pain and that health care providers are too busy to manage their pain (Ward, Hughes, Gonovan, & Serlin, 2001). Pain is perceived by some individuals to be unavoidable and is integral to growing old, perpetuating a sense of helplessness and hopelessness about pain. In a pilot study (Gibson, Keast, Woodbury et al., 2004), five chronic wound patients described dressing change pain more manageable after receiving educational information. Pain related education is a necessary step in effecting change in pain management.
by rebuking common misconceptions and myth that may obstruct effective pain management.

**Enlist patients’ participation**

Patients should be informed of various treatment options (see figure 2) and be empowered to be active participants in care. Being an active participant involves taking part in the decision making for the most appropriate treatment, monitoring response to treatment, and communicating concerns to his/her health care providers. Several recommended behavioural, pharmacological, and procedural treatment options are presented in Figure 19. People with dismissing attachment pattern may be more responsive to approaches that respect the interpersonal distance and maximize their self-directedness and autonomy. In contrast, people described as fearful/avoidant and preoccupied may benefit from concrete directions and suggestions as their levels of attachment anxiety may be too overwhelming for them to make a decision.
Figure 19  Strategies to reduce wound related pain

Social support

The concept of social support refers to an interactive process that entails perceived availability of help or support actually received (Morgan et al., 2004). Social support takes place in a meaningful social context that can be instrumental (e.g., assist with a problem), tangible (e.g., donate goods), informational (e.g., give advice), and emotional (e.g., give reassurance). In a study of 56 patients with venous leg ulcers, Edwards and co-investigators (2005) evaluated the impact of a community Leg Club model of care on wound pain and healing. Subjects were randomized to receive individual home visits
from community nurses (the control group), or to pay a weekly visit to a nurse-managed Leg Club™ (the intervention group). Leg clubs offer a setting where the subjects could obtain advice/information to manage their ulcers through social interaction with expert nurses as well as with their peers. Subjects who attended the leg club expressed significant reductions in the amount of pain experienced \((Z=3.02, P = 0.001)\) after 12 weeks. The pain ratings did not improve in the control group.

Individuals may regress to a more primitive and predictable pattern of attachment under stress. Multiple strategies are proposed to facilitate coping with stress. Considering a continuum that represents attachment anxiety, one extreme indicates dismissing attitude while the other extreme connotes preoccupied and fearful/avoidant tendency, the treatment goal is to mobilize individuals toward a more neutral position in the center.

Pain is a subjective experience within a complex psychosocial context. Treatment of pain would necessitate a personalized approach that is informed by individual’s attachment patterns. Strategies to enhance communication actualize empowerment, and bridge knowledge uptake may modulate the model of self and normalize attachment anxiety. Successful modulation of self may reduce the negative emotional reaction such as anxiety and rendering pain more amendable to other treatment modalities such as education, exercise, and biofeedback. By expanding the knowledge and awareness of attachment and pain, more explanations can be generated and more options for management become available.
Future research

The current study explored the relationship between pain and anxiety. While anxiety had been demonstrated to increase pain, other psychosocial determinants including anger, powerlessness, depression, and social isolation should be evaluated within the attachment framework. There are pharmacological and non-pharmacological strategies to improve anxiety, stress and pain.

Common non-pharmacological pain management strategies are aimed at reducing the potential effect of psychological factors (such as anxiety and stress) that may aggravate the pain experience. These techniques include relaxation techniques, music therapy, (Richards, Johnson, Sparks, & Emerson 2007; Ferguson & Voll 2004; Kwekkeboom, 2003), touch therapy (Turner, Clark, Gauthier, Williams 1998), visual stimulation (Tse, Ng, & Chung 2003), hypnosis, stress reducing strategies, guided imagery (Danhauer, Marler, Rutherford, et al., 2007), behavioural and cognitive therapy, along with distraction (Kwekkeboom, 2003). However, the evidence to support their relative effectiveness in the chronic wound population is lacking (Carroll & Seers, 1998). Future research should address whether specific attachment patterns are more responsive to certain treatment modalities.
Although the RSQ is a valid tool to measure adult attachment in a research study, the applicability of this instrument in clinical practice is not clear. There is a need to develop a brief questionnaire or observation toolkit to evaluate the degree of attachment anxiety in order to guide clinical approach to foster patient interaction/alliance. Future studies should replicate this study to determine whether the relationship between attachment, anxiety, and pain is generalizable to older adults with other common medical conditions (e.g. arthritis, post surgery, and cancer). A longitudinal study could shed some light on the causal relationship between attachment anxiety and pain. While pre-existing attachment anxiety may enhance the experience of pain, chronic pain may polarize the level of anxiety in attachment relationships.

It has been proposed that people are increasingly more dismissing with aging. This question may be addressed by following individuals over time to determine the factors (e.g. self actualization, personality, number of stressors) that may have altered the attachment pattern. If older adults were more likely to hold a dismissing attitude toward pain and their attachment needs, clinicians may need to explore the true impact of pain.
Conclusions

This study has demonstrated that elderly subjects experienced more pain during dressing change than at baseline. Attachment needs (anxiety over self worth and closeness to others) continue to exert a tremendous influence on older people living with chronic pain. Patients who expressed high levels of attachment anxiety and avoidance reported heightened anxiety, increased anticipation of pain, and more intense pain during dressing change in comparison to secure individuals. Attachment anxiety and avoidance were critical to understanding how one reacts to threat, regulates negative emotions, and interprets a physiological symptom (pain). Regression analysis indicated that the relationship between attachment and pain was mediated by anxiety. The intensity of pain was determined by one’s emotional reactivity and ability to control anxiety based on his/her internal representation of self and others. In conclusion, this study of older adults has provided empirical evidence to support the influence of attachment on anticipatory pain, anxiety and experienced pain at dressing change.
References


Betts, J. (2003). Review: wound cleansing with water does not differ from no cleansing or cleansing with other solutions for rates of wound infection or healing. Evid Based Nurs, 6(3), 81.


Joseph R. (1999). Environmental influences on neural plasticity, the limbic system, emotional development and attachment: a review. Child Psychiatry Hum Dev.29(3):189-208


Kolb LC. (1982). Attachment behavior and pain complaints Psychosomatics. 23(4):413-25


Schupp CJ, Berbaum K, Berbaum M, Lang EV. (2005). Pain and anxiety during interventional radiologic procedures: effect of patients' state anxiety at baseline and


The most intense pain imaginable

0 1 2 3 4 5 6 7 8 9 10

No Pain

On this scale, 0 represents no pain and 10 represents pain as bad as it could be. Please choose a number to indicate the intensity of pain in the wound right now, that is, at this moment.
<table>
<thead>
<tr>
<th>Description</th>
<th>None</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throbbing</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Shooting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Stabbing</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Sharp</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Cramping</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Gnawing</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Hot-Burning</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Aching</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Heavy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Tender</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Splitting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
### Pain Assessment in Advanced Dementia (PAINAD) Scale

<table>
<thead>
<tr>
<th>Items*</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative vocalization</td>
<td>None</td>
<td>Occasional moan or groan. Low-level speech with a negative or disapproving quality.</td>
<td>Repeated troubled calling out. Loud moaning or groaning. Crying.</td>
<td></td>
</tr>
<tr>
<td>Consolability</td>
<td>No need to console</td>
<td>Distracted or reassured by voice or touch.</td>
<td>Unable to console, distract or reassure.</td>
<td></td>
</tr>
</tbody>
</table>

Total**

*Five-item observational tool (see the description of each item below).

**Total scores range from 0 to 10 (based on a scale of 0 to 2 for five items), with a higher score indicating more severe pain (0="no pain" to 10="severe pain").
### Pain Assessment in Advanced Dementia (PAINAD) Instructions

#### Item Definitions

<table>
<thead>
<tr>
<th>Breathing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal breathing</td>
<td>Normal breathing is characterized by effortless, quiet, rhythmic (smooth) respirations.</td>
</tr>
<tr>
<td>Occasional labored breathing</td>
<td>Occasional labored breathing is characterized by episodic bursts of harsh, difficult or wearing respirations.</td>
</tr>
<tr>
<td>Short period of hyperventilation</td>
<td>Short period of hyperventilation is characterized by intervals of rapid, deep breaths lasting a short period of time.</td>
</tr>
<tr>
<td>Noisy labored breathing</td>
<td>Noisy labored breathing is characterized by negative sounding respirations on inspiration or expiration. They may be loud, gurgling, wheezing. They appear strenuous or wearing.</td>
</tr>
<tr>
<td>Long period of hyperventilation</td>
<td>Long period of hyperventilation is characterized by an excessive rate and depth of respirations lasting a considerable time.</td>
</tr>
<tr>
<td>Cheyne-Stokes respirations</td>
<td>Cheyne-Stokes respirations are characterized by rhythmic waxing and waning of breathing from very deep to shallow respirations with periods of apnea (cessation of breathing).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Negative Vocalization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None is characterized by speech or vocalization that has a neutral or pleasant quality.</td>
</tr>
<tr>
<td>Occasional moan or groan</td>
<td>Occasional moaning is characterized by mournful or murmuring sounds, wails or laments. Groaning is characterized by louder than usual inarticulate involuntary sounds, often abruptly beginning and ending.</td>
</tr>
<tr>
<td>Low level speech with a negative or disapproving quality</td>
<td>Low level speech with a negative or disapproving quality is characterized by muttering, mumbling, whining, grumbling, or swearing in a low volume with a complaining, sarcastic or caustic tone.</td>
</tr>
<tr>
<td>Repeated troubled calling out</td>
<td>Repeated troubled calling out is characterized by phrases or words being used over and over in a tone that suggests anxiety, uneasiness, or distress.</td>
</tr>
<tr>
<td>Loud moaning or groaning</td>
<td>Loud moaning is characterized by mournful or murmuring sounds, wails or laments in much louder than usual volume. Loud groaning is characterized by louder than usual inarticulate involuntary sounds, often abruptly beginning and ending.</td>
</tr>
<tr>
<td>Crying</td>
<td>Crying is characterized by an utterance of emotion accompanied by tears. There may be sobbing or quiet weeping.</td>
</tr>
</tbody>
</table>

#### Facial Expression

<table>
<thead>
<tr>
<th>Smiling or Inexpressive</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smiling</td>
<td>Smiling is characterized by upturned corners of the mouth, brightening of the eyes and a look of pleasure or contentment. Inexpressive refers to a neutral, at ease, relaxed, or blank look.</td>
</tr>
<tr>
<td>Sad</td>
<td>Sad is characterized by an unhappy, lonesome, sorrowful, or dejected look. There may be tears in the eyes.</td>
</tr>
<tr>
<td>Frightened</td>
<td>Frightened is characterized by a look of fear, alarm or heightened anxiety. Eyes appear wide open.</td>
</tr>
<tr>
<td>Frown</td>
<td>Frown is characterized by a downward turn of the corners of the mouth. Increased facial wrinkling in the forehead and around the mouth may appear.</td>
</tr>
<tr>
<td>Facial grimacing</td>
<td>Facial grimacing is characterized by a distorted, distressed look. The brow is more wrinkled as is the area around the mouth. Eyes may be squeezed shut.</td>
</tr>
<tr>
<td><strong>Body Language</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Relaxed</td>
<td>Relaxed is characterized by a calm, restful, mellow appearance. The person seems to be taking it easy.</td>
</tr>
<tr>
<td>Tense</td>
<td>Tense is characterized by a strained, apprehensive or worried appearance. The jaw may be clenched. (Exclude any contractures.)</td>
</tr>
<tr>
<td>Distressed pacing</td>
<td>Distressed pacing is characterized by activity that seems unsettled. There may be a fearful, worried, or disturbed element present. The rate may be faster or slower.</td>
</tr>
<tr>
<td>Fidgeting</td>
<td>Fidgeting is characterized by restless movement. Squirming about or wiggling in the chair may occur. The person might be hitching a chair across the room. Repetitive touching, tugging or rubbing body parts can also be observed.</td>
</tr>
<tr>
<td>Rigid</td>
<td>Rigid is characterized by stiffening of the body. The arms and/or legs are tight and inflexible. The trunk may appear straight and unyielding. (Exclude any contractures.)</td>
</tr>
<tr>
<td>Fists clenched</td>
<td>Fists clenched is characterized by tightly closed hands. They may be opened and closed repeatedly or held tightly shut.</td>
</tr>
<tr>
<td>Knees pulled up</td>
<td>Knees pulled up is characterized by flexing the legs and drawing the knees up toward the chest. An overall troubled appearance. (Exclude any contractures.)</td>
</tr>
<tr>
<td>Pulling or pushing away</td>
<td>Pulling or pushing away is characterized by resistiveness upon approach or to care. The person is trying to escape by yanking or wrenching him or herself free or shoving you away.</td>
</tr>
<tr>
<td>Striking out</td>
<td>Striking out is characterized by hitting, kicking, grabbing, punching, biting, or other form of personal assault.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Consolability</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>No need to console</td>
<td>No need to console is characterized by a sense of well being. The person appears content.</td>
</tr>
<tr>
<td>Distracted or reassured</td>
<td>Distracted or reassured by voice or touch is characterized by a disruption in the behavior when the person is spoken to or touched. The behavior stops during the period of interaction with no indication that the person is at all distressed.</td>
</tr>
<tr>
<td>voice or touch</td>
<td></td>
</tr>
<tr>
<td>Unable to console, distract or reassure</td>
<td>Unable to console, distract or reassure is characterized by the inability to soothe the person or stop a behavior with words or actions. No amount of comforting, verbal or physical, will alleviate the behavior.</td>
</tr>
</tbody>
</table>
Appendix E  Mini- Mental State Examination

<table>
<thead>
<tr>
<th>Maximum</th>
<th>Score</th>
<th>Section</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>(     )</td>
<td>Orientation</td>
<td>What is the (year) (season) (date) (day) (month)?</td>
</tr>
<tr>
<td>5</td>
<td>(     )</td>
<td></td>
<td>Where are we (state) (country) (town) (hospital) (floor)?</td>
</tr>
<tr>
<td>3</td>
<td>(     )</td>
<td>Registration</td>
<td>Name 3 objects: 1 second to say each. Then ask the patient</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>all 3 after you have said them. Give 1 point for each correct answer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Then repeat them until he/she learns all 3. Count trials and record.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Trials __________</td>
</tr>
<tr>
<td>5</td>
<td>(     )</td>
<td>Attention and Calculation</td>
<td>Serial 7’s. 1 point for each correct answer. Stop after 5 answers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Alternatively spell “world” backward.</td>
</tr>
<tr>
<td>3</td>
<td>(     )</td>
<td>Recall</td>
<td>Ask for the 3 objects repeated above. Give 1 point for each correct answer.</td>
</tr>
<tr>
<td>2</td>
<td>(     )</td>
<td>Language</td>
<td>Name a pencil and watch.</td>
</tr>
<tr>
<td>1</td>
<td>(     )</td>
<td></td>
<td>Repeat the following “No ifs, ands, or buts”</td>
</tr>
<tr>
<td>3</td>
<td>(     )</td>
<td></td>
<td>Follow a 3-stage command: “Take a paper in your hand, fold it in half, and put it on the floor.”</td>
</tr>
<tr>
<td>1</td>
<td>(     )</td>
<td></td>
<td>Read and obey the following: CLOSE YOUR EYES</td>
</tr>
<tr>
<td>1</td>
<td>(     )</td>
<td></td>
<td>Write a sentence.</td>
</tr>
<tr>
<td>1</td>
<td>(     )</td>
<td></td>
<td>Copy the design shown.</td>
</tr>
</tbody>
</table>
Relationship Styles Questionnaire
Listed below are a number of statements about close relationships. I would like you to indicate the extent to which each of the statements describes your feelings about close relationships. Think about all of your close relationships, past and present, and in terms of how you generally feel in these relationships.

Never-0    Hardly Ever-1    Sometime-2    Often-3    Very often-4

1. You find it difficult to depend on other people.
2. It is very important to you to feel independent.
3. You find it easy to get emotionally close to others.
4. You want to be totally close with another person, like a twin.
5. You worry that you will be hurt if you allow yourself to become too close to others.
6. You are comfortable without close emotional relationships.
7. You are not sure that you can always depend on others to be there when you need them.
8. You want to be completely emotionally intimate with others.
9. You worry about being alone.
10. You are comfortable depending on other people.
11. You often worry that people who are important to you don't really love you.
12. You find it difficult to trust others completely.
13. You worry about others getting too close to you.
14. You want emotionally close relationships.
15. You are comfortable having other people depend on you.
16. You worry that others don't value you as much as you value them.
17. People are never there when you need them.
18. Your desire to merge completely sometimes scares people away.
19. It is very important to you to feel self-sufficient.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20.</td>
<td>You are nervous when anyone gets too close to you.</td>
</tr>
<tr>
<td>21.</td>
<td>You often worry that people close to you won't want to stay with you.</td>
</tr>
<tr>
<td>22.</td>
<td>You prefer not to have other people depend on you.</td>
</tr>
<tr>
<td>23.</td>
<td>You worry about being abandoned.</td>
</tr>
<tr>
<td>24.</td>
<td>You are somewhat uncomfortable being close to others.</td>
</tr>
<tr>
<td>25.</td>
<td>You find that others are reluctant to get as close as you would like.</td>
</tr>
<tr>
<td>26.</td>
<td>You prefer not to depend on others.</td>
</tr>
<tr>
<td>27.</td>
<td>You know that others will be there when you need them.</td>
</tr>
<tr>
<td>28.</td>
<td>You worry about having others not accept you.</td>
</tr>
<tr>
<td>29.</td>
<td>Other people often want you to be closer than you feel comfortable.</td>
</tr>
<tr>
<td>30.</td>
<td>You find it relatively easy to get close to others.</td>
</tr>
</tbody>
</table>
**Appendix G**

**STAI-S**

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the phrase that indicates HOW YOU FEEL RIGHT NOW, that is, AT THIS MOMENT. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

<table>
<thead>
<tr>
<th>I am worried</th>
<th>Not At All</th>
<th>Somewhat</th>
<th>Moderately So</th>
<th>Very Much so</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I feel calm</th>
<th>Not At All</th>
<th>Somewhat</th>
<th>Moderately So</th>
<th>Very Much So</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I am tense</th>
<th>Not At All</th>
<th>Somewhat</th>
<th>Moderately So</th>
<th>Very Much So</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>I feel upset</th>
<th>Not At All</th>
<th>Somewhat</th>
<th>Moderately So</th>
<th>Very Much So</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>I feel nervous</th>
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<th>Somewhat</th>
<th>Moderately So</th>
<th>Very Much So</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
Appendix H

Pressure Ulcer Scale for Healing (PUSH)

PUSH Tool 3.0

Patient Name: ___________________________ Patient ID: ___________________________

Ucer Location: ___________________________ Date: ___________________________

**Directions:**

Observe and measure the pressure ulcer. Categorize the ulcer with respect to surface area, exudate, and type of wound tissue. Record a sub-score for each of these ulcer characteristics. Add the sub-scores to obtain the total score. A comparison of total scores measured over time provides an indication of the improvement or deterioration in pressure ulcer healing.

<table>
<thead>
<tr>
<th>LENGTH X WIDTH (in cm²)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Sub-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td></td>
<td>&gt; 24.0</td>
</tr>
<tr>
<td>0 – 3.1</td>
<td>&lt; 0.3</td>
<td>0.3 – 0.6</td>
<td>0.7 – 1.0</td>
<td>1.1 – 2.0</td>
<td>2.1 – 3.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 – 4.0</td>
<td>4.1 – 8.0</td>
<td>8.1 – 12.0</td>
<td>12.1 – 24.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>EXUDATE AMOUNT</th>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>Sub-score</th>
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<tbody>
<tr>
<td>None</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TISSUE TYPE</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Sub-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Epithelial Tissue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granulation Tissue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slough</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Necrotic Tissue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Length x Width:** Measure the greatest length (head to toe) and the greatest width (side to side) using a centimeter ruler. Multiply these two measurements (length x width) to obtain an estimate of surface area in square centimeters (cm²). Caveat: Do not guess! Always use a centimeter ruler and always use the same method each time the ulcer is measured.

**Exudate Amount:** Estimate the amount of exudate (drainage) present after removal of the dressing and before applying any topical agent to the ulcer. Estimate the exudate (drainage) as none, light, moderate, or heavy.

**Tissue Type:** This refers to the types of tissue that are present in the wound (ulcer) bed. Score as a “4” if there is any necrotic tissue present. Score as a “3” if there is any amount of slough present and necrotic tissue is absent. Score as a “2” if the wound is clean and contains granulation tissue. A superficial wound that is reepithelializing is scored as a “1”. When the wound is closed, score as a “0”.

- **4 – Necrotic Tissue (Eschar):** black, brown, or tan tissue that adheres firmly to the wound bed or ulcer edges and may be either firmer or softer than surrounding skin.
- **3 – Slough:** yellow or white tissue that adheres to the ulcer bed in strings or thick clumps, or is mucinous.
- **2 – Granulation Tissue:** pink or beefy red tissue with a shiny, moist, granular appearance.
- **1 – Epithelial Tissue:** for superficial ulcers, new pink or shiny tissue (skin) that grows in from the edges or as islands on the ulcer surface.
- **0 – Closed/Resurfaced:** the wound is completely covered with epithelium (new skin).
Appendix I  Instructions for Using the PUSH Tool

To use the PUSH Tool, the pressure ulcer is assessed and scored on the three elements in the tool:

• Length x Width --> scored from 0 to 10
• Exudate Amount ---> scored from 0 (none) to 3 (heavy)
• Tissue Type ---> scored from 0 (closed) to 4 (necrotic tissue)

In order to insure consistency in applying the tool to monitor wound healing, definitions for each element are supplied at the bottom of the tool.

Step 1: Using the definition for length x width, a centimeter ruler measurement is made of the greatest head to toe diameter. A second measurement is made of the greatest width (left to right). Multiple these two measurements to get square centimeters and then select the corresponding category for size on the scale and record the score.

Step 2: Estimate the amount of exudate after removal of the dressing and before applying any topical agents. Select the corresponding category for amount & record the score.

Step 3: Identify the type of tissue. Note: if there is ANY necrotic tissue, it is scored a 4. Or, if there is ANY slough, it is scored a 3, even though most of the wound is covered with granulation tissue.

Step 4: Sum the scores on the three elements of the tool to derive a total PUSH Score.
Appendix J  Patient demographic sheet

Age: ___________ Years

D.O.B. _____________ (YYYY/MM/DD)

Sex: Male / Female

Reason for admission: ________________________________

Weight: _____________ (lb/kg)  Height: _____________ (in/cm)

Ethnic background: ________________________________

Language spoken: ________________________________

Marital status:

1. Single  4. Divorced
2. Married  5. Separated
3. Widowed

Education: the highest level completed in school:

1. less than high school  4. some university/bachelor’s degree
2. high school  5. some post graduate training
3. post-secondary certificate/diploma

Type of wounds:

1. Pressure ulcer  2. Diabetic foot ulcers  3. Arterial ulcer
4. Venous ulcer  5. Unknown

Duration of wound: _______________ (approximate / actual)

Treatment location: ________________________________

Length of time attending clinic/in hospital: ________________________________

Frequency of Dressing Change:

☐ OD  ☐ BID  ☐ Other: _______________

Type of cleaning solution:

☐ Saline  ☐ Sterile water  ☐ Other: ___________________________
Type of dressing:

☐ Dry gauze ☐ calcium algamates
☐ Saline soaked (wet to dry) dressing
☐ Antimicrobials
☐ Gel dressing ☐ Hydrocolloid
☐ Foam ☐ Other ________________________

Concurrent medical diagnoses/symptoms:

____________________________________________________________________________________

____________________________________________________________________________________

Concurrent medications:

____________________________________________________________________________________

____________________________________________________________________________________
Purpose
You have been asked to participate in a study, which is designed to understand pain during dressing change in older adults. This information will help in understanding how pain can be managed for people with your condition.

Procedures
You will be asked to response the questions about your memory, wound pain, anxiety and relationship with other people. During the dressing change, you will be asked to indicate the intensity of pain immediately after the dressing is removed, immediately after your wound is cleansed, and immediately after the dressing is reapplied.
We would like your permission to review information about your medical history and medications by examining your hospital chart.

Risks
There is no risk participating in this study. Dressing change will be prolonged by a few minutes.

Benefits
You may or may not receive any medical benefit from your participation in this study. Information learned from this study may benefit other patients in the future with your disease.

Confidentiality
All information obtained during the study will be held in strict confidence. You will be identified with a study number only. No names or identifying information will be used in any publication or presentations. No information identifying you will be transferred outside the investigators in this study. During the regular monitoring of your study or in the event of an audit, your medical record may be reviewed by the North York General Hospital Research Ethics Board.

Participation
Your participation in this study is voluntary. You can choose not to participate or you may withdraw at any time without affecting your medical care.

If you become ill or are physically injured as a result of participation in this study, medical treatment will be provided. In no way does signing this consent form waive your legal rights nor does it relieve the investigators, sponsors or involved institutions from their legal and professional responsibilities.

Questions
If you have any questions about the study, please call Kevin Woo at 416-756-6000 Ext. 4896. If you have any questions about your rights as a research subject, please call North York General Hospital Research Ethics Board at (416) 756-.

Consent
I have had the opportunity to discuss this study and my questions have been answered to my satisfaction. I consent to take part in the study with the understanding I may withdraw at any time without affecting my medical care. I have received a signed copy of this consent form. I voluntarily consent to participate in this study.
I confirm that I have explained the nature and purpose of the study to the subject named above. I have answered all questions.
Appendix L

Information Form

Principal Investigators: Kevin Woo North York General Hospital
Dr. Joel Sadavoy University of Toronto

Co-investigators: Dr. R. Maunder University of Toronto
Dr. G. Sibbald University of Toronto
Dr. S. Sidini University of Toronto

TITLE : Pain during dressing change: how does attachment style affect pain in the older adults.

We are presently doing a study to understand pain during dressing change in the elderly population. Patients who have a chronic wound requiring dressing change are invited to take part in this study.

The purpose of the study is to explore how wound related pain may be influenced by how you relate to other people and feelings of anxiety. It is not anticipated that there will be any direct benefits to you from participating in this study. However, results of this study may help us better care for patients with wounds in the future.

You will be asked to questions about your memory, wound related pain, anxiety, and about how you relate to other people.

We would also like to ask for your permission to get information about your medical history and medications.

All the information will be strictly confidential. You will be identified by number only and your name will not appear on any of the papers. Should you decide to partake in this study you are free to withdraw from the
study at any time. In no way will your decision to part take or withdraw from this study affect the care you receive from the hospital.